

SPECIFICATIONS

MACOMB COUNTY
CLEMENS CENTER
COUNTY CLERK STORAGE RENOVATION
PROJECT NUMBER: 231987
BID ITEM #20-24
JULY 25, 2024

PROJECT

MACOMB COUNTY CLEMENS CENTER COUNTY CLERK STORAGE RENOVATION

OWNER

Macomb County Board of Commissioners
Administration Building
1 South Main – 9th Floor
Mt. Clemens, MI 48043

ARCHITECT

Wakely Associates, Inc.
30500 Van Dyke Ave., Suite 209
Warren, Michigan 48093

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PROJECT NUMBER 231987
JULY 25, 2024

PROJECT

MACOMB COUNTY
CLEMENS CENTER
COUNTY CLERK STORAGE RENOVATION

OWNER

MACOMB COUNTY BOARD OF COMMISSIONERS
ADMINISTRATION BUILDING
1 SOUTH MAIN - 9TH FLOOR
MT. CLEMENS, MI 48043

ARCHITECT

WAKELY ASSOCIATES, INC.
30500 VAN DYKE, SUITE 209
WARREN, MICHIGAN 48093
586-573-4100

STRUCTURAL

ANDERSON ECKSTEIN & WESTRICK
51301 SCHOENHERR ROAD
SHELBY TOWNSHIP, MI 48315
(586) 726-1234

MECHANICAL/ELECTRICAL

UNIFIED BUSINESS SYSTEMS ENGINEERING, LLC
75 N. MAIN STREET, SUITE 221
MT. CLEMENS, MI 48043
586-500-7055

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**BID ITEM # 20-24
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**MACOMB COUNTY PURCHASING DEPARTMENT
REQUEST FOR BID**

BID ITEM NO.: 20-24

**BID TITLE: Macomb County
Clemens Center-County Clerk Storage Renovation Project**

REQUEST FOR BID

The Macomb County Purchasing Department will be receiving sealed proposals for the Macomb County Various Projects, MC Clemens Center-County Clerk Storage Project (Wakely Project Number 231987).

This project consists of work at: Clemens Center, 14 Market Street, Mt. Clemens, MI 48043.

A. The project consists of all necessary prep, labor and material to perform the indicated work in the following areas:

1. Clemens Center, 14 Market Street, Mt. Clemens, MI 48043-Clerk Storage Facility

The Project consists of, but not limited to:

- a. Selective demolition of existing gypsum board walls, masonry and portions of concrete slab.
- b. New gypsum board walls.
- c. Leveling of existing concrete slab.
- d. New Mobile H.D. storage system and fixed racks.
- e. New FRP doors in aluminum frames, new wood doors in HM frames.
- f. New floor finishes.
- g. New millwork.
- h. New acoustical ceilings in office areas.
- i. Painting of floors, walls and exposed structure.
- j. New HVAC system.
- k. New LED lighting.
- l. New fire suppression system pre-activation.
- m. New power.
- n. New signage.

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OBJECTIVE

The purpose of this Request for Bid (RFB) is to select a vendor to provide renovations to the Macomb County Clemens Center-County Clerk Storage Renovation. The goal is to select the most capable vendor offering the most competitive price. This proposal is in accordance with the Macomb County Procurement Policy.

SUBMISSION PROCEDURES

Date Due: **Thursday, August 15, 2024 at 10:00 AM (local time)**

Bids will be publicly opened and read.

DELIVER via FEDEX, UPS, or hand deliver DIRECTLY TO 44900 Vic Wertz Dr. Clinton Township, MI 48036 PURCHASING DEPARTMENT BY DUE DATE & TIME.

IF HAND DELIVERED – MAKE SURE TO GET A DATE AND TIME STAMPED RECEIPT FOR PROOF OF DELIVERY.

If USPS utilized for submissions, there is no guarantee of a timely delivery as the Post Office does not deliver to individual County Buildings.

NO LATE BIDS ACCEPTED.

Mail to: Macomb County Purchasing
Mark Chomontowski, Purchasing Manager
ATTN: Mary Schultz
44900 Vic Wertz Dr.
Clinton Township, MI 48036

Return: One (1) hard copy original
Two (2) copies of the Bid
Clearly mark on the envelope **SEALED BID ITEM 20-24 MACOMB COUNTY-
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION PROJECT**
Label all submission envelopes with the company name on the outside.
Complete and return all pages requiring vendor response.

All Bids must be submitted on the forms provided, properly executed and with all items filled out in ink or typed. Do not change or add words to the forms. Unauthorized conditions, limitations, or provisions on or attached to the forms may be cause for rejection of the Bid. Any Bidder information that is altered by erasure or by inter-lineation prior to submittal must be initialed and explained by notation above the signature of the Bidder.

Macomb County vendors should be registered on the Michigan Inter-governmental Trade Network (MITN) website www.bidnetdirect.com/mitn.

QUESTIONS

Due: **Thursday, August 8, 2024 at 12:00 PM (local time)**

Submit to: Email: Mary.Schultz@macombgov.org

Questions regarding bid specifications may be directed in writing only, by email. All questions or clarifications must be directed to the Purchasing Department. Any attempt to contact a county department, other than purchasing, regarding current bids may be grounds for disqualification as a vendor. Answers will be posted to MITN.

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MANDATORY PRE-BID MEETING

Date: **Thursday, August 1, 2024 at 10:00 AM (local time)**

Location: **Clemens Center Lobby, 14 Market Street, Mt. Clemens, MI 48043**

This is a **Mandatory** pre-bid meeting.

The purpose of this meeting is to review the job location and Bid Specifications. No other site visit will be scheduled. **No bids will be accepted if you do not attend this meeting.**

Facility related questions will be answered at this meeting. Other questions related to the Bid specifications must be submitted in writing to the Purchasing Department.

MODIFICATIONS

Macomb County vendors should be registered on the Michigan Inter-governmental Trade Network (MITN) website www.bidnetdirect.com/mitn. Clarifications, modifications, or amendments may be made to this document at the discretion of the Macomb County Purchasing Department prior to the opening of the solicitations. Should any such changes be made, an addendum will be issued and posted on the MITN website. It is the responsibility of each Bidder to check the website and verify that he/she has received all Addenda prior to submitting a Bid.

It is also the responsibility of each Bidder to verify that all sub-Bidders and material suppliers whose prices are incorporated in the Bidder's Bid are familiar with the Bidding Documents in their entirety, including all Addenda issued up to the time of the Bid opening. (See also *ERRORS, OMISSIONS, AND/OR DISCREPANCIES, below.*)

All addenda issued to Bidders prior to date of receipt of Bids shall become a part of these specifications, and all Bids are to include the Work therein described.

DEFINITIONS

- A. Bidding Documents include this Request for Bid, (including drawings, specifications and all Addenda issued prior to execution of the Contract) and the proposed Contract Documents.
- B. Addenda are written or graphic instruments issued by Macomb County prior to the execution of the Contract that modify or interpret the Bidding Documents.
- C. The Base Bid is the sum state in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted.
- D. A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work as described in the Bidding Documents.
- E. A Bidder is a person or entity who submits a Bid to Macomb County, and who meets the requirements set forth in the Bidding Documents.

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- F. Default is the failure of the Bidder to fulfill the obligations of the contract, including but not limited to, failure to deliver on time or the unauthorized substitution of articles other than those quoted and specified on the contract; or failure to deliver specified quantities (repetitive shortages).
- G. Owner is the County of Macomb.
- H. Contractor is a person or business which provides goods or services to the County of Macomb under terms specified in a contract.

BIDDING DOCUMENTS

All Bidding Documents are available on the Michigan Inter-governmental Trade Network (MITN) website www.bidnetdirect.com/mitn. Bidders shall use complete sets of Bidding Documents in preparing Bids. Macomb County assumes no responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

All Bidding Documents are the property of the Architect.

EXAMINATION OF BIDDING DOCUMENTS AND SITE

Before submitting a Bid, the Bidder shall carefully examine the drawings, read the specifications and all other Bidding Documents; and visit the site of the Work. Each Bidder shall inspect the site of the proposed Work to arrive at a clear understanding of the conditions under which the Work is to be performed. The Bidder shall fully inform himself/herself prior to bidding as to all existing conditions and limitations under which the Work is to be performed and he/she shall include in the Bid a sum to cover the cost of all items necessary to perform the Work as set forth in the Bidding Documents. No allowance will be made to the Bidder because of lack of such examination or knowledge. The submission of a Bid shall be construed as conclusive evidence that the Bidder has made such examination. Claims for extra payments based on lack of knowledge of existing circumstances will not be allowed.

BIDDER'S QUALIFICATIONS

Bidders must be properly licensed under the state laws governing their respective trades. Bidders shall meet qualifications indicated in the Bidding Documents. Macomb County may make such investigations as necessary to determine the ability of the Bidder to perform the Work, and the Bidder shall furnish to Macomb County all such information and data for this purpose as Macomb County may request. Macomb County reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy Macomb County that such Bidder is not properly qualified to carry out the obligations of the Contract.

Submission of a Bid shall serve as evidence that the Bidder has confirmed that the Bidder is properly qualified to perform the work and is capable of obtaining the required bonds and insurance.

COMPONENT/PRODUCT RESPONSIBILITY

The successful Bidder will provide field instructions for Macomb County's operators, mechanics and/or supervisors. The successful Bidder shall be responsible to insure that all components delivered operate properly and with the intent and details of these specifications.

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STATUS OF BIDDERS

Proprietors submitting Bids shall indicate their status as proprietors.

Bidders submitting Bids for partnerships shall indicate their status as partners and shall submit, upon request of Macomb County within 24 hours following receipts of Bids, a certified copy of the power of attorney authorizing the executor of the Bid to bind the partnership.

Bidders submitting Bids for corporations shall indicate their status as corporations and shall submit, upon request of the Owner within 24 hours following receipt of Bids, a certified copy of the board of directors' authorization for the Bidder to bind the corporation and shall affix the corporate seal on the Bid.

Bidders shall provide, upon request of Macomb County, within 24 hours following receipt of Bids, the following:

1. Names and addresses of proprietors, of all members of a partnership, or of the corporation's officers.
2. Name of county or state where the partnership is registered or where the corporation is incorporated. Corporations must be licensed to do business in the project state at the time of executing the contract.

ERRORS, OMISSIONS, AND/OR DISCREPANCIES

Bidder shall not be allowed to take advantage of errors, omissions, and/or discrepancies found in the Bidding Documents. In the event a conflict or omission is discovered in the Bidding Documents after the issuing of the last addendum such that an interpretation cannot be issued by Macomb County prior to bidding, the Bidder is directed to estimate on and provide the quantity and quality of material and labor consistent with the overall represented work so as to provide all materials, equipment, labor, and services necessary for the completion of the Work.

SUBSTITUTION OF MATERIALS AND EQUIPMENT

Whenever a material, article or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided that the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equal substance appearance and function.

To obtain approval to use unspecified products, Bidders shall submit written requests at least ten (10) days before the bid date. Requests received after this time will not be considered. Requests shall clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability.

If the product is acceptable, the Architect will approve it in an Addendum which will be posted on the MITN website. The product shall not be purchased or installed by the Contractor without the Architect's written approval.

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Voluntary alternates or qualifications contrary to the Contract requirements made by the Bidder in or accompanying his/her Bid as a condition for the acceptance of the Contract will not be considered in the award of the Contract and will cause the rejection of the entire Bid.

TERMINATION

Macomb County reserves the right to terminate any award to the Bidder without any liability, upon a 30-day notice from Macomb County.

DEFAULT (refer to Section: Definitions, Item F)

If continued abuse of any/or all of the default conditions persist, Macomb County will notify the Contractor in writing. The Contractor will be given thirty (30) days to correct this default condition. Failure to correct within the specified period will result in Macomb County canceling the Contract and procuring the articles or services from other sources. The Contractor will be responsible for any excess costs occasioned thereby.

RIGHT TO REJECT

Macomb County reserves the right to reject any or all Bids in whole or in part and to waive any informalities therein or accept any Bid it may deem in the best interest of the County.

Note: Past experience and performance may be a factor in making an award.

MODIFICATION AND WITHDRAWAL OF BIDS

A Bid may be withdrawn on personal requests received from Bidder prior to submission time. A Bid being withdrawn may be re-submitted up to submission time. Negligence or error on the part of the Bidder in preparing his/her Bid confers no right for withdrawal of the Bid after it has been opened.

OFFER PERIOD

Bids will remain firm for a period of 30 days after official opening of Bids.

BID BREAKDOWN CONSTRUCTION INFORMATION

Upon notice from the Architect, the low Bidders shall submit a detailed cost breakdown of all work covered by the Bidding Documents. The breakdown shall show quantity of material and labor, units of material and labor, material cost, labor cost and total cost.

EXECUTION OF CONTRACT

Macomb County reserves the right to accept any and all Bids, or to negotiate contract terms with the various Bidders when such is deemed by Macomb County to be Macomb County's best interest.

SCHEDULE - TIME OF COMPLETION

Work is to commence on a date specified in a written "Notice to Proceed", and the Work shall be fully complete within the required time allowed. Macomb County requires the Work to be substantially complete no later than **February 28, 2025**.

BASIS OF BID

A single lump sum Bid is being entertained for the Work of the Bid.

SALES AND EXCISE TAXES

All prices stated in the Bid response will include all Federal, State, County and Municipal taxes, including Michigan State Sales and Use Taxes, or contributions required by Bidder's business.

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PERMITS

Any needed city permits, and bonds will be required prior to award of Contract and commencement of Work.

INDEMNIFICATION

Macomb County will not be responsible for injury to Contractor's employees, Sub-Contractors, or to third parties caused by the Contractor's agents, servants or employees. Therefore, the Contractor agrees to incorporate the below hold harmless agreement into the required insurance and to be evidenced by being contained in the certificate of insurance. Further, the below listed indemnification is incorporated and is part of the subject contract.

The Contractor agrees to protect, defend, indemnify and hold the County of Macomb and its commissioners, officers, employees and agents free and harmless from and against any and all losses, penalties, damages, settlements, costs, charges, professional fees, or other expenses or liabilities of every kind and character arising out of or relating to any and all claims, legal fees, liens, demands, court costs, obligations, actions, proceedings or causes of action of every kind and character in connection with or arising directly or indirectly out of this agreement and/or the performance hereof. Without limiting the generality of the foregoing, any and all such claims, etc. relating to personal injury, death, damage to property, defects in materials or workmanship, or any actual or alleged violation of any applicable statute, ordinance, administrative order, rule or regulation, or decree of any court, shall be included in the indemnity hereunder.

The Contractor further agrees to investigate, handle, respond to, provide defense for and defend any such claims, etc. at his sole expense and agrees to bear all other costs and expenses related hereto, even if it (claims, etc.) is groundless, false or fraudulent. In any case in which this indemnification would violate legal prohibition, the foregoing provision concerning indemnification shall not be construed to identify the County for damage arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence of the County, its commissioners, officers, employees or agents.

BID BOND/GUARANTEE

All Bids must be accompanied by a certified check, cashier's check, or a satisfactory Surety Bid Bond in an amount not less than five percent (5%) of the total Bid price. Checks shall be made payable to County of Macomb. No Bid shall be considered unless it is accompanied by a certified check, cashier's check or a satisfactory Surety Bid Bond.

Checks will be returned to all except the three (3) lowest Bidders for each contract within five (5) days after the opening of the Bids, and the remaining checks will be returned promptly after Macomb County and the accepted Bidders have executed the Contract, or if no award has been made, within one hundred twenty (120) days after the date of the opening of the Bids, upon demand of the Bidder at any time thereafter, so long as he has not been notified of the acceptance of his/her Bid.

The Bid Bond/Guarantee may be forfeited to Macomb County, if the successful Bidder refuses to enter into a Contract within ten (10) days upon award of Contract from Macomb County.

Bid Bonds shall be accompanied by a Power-of-Attorney authorizing the signer of the bond to do so on behalf of the Surety Company.

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PERFORMANCE AND PAYMENT BOND

The successful Bidder will be required to furnish a satisfactory performance and payment bond each in an amount equal to 100 percent of the Contract Sum, within five (5) days after notification of intent to enter into Contract. Bonds, in the full amount of the contract, are required so that the County has a guarantee that the Contractor will faithfully perform the contract and the Contractor will make all payments for all labor and material costs or claims covered or furnished under the contract.

All bonds and policies or certificates of insurance must meet with the approval of Macomb County before the Contractor will be allowed to commence the Work. Failure or refusal to furnish bonds or insurance policies or certificates in a form satisfactory to Macomb County shall subject the Bidder(s) to forfeiture of Bid Bond.

The Performance and Payment Bond must be from a surety company licensed to do business in the State of Michigan, and will be in Compliance with all the requirements of MCL 129.201 et seq.

CONTRACTS WITH SUB-CONTRACTORS

All contracts made by the Bidder with Sub-Contractors shall be covered by the terms and conditions of the Contract. The Bidder shall inform all Sub-Contractors of these terms and conditions. Macomb County reserves the right to require of the Bidders tentatively selected for consideration in the awarding of the Contract, a list of the Sub-Contractors whom the Contractor intends to employ.

Macomb County reserves the right to disapprove the use of any proposed Sub-Contractor, and in such event, the Bidder submitting such Sub-Contractor shall submit another such Sub-Contractor in like manner within the time specified by Macomb County. Macomb County reserves the right to reject any proposal if such information required by Macomb County is not submitted as above indicated.

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INSURANCE

COMMERCIAL GENERAL LIABILITY INSURANCE

Shall be written on an occurrence basis with limits of Liability of not less than \$1,000,000 (one million dollars) as combined single limit for each occurrence of bodily injury and personal injury with an annual aggregate of not less than \$2,000,000 (two million dollars). The policy shall include:

- a. Contractual Liability
- b. Products and Completed Operations
- c. Independent Contractors Coverage
- d. Broad Form General Liability Extensions or equivalent

WORKERS' COMPENSATION

Workers' Compensation Insurance meeting Michigan statutory requirements. Employer's Liability Insurance with minimum limits of \$500,000 each accident, \$500,000 bodily injury by disease policy limit, \$500,000 bodily injury by disease each employee.

AUTOMOBILE LIABILITY INSURANCE

Motor Vehicle Liability Insurance including Michigan NO-FAULT Coverage for all vehicles, owned and non-owned, leased and hired used in the performance of this contract with limits of \$1,000,000 (one million dollars) as the combined single limit for each occurrence for bodily injury and property damage.

PROFESSIONAL LIABILITY/ERRORS & OMISSIONS

Professional Liability Insurance with minimum limits of \$1,000,000 (one million dollars) each occurrence and \$2,000,000 (two million dollars) aggregate.

INSURANCE INSTRUCTIONS

All certificates of insurance and duplicate policies shall contain the following:

The County of Macomb shall be named additional insured on all policies (excluding Worker's Compensation) and the underwriters will have no right of recovery or subrogation against the County of Macomb including its agents, employees, elected and appointed officials and agencies. It being the intention of the parties that the insurance policy so effected will protect both parties in primary coverage for any and all losses covered by the subject policy. The insurance carrier(s) must have an A.M. Best rating of no less than an A-, VII.

The insurance company(s) issuing the policy or policies will have no recourse against the County of Macomb for payment of any premiums or for assessments under any form of policy.

The Contractor will assume any and all deductibles in the above any and all deductibles in the above-described insurance policies.

The term "INSURED" is used severally, not collectively, but the inclusion in this policy of more than one insured will not operate to increase the limit of the Owner's liability.

All certificates are to provide a thirty (30) day notice of material change or cancellation. Certificates of insurance must be provided no less than ten (10) working days before commencement of work to the County of Macomb, 120 North Main Street, Mt. Clemens, Michigan 48043 Attention: Department of Risk Management.



FORMS

INSTRUCTIONS

All Proposals must be submitted on the forms provided, properly executed and with all items filled out in ink or typed. Do not change or add words to the forms. Unauthorized conditions, limitations, or provisions on or attached to the forms may be cause for rejection of the proposal. Any Bidder information that is altered by erasure or by inter-lineation prior to submittal must be initialed and explained by notation above the signature of the Bidder.

LIST

The following is a list of forms that are to be completed and returned:

County Vendor Disclosure Form	Page 12
Non-Collusion Affidavit	Page 14
Macomb County Preference	Page 15
General Information	Page 16
Work References	Page 17
Federal E-Verify Program	Page 18
Iran Economic Sanction Act	Page 19
Bid Form	Page 20
Bid Form Supplement	Page 23
Vendor Certification Debarment	Page 26
Good Housekeeping & Best Mgmt Practices	Page 27

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



**County of Macomb, Michigan
VENDOR DISCLOSURE FORM**

The Macomb County ethics ordinance requires vendors of the County to complete and file a disclosure statement, the purpose of which is to disclose any financial relationships or other conflicts of interest that may exist between vendors and employees or elected officials (or their appointees) of the County. Once filed, the disclosure form does not need to be updated unless there is a change in circumstance that would cause the answer to any of the questions to change, at which time an amended disclosure form must be filed. Filing of the disclosure form is considered a condition of payment.

PLEASE RETURN THE COMPLETED FORM TO:

Macomb County Purchasing Department
ATTN: Vendor Disclosure/Mary Schultz
44900 Vic Wertz Dr.
Clinton Township, MI 48036

VENDOR NAME: _____

1. Does the vendor currently employ a relative of any employee, elected official or appointee of an elected official of Macomb County? Relative is defined as husband or wife, father or mother, son or daughter, brother or sister, uncle or aunt, first cousin, nephew or niece, great uncle or great aunt, grandfather or grandmother, grandson or granddaughter, father-in-law or mother-in-law, son-in-law or daughter-in-law, brother-in-law or sister-in-law, stepfather or stepmother, stepson or stepdaughter, stepbrother or stepsister, half-brother or half-sister, the parents or grandparents of the individual's fiancée.

YES NO

If yes, please answer the following:

- Name of County employee or elected official (or appointee): _____
- B. County Position/Title: _____
County Department or _____
- C. Agency: _____

2. Does any employee or elected official of Macomb County have an interest in the vendor organization in any of the following capacities, either compensated or non-compensated: director, officer, partner, beneficiary, trustee, member, employee or contractor.

YES NO

If yes, please answer the following:

- Name of County employee or elected official (or appointee): _____
- B. County Position/Title: _____
- C. County Department or Agency: _____
- D. Position/Title with Vendor: _____

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



3. Does any current employee or elected official of Macomb County have legal or beneficial ownership of 10% or more of the outstanding stock of the vendor organization?

YES **NO**

If yes, please answer the following:

- A. Name of County employee or elected official (or appointee): _____
- B. County Position/Title: _____
- C. County Department or Agency: _____
 % of Ownership of Vendor
- D. Organization: _____

4. In the last five calendar years, has the vendor failed to perform or otherwise deliver on the terms of a contract or agreement with Macomb County, or any other public entity, including suspensions or debarments?

YES **NO**

If yes, please provide further explanation:

I hereby certify that the information included on this form is complete, true and accurate to the best of my knowledge and belief. I understand that either myself or the organization to which this form applies may be subject to sanctions and/or penalties as set forth in the ethics ordinance if any information has been falsified or omitted.

Name (Please Print)

Title

Signature

Date

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



MACOMB COUNTY BASED PREFERENCE

A local preference percentage credit from the following allowance table will be applied to the bid of any County-based Enterprise. This credit will be subtracted from the bid of the County-based Enterprise. In comparing bids, the bid of the County –based Enterprise after subtraction of the credit shall be considered the official bid. However, if the County-based Enterprise is awarded the Contract, the bid without the equalization percentage credit shall be the Contract price.

<u>Contract Amount</u>	<u>Local Preference Percentage</u>
Up to \$50,000.00	5
\$50,000.00 to \$200,000.00	3
\$200,000.00 and over	1

1. No business shall receive these credits unless it has been certified by the Purchasing Manager.
2. Any business who claims entitlement to any local preference credit shall disclose the records necessary to establish eligibility to the County.
3. After applying any local preference credits as provided above, the Contract shall be awarded to the lowest Responsible Bidder thus evaluated.

IN ORDER TO DETERMINE IF YOUR BUSINESS IS ENTITLED TO RECEIVE A LOCAL PREFERENCE PERCENTAGE CREDIT, PLEASE ANSWER THE FOLLOWING QUESTIONS:

1. Is your business headquarters physically located within Macomb County, or has it been conducting business at a location with a permanent street address in the County of Macomb on an ongoing basis for not less than one taxable year prior to your bid or response to this Request for Proposal? **YES _____ NO _____**
2. Has your business paid property taxes on real or personal property within the past year on property which is ordinarily needed to perform the proposed contract? **YES _____ NO _____**
3. Are at least 50 percent of your regular full-time employees based at the County location to perform the proposed contract? **YES _____ NO _____**
4. Has your business been dealing for at least one year on a regular commercial basis in the kind of goods or services which are the subject of this bid or proposal? **YES _____ NO _____**

Drug Screening

To the extent not prohibited by law, all contracts for construction, repair, alteration, or rebuilding of a County building or other property shall include a provision requiring the contractor and any subcontractor providing services under the contract to conduct pre-hire screening for illegal drug use by their employees who provide services under the contract.

If applicable, is your business compliant with this requirement? **YES _____ No _____**

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



GENERAL INFORMATION

In further description of this Bid, we desire to submit sheets marked as follows:

Bidding under the name of: _____

DUNS Number: _____

Federal Employer Identification Number: _____

which is (check one of the following):

() Corporation, incorporated under the laws of the State of:

() Partnership, consisting of (list partners):

() Assumed Name (Register No.) _____

() Individual

AUTHORIZED SIGNATURE: _____

Printed or typed signature: _____

Title: _____

Address: _____

City, State: _____

Date: _____

Telephone Number: _____

Fax Number: _____

Email: _____

When payment on such order or contract is to be directed to the same company at an address different from above, please list the address to be used below:

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



WORK REFERENCES

BIDDER'S COMPANY NAME _____
Please list at least three (3) companies or public agencies for which you have done similar work.

Macomb County reserves the right to reject low Bids for poor past performance or inadequate references.

NAME OF COMPANY _____

CONTACT PERSON _____

ADDRESS _____

TELEPHONE NO. _____

NAME OF COMPANY _____

CONTACT PERSON _____

ADDRESS _____

TELEPHONE NO. _____

NAME OF COMPANY _____

CONTACT PERSON _____

ADDRESS _____

TELEPHONE NO. _____

NAME OF COMPANY _____

CONTACT PERSON _____

ADDRESS _____

TELEPHONE NO. _____

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



FEDERAL E-VERIFY PROGRAM

The Macomb County Board of Commissioners has established a policy regarding the Federal E-Verify Program. This policy states that future contracts (including both new and reviewing contracts) between Macomb County and contractors and vendors who provide services in excess of twenty-thousand dollars (\$20,000) shall require the contractors and vendors to register with, participate in, and utilize the E-Verify Program (or any successor program implemented by the federal Department of Homeland Security and Social Security Administration) when hiring their employees and require the County's Human Resources Department to utilize the E-Verify Program (or any successor program implemented by the federal Department of Homeland Security and Social Security Administration) when hiring new employees.

For more information about E-Verify, go to www.uscis.gov. Click on the E-Verify icon on the bottom left-hand corner of page.

**ACKNOWLEDGMENT OF MACOMB COUNTY'S POLICY
REQUIRING PARTICIPATION IN THE FEDERAL E-VERIFY PROGRAM
AND CERTIFICATION OF COMPLIANCE**

The undersigned hereby acknowledges receipt of a copy of the policy of the Macomb County Board of Commissioners requiring contractors, including those providing professional services, who provide services **in excess of \$20,000 a year** to the County to register and participate in the Federal E-Verify Program.

The undersigned hereby certifies that (he/she/it) will comply with this policy and will register with, participate in and utilize the E-Verify Program or any successor program implemented by the Federal Department of Homeland Security and Social Security Administration when hiring employees.

DATED: _____

Authorized Signature

Printed or Typed Signature

Name of Company



CERTIFICATION OF COMPLIANCE – IRAN ECONOMIC SANCTIONS ACT

Michigan Public Act No. 517 of 2012

The undersigned, the owner or authorized officer of the below-named Bidder _____, hereby certifies, represents and warrants that the Bidder, including its officers, directors and employees, is not an “Iran linked business” within the meaning of the Iran Economic Sanctions Act, Michigan Public Act No. 517 of 2012 (the “Act”), and that in the event Bidder is awarded a contract, the Bidder will not become an “Iran linked business” at any time during the course of performing any services under the contract.

BIDDER: _____
Name of Bidder

By: _____

Its: _____

Date: _____

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



BID FORM

Bid Item #20-24
Macomb County
Clemens Center-County Clerk Storage Renov. Project

Bidder: _____
(print or type company name)

County of Macomb
Mount Clemens, Michigan

OWNER

(Telephone Number)

MACOMB COUNTY
MT. CLEMENS, MICHIGAN 48043

ARCHITECT

WAKELY ASSOCIATES INC.
30500 VAN DYKE AVENUE, SUITE 209
WARREN, MI 48093

GENERAL AGREEMENTS

- A. The Bidder acknowledges that he/she has had the opportunity to examine the site and locality where the Work is to be performed and has become familiar with the legal requirements, laws, rules, regulations and conditions affecting the cost, progress and performance of the Work; and has made such independent investigations as Bidder deemed necessary to prepare the Bid. Further, Bidder hereby states that the Base Bid set forth in this Bid Response is true and correct.
- B. The Bidder agrees that this Bid shall not be withdrawn for a period of 30 calendar days after the scheduled closing time for receiving Bids.
- C. The Bidder declares that in preparing this Bid, Bidder is assured of the availability of all labor, materials and products to meet the substantial completion date.
- D. The Bidder acknowledges that the price stated below includes all taxes of whatever character or description.
- E. The Bidder agrees to execute a Contract for work covered by this Bid, provided that he/she be notified of its acceptance within thirty (30) days after the opening of Bids.

SCHEDULE - TIME OF COMPLETION

The undersigned agrees to commence the Work of the Contract Documents on a date specified in a written "Notice to Proceed", and shall fully complete the Work within the required time allowed. Owner requires work to be substantially complete no later than **February 28, 2025**. The proposed Bid is in full consideration of this.

ACKNOWLEDGEMENT OF ADDENDA

The Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

Addendum No. 1, dated _____, Addendum No. 3, dated _____

Addendum No. 2, dated _____, Addendum No. 4, dated _____

BID FORM SUPPLEMENTS

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



Attached to this Bid Form and incorporated herein are the following documents, completed in full by the undersigned:

Base Bid Form Supplement – Unit Prices/Supplemental Fees

BASE BID

The undersigned Bidder, having carefully examined the Bidding and Contract Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, all as issued by the Owner, and being familiar with all conditions and requirements of the Work, hereby proposes and agrees to furnish all material, labor, equipment, tools and supervision; and to furnish all services necessary to complete the Work required in accordance with the Bidding Documents for the following projects, in the following amount:

_____ Dollars \$ _____
(Sum to be written out)

The undersigned acknowledges that he/she has included the sum of \$50,000.00 (Fifty Thousand Dollars) in the base bid for use of a Construction Contingency. This amount, when unused, will be returned to the Owner. This allowance will be only used after written authorization of the Owner's representative and Owner.

ALTERNATES

Two Alternates are being priced. As follows:

Alternate No. 1: Cost to provide standard plastic laminate countertops in lieu of quartz at millwork/casework at the Clemens Center. Refer to Section 12300.

ALTERNATE NO. 1: _____
Dollars \$ _____ (sum to be written out)

Alternate No. 2: Cost to provide an FRP door and aluminum frame at door A104 at the Clemens Center in lieu of a HM door and frame.

ALTERNATE NO. 2: _____
Dollars \$ _____ (sum to be written out)

**BID ITEM # 20-24
 MACOMB COUNTY
 CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



VOLUNTARY ALTERNATES

The following voluntary alternates are offered by the Bidder. The undersigned agrees that the amounts indicated below shall be added to or deducted from the Base Bid, as the case may be for each alternate which is accepted.

Description of Voluntary Alternates	Add	Deduct
1. _____	\$ _____	\$ _____
2. _____	\$ _____	\$ _____
3. _____	\$ _____	\$ _____
4. _____	\$ _____	\$ _____

Respectfully submitted this ____ day of _____, 20____.

By: _____
 (Name of bidding firm or corporation)

Witness:

By: _____
 (Signature)

Attest: _____
 (Signature)

 (Type or print name)

By: _____
 (Type or print name)

Title: _____
 (Owner/Partner/President/Vice Pres.)

Title: _____
 (Corporate Secretary or Assistant Secretary Only)

Address: _____
 Phone: _____

License: _____

Federal ID No.: _____

(Affix Corporate Seal Here)

 Company Name

 Company Representative

 Title

 Date

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



BID FORM SUPPLEMENT - UNIT PRICES/SUPPLEMENTAL FEES

This form is required to be attached to the Base Bid Form.

Bid Item #20-24 Bidder: _____
Macomb County (print or type company name)
Clemens Center-County Clerk Storage Renov.

County of Macomb
Mount Clemens, Michigan

SUPPLEMENTAL FEES

For additional work performed upon instruction of Macomb County, by Sub-Contractors of the Undersigned, add to the Sub-Contractor's prices for such work a fee of _____%, which includes all the charges of the undersigned for overhead and profit.

Any additional work performed upon instruction of Macomb County by persons other than the Sub-Contractors of the undersigned, the charges will be actual cost of the labor, and materials, (less all discounts) plus the fee of _____%, which includes all the charges of the undersigned for overhead and profit, and to which shall be added the actual cost of insurance & taxes.

Each Bid covering extra work, shall be accompanied with complete itemized material & labor breakdowns.

For all revisions involving the deletion of contract work, it is agreed that the full credit shall be given Macomb County for such work deleted, including overhead and profit as quoted hereinbefore.

NEGOTIATION

The undersigned agrees that, should the overall cost exceed the funds available, he/she will be willing to negotiate with Macomb County and Architect; for the purpose of making further reductions in the Contract work, and shall agree to give full credit for all such reductions in the work requested by Macomb County, including full value of labor, materials, and Sub-Contract work and reasonable proportionate reductions in overhead and profit, thereby arriving at an agreed upon Contract price.

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



Submitted this ____ day of _____, 20 ____

By: _____
(Name of bidding firm or corporation)

By: _____
(Signature)

(Type or print name)

Title: _____
(Owner/Partner/President/Vice Pres.)

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



BID FORM SUPPLEMENT - LIST OF SUB-CONTRACTORS

All sealed bids for construction contracts shall provide a list of preferred sub-contractors and identify, with documentation, whether each subcontractor is a County-based Enterprise.

NAME OF BIDDER: _____

NAME OF SUB-CONTRACTOR _____

CONTACT PERSON _____

ADDRESS _____

TELEPHONE NO. _____

MACOMB COUNTY BASED ENTERPRISE (Y/N) _____

NAME OF SUB-CONTRACTOR _____

CONTACT PERSON _____

ADDRESS _____

TELEPHONE NO. _____

MACOMB COUNTY BASED ENTERPRISE (Y/N) _____

NAME OF SUB-CONTRACTOR _____

CONTACT PERSON _____

ADDRESS _____

TELEPHONE NO. _____

MACOMB COUNTY BASED ENTERPRISE (Y/N) _____

NAME OF SUB-CONTRACTOR _____

CONTACT PERSON _____

ADDRESS _____

TELEPHONE NO. _____

MACOMB COUNTY BASED ENTERPRISE (Y/N) _____

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



COUNTY OF MACOMB

VENDOR CERTIFICATION DEBARMENT

All information requested in this section must be completed and the document notarized. Any information omitted, or erroneously reported, may result in disqualification for current or future bidding and supply on behalf of the County of Macomb.

The undersigned warrants and presents that they have full complete authority to make representations for and on behalf of the undersigned company and that their representations are fully binding upon the undersigned company.

1. The undersigned are not presently debarred, suspended, proposed for debarment, declared ineligible, or excluded from transactions by any federal department or agency, or any state, county or local municipality, department or agency.
2. The undersigned has not within a three (3) year period preceding this bid been convicted of, or had a civil judgment rendered against them for the commission of fraud, a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction, or a contract a public transaction, violation of federal or state antitrust statutes, or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.
3. The undersigned are not presently indicted for or otherwise criminally or civilly charged by any governmental entity (federal, state or local) with commission of any of the offenses set forth in paragraph 2.
4. The undersigned have not within a three (3) year period preceding this bid, had one or more public transactions (federal, state or local) terminated or attempted to be terminated for cause or default.

IF THE APPLICANT IS UNABLE TO CERTIFY TO ANY OF THE STATEMENTS IN THIS CERTIFICATION, CERTIFICATION AND EXPLANATION SHALL BE ATTACHED AND PRESENTED WITH THIS CERTIFICATION.

THE UNDERSIGNED CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF THE CONTENTS OF THE STATEMENTS SUBMITTED MADE ON BEHALF OF THE UNDERSIGNED BIDDER.

Bidder: _____

Bidder Address: _____

Applicant/Bidder Representative: _____

Signature: _____
(Print full name)

Subscribed and sworn to before me this
_____ day of _____, 20__.

Notary Public
County of _____,
State of _____
My Commission expires: _____

**BID ITEM # 20-24
MACOMB COUNTY
CLEMENS CENTER-COUNTY CLERK STORAGE RENOVATION**



GOOD HOUSEKEEPING AND BEST MANAGEMENT PRACTICES

Bidder shall comply with the Good Housekeeping and Best Management Practices as outlined in SEMCOG's LID that can be found at:

<https://semcog.org/Reports/LID/files/assets/basic-html/page-1.html#>.

Where applicable, Bidder to annually certify their trucks and tanks to ensure that materials extracted stay within the truck until it reaches the permitted disposal site.

All equipment utilized in the cleaning process will abide by manufacturers recommendations.

Initial

Date

MACOMB COUNTY
CLEMENS CENTER

COUNTY CLERK STORAGE RENOV. 231987

JULY 25, 2024

SECTION 00851 - INDEX OF DRAWINGS

TITLE SHEET

The following drawings, dated July 25, 2024, are issued for Macomb County Board of Commissioners, Clemens Center-County Clerk Storage Renovation, Bid Item #20-24, Mt. Clemens, MI. Architect's Project Number 231987.

SHEET INDEX

ARCHITECTURAL DRAWINGS:

G0.0 COVER SHEET
G4.1 GENERAL INFORMATION, SYMBOLS AND ABBREVIATIONS

A1.0 COMPOSITE FLOOR PLANS
A1.1 CLEMENS CENTER - ENLARGED DEMOLITION AND NEW WORK FLOOR PLANS
A1.2 CLEMENS CENTER - ENLARGED REFLECTED CEILING AND ROOF PLANS

MECHANICAL DRAWINGS:

M0.00 CLEMENS CENTER - MECHANICAL GENERAL INFORMATION
MD1.00 CLEMENS CENTER - MECHANICAL DEMOLITION LOWER LEVEL FLOOR PLAN
P1.00 CLEMENS CENTER - PLUMBING NEW WORK LOWER LEVEL FLOOR PLAN
M1.00 CLEMENS CENTER - MECHANICAL NEW WORK LOWER LEVEL FLOOR PLAN
M5.00 CLEMENS CENTER - MECHANICAL DETAILS AND SCHEDULES

ELECTRICAL DRAWINGS:

E0.00 CLEMENS CENTER - ELECTRICAL GENERAL INFORMATION AND LIGHTING SCHEDULE
EPD1.00 CLEMENS CENTER - POWER DEMOLITION LOWER LEVEL FLOOR PLAN
ELD1.00 CLEMENS CENTER - LIGHTING DEMOLITION LOWER LEVEL FLOOR PLAN
EP1.00 CLEMENS CENTER - POWER NEW WORK LOWER LEVEL FLOOR PLAN
EL1.00 CLEMENS CENTER - LIGHTING NEW WORK LOWER LEVEL FLOOR PLAN
E5.00 CLEMENS CENTER - ELECTRICAL DETAILS AND PANEL SCHEDULES
E6.00 CLEMENS CENTER - ELECTRICAL ONE LINE DIAGRAM

END OF SECTION 00851

SECTION 01010 - SUMMARY OF WORK

PART I - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this section.

1.02 PROJECT:

- A. The project consists of the following:

- 1. **Clemens Center, 14 Market Street, Mt. Clemens, MI 48043-Clerk Storage Facility**

The Project consists of, but not limited to:

- a. Selective demolition of existing gypsum board walls, masonry and portions of the existing concrete slab.
- b. New gypsum board walls.
- c. Leveling of existing concrete slab.
- d. New Mobile H.D. storage system and fixed racks.
- e. New FRP doors in aluminum frames, new wood doors in HM frames.
- f. New floor finishes.
- g. New millwork.
- h. New acoustical ceilings in office areas.
- i. Painting of floors, walls and exposed structure.
- j. New HVAC system.
- k. New LED lighting.
- l. New fire suppression system pre-activation.
- m. New power.
- n. New signage.

1.03 SCHEDULE:

- A. Asbestos may be present and if found will be abated by the Owner. There will be no extra costs allowed due to the time required by the Owner for any abatement.
- B. The site will remain in operation during the construction/repair period. Schedule and work operations must be coordinated with Macomb County Facilities and Operations.

MACOMB COUNTY
CLEMENS CENTER
COUNTY CLERK STORAGE RENOV. 231987 JULY 25, 2024

1.04 ALLOWANCES:

- A. The undersigned acknowledges that he/she has included the sum of **FIFTY THOUSAND DOLLARS (\$50,000.00)** in the base bid for use as a Construction Contingency. This amount, when unused, will be returned to the Owner. This allowance will only be used after written authorization of the Owners representative.

PARTS 2 & 3 - PRODUCT AND EXECUTION
Not applicable

END OF SECTION 01010

SECTION 01041 - PROJECT COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

- A. Contractor shall provide the services of a full time Project Coordinator for the duration of the construction work.
 - 1. Employ someone with not less than (10) ten years experience performing coordination work on projects of similar size and scope.
 - 2. Submit name and qualifications to Architect.
- B. Provide additional administrative and supervisory personnel as required for the performance of the work including coordination of the various subcontractors.
- C. Related Requirements Specified in Other Sections:
 - 1. Summary of Work: Section 01010.

1.03 PROJECT COORDINATOR'S DUTIES:

- A. Coordinate the work of the various subcontractors:
 - 1. For temporary utilities.
 - 2. With the work of trades specified in Division 2 through 28.
- B. Coordinate the schedules of subcontractors.
 - 1. Verify timely deliveries of products for installation by other trades.
 - 2. Verify that labor and materials are adequate to maintain schedules.

- C. Maintain conferences among subcontractors and other concerned parties, as necessary to:
1. Maintain coordination and schedules.
 2. Resolve matters in dispute.
- D. Participate in project meetings:
1. Report progress of work.
 2. Recommend needed changes in schedule.
- E. Temporary Utilities:
1. Coordinate installation, operation and maintenance, to verify compliance with project requirements and with Contract Documents.
 2. Verify adequacy of service at required locations.
- F. Shop Drawings, Product Data and Samples:
1. Prior to submittal, review for compliance with Contract Documents.
 - a. Check field dimensions and clearance dimensions.
 - b. Check relation to available space.
 - c. Check existing curtain wall anchorage in area of work and report any damage to Architect.
 - d. Review the effect of any changes on the work of other contracts or trades.
 - e. Check compatibility with equipment and work of other trades.
- G. Coordination Drawings:
1. Prepare, as required to assure coordination of work or to resolve conflicts.
 2. Submit for review and transmittal.
 3. Reproduce and distribute approved copies to all concerned parties.

H. Observe required testing; maintain a record of tests:

1. Testing agency and name of inspector.
2. Subcontractor.
3. Manufacturer's representative present.
4. Date and time of testing.
5. Type of product or work.
6. Type of test and results.
7. Retesting required.

I. Verify that subcontractors maintain accurate record documents.

J. Substitutions and Changes:

1. Review proposals and requests.
 - a. Check for compliance with Contract Documents.
 - b. Verify compatibility with work and equipment of other trades.
2. Promptly report deficiencies or discrepancies to the contractor.

K. Assemble documentation for handling of claims or disputes.

L. Inspection and Acceptance of Work:

1. Prior to inspection, check that work is complete and ready for acceptance
2. Assist Inspector: Prepare list of items to be completed or corrected.
3. Should acceptance of work constitute the beginning of the specified guarantee period, prepare and transmit written notice to Contractor for the Owner.

M. Assemble record documents from subcontractors.

END OF SECTION 01041

SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
- C. Demolition of selected portions of the building for alterations is included in Section 02070 "Selective Demolition."

1.3 SUBMITTALS

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
 - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
 - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 - 3. List products to be used and firms or entities that will perform Work.
 - 4. Indicate dates when cutting and patching is to be performed.
 - 5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.4QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.
 - 1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
 4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
 5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.

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4. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.4 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

SECTION 01090 - REFERENCE STANDARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Quality assurance.
- B. Schedule of references.

1.02 QUALITY ASSURANCE:

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date for receiving bids.
- C. Obtain copies of standards when required by Contract Documents.
- D. Maintain copy at job site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- F. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.04 SCHEDULE OF REFERENCE:

- AA Aluminum Association
900 19th Street, N.W. - Suite 300
Washington, DC 20006
- AABC Associated Air Balance Council
1518 K Street N.W.
Washington, DC 20005
- AASHTO American Association of State Highway
and Transportation Officials
444 North Capitol Street, N.W. - Suite 249
Washington, DC 20001

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ACI American Concrete Institute
P.O. Box 9094
Farmington Hills, MI 48333-9094

ADC Air Diffusion Council
1901 N. Roselle Rd., Suite 800
Schaumburg, IL 60195

AF&PA American Forest & Paper Association
1111 19th Street, NW, Suite 800
Washington, DC 20036

AGC Associated General Contractors of America
2300 Wilson Blvd., Suite 400
Arlington, VA 22201

AI Asphalt Institute
2696 Research Park Drive
Lexington, KY 40511-8480

AIA American Institute of Architects
1735 New York Avenue, N.W.
Washington, DC 20006-5292

AISC American Institute of Steel Construction
One East Wacker Drive
Suite 3100
Chicago, IL 60601-2001

AISI American Iron and Steel Institute
1140 Connecticut Ave - Suite 705
Washington, DC 20036

AITC American Institute of Timber Construction
7012 S. Revere Parkway - Suite 140
Englewood, CO 80112

AMCA Air Movement and Control Association
30 West University Drive
Arlington Heights, IL 60004

ANSI American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

APA American Plywood Association
Box 11700
Tacoma, WA 98411-0700

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ARI Air Conditioning and Refrigeration Institute
4100 North Fairfax Drive - Suite 200
Arlington, VA 22203

ASHRAE American Society of Heating, Refrigeration and
Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, GA 30329

ASME American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

ASTM American Society for Testing and Materials
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

AWI Architectural Woodwork Institute
46179 Westlake Drive, Suite 120
Potomac Falls, VA 20165

AWPA American Wood-Preservers' Association
P.O. Box 5690
Grandbury, TX 76049

AWS American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

BIA Brick Institute of America
1350 Centennial Park Drive, Suite 301
Reston, VA 20191

CDA Copper Development Association
260 Madison Avenue - 16th Floor
New York, NY 10016

CLFMI Chain Link Fence Manufacturers Institute
10015 Old Columbia Road, Suite B-215
Columbia, MD 21046

CRSI Concrete Reinforcing Steel Institute
933 Plum Grove Road
Schaumburg, IL 60173-4758

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CSSB Cedar Shake and Shingle Bureau
P.O. Box 1178
Sumas, WA 98295-1178

DHI Door and Hardware Institute
14150 Newbrook Drive, Suite 200
Chantilly, VA 20151

EJCDC Engineers' Joint Contract Documents Committee
American Council of Engineering Companies
1015 15th Street, N.W., 8th Floor
Washington, DC 20005

EJMA Expansion Joint Manufacturers Association
25 North Broadway
Tarrytown, NY 10591

FGMA Flat Glass Marketing Association
3310 Harrison
White Lakes Professional Building
Topeka, KS 66611

FM Factory Mutual System
Standards Laboratories Department
1151 Boston-Providence Turnpike
Norwood, MA 02062

FS Federal Specification
General Services Administration
Specifications and Consumer Information
Distribution Section (WFSIS)
1800 F Street, NW
Washington, DC 20405

GA Gypsum Association
810 First Street N.W. #510
Washington, DC 20002-4268

ICC International Code Council
5203 Leesburg Pike, Suite 600
Falls Church, VA 22041

IEEE Institute of Electrical and Electronics Engineers
345 East 47th Street
New York, NY 10017

IMIAC International Masonry Industry All-Weather Council
International Masonry Institute
815 15th Street, N.W.
Washington, DC 20005

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MBMA Metal Building Manufacturer's Association
1300 Sumner Avenue
Cleveland, OH 44115-2351

MFMA Maple Flooring Manufacturers Association
60 Revere Drive
Northbrook, IL 60062

MIL Military Specification
Naval Publications and Forms Center
700 Robbins Avenue, Building 4, Section D
Philadelphia, PA 19111-5093

ML/SFA Metal Lath/Steel Framing Association
Division of National Association of Architectural Metal
Manufacturers (NAAMM MLIFSA)
600 South Federal Street, Suite 400
Chicago, IL 60605

NAAMM National Association of Architectural Metal
Manufacturers
800 Roosevelt Road, Building C, Suite 312
Glen Ellyn, IL 60137

NCMA National Concrete Masonry Association
2302 Horse Pen Road
Herndon, VA 22071-3499

NEBB National Environmental Balancing Bureau
8575 Grovement Circle
Gaithersburg, MD 20877

NEMA National Electrical Manufacturers' Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209

NFPA National Fire Protection Association
#1 Battery March Park
Quincy, MA 02269-9101

NSWMA National Solid Wastes Management Association
4301 Connecticut Avenue, N.W., Suite 300
Washington, DC 20008-2304

NTMA National Terrazzo and Mosaic Association
201 North Maple, Suite 208
Purcellville, VA 20132

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PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

PCI Precast Prestressed Concrete Institute
175 W. Jackson Blvd.-Suite 1859
Chicago, IL 60604-9773

PS Product Standard
U.S. Department of Commerce
1401 Constitution Avenue, N.W.
Washington, DC 20230

RIS Redwood Inspection Service
Division of California Redwood Association)
405 Enfrente Drive
Novato, CA 94949

SDI Steel Deck Institute
P.O. Box 25
Fox River Grove, IL 60021

SDI Steel Door Institute
c/o Wherry Associates
30200 Detroit Road
Cleveland, OH 44145-1967

SIGMA Sealed Insulating Glass Manufacturers Association
401 N. Michigan Avenue
Chicago, IL 60611

SJI Steel Joist Institute
3127 10th Avenue North
Myrtle Beach, SC 29577-6760

SMACNA Sheet Metal and Air Conditioning Contractors'
National Association
4201 Lafayette Center Drive
Chantilly, VA 20151-1209

SSPC Society for Protective Coatings
40 24th Street, 6th Floor
Pittsburgh, PA 15222-4656

TCNA Tile Council of North America, Inc.
100 Clemson Research Blvd.
Anderson, SC 29625

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TPI Turfgrass Producers International
2 East Main Street
East Dundee, IL 60118

UL Underwriters' Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062-2096

WCLIB West Coast Lumber Inspection Bureau
6980 S.W. Varns Road
Tigard, OR 97223

WDMA Window & Door Manufacturers Associations
1400 W. Touhy Avenue, Suite 470
Des Plaines, IL 60018

WWPA Western Wood Products Association
522 SW Fifth Avenue, Suite 500
Portland, OR 97204-2122

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01090

SECTION 01100 - ALTERNATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. This section identifies each Alternate by number, and describes the basic changes to be incorporated into the work, only when the Alternate is made a part of the work by specific provisions in the Owner-Contractor Agreement.
- B. Alternate schedule below is part of the Bidding Documents and will be considered in selection of Contractors and awarding contracts.
- C. Unless otherwise provided, Owner will accept or reject alternates within thirty (30) days of date of contract. Owner reserves the right to reject any or all alternates.

1.03 ALTERNATES:

A. General:

- 1. The descriptions for each alternate listed in the schedule are primarily scope definitions, and do not necessarily detail the full range of materials and processes needed to complete the work as required.
- 2. Refer to applicable specification sections (Division 2 through 28), and to applicable drawings, for specific requirements of the work, regardless of whether references are so noted in description of each alternative.
- 3. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each Alternate, and to provide the complete construction required by Contract Documents.
- 4. Referenced sections of specifications stipulate pertinent requirements for products and methods to achieve the work stipulated under each Alternate.

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B. Schedule:

1. **Alternate No. 1:**
Cost to provide standard plastic laminate countertops in lieu of quartz at millwork/casework at the Clemens Center. Refer to Section 12300.
2. **Alternate No. 2:**
Cost to provide an FRP Door and aluminum frame at door A104 at the Clemens Center in lieu of a HM door and frame.

END OF SECTION 01100

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Pre-Construction Conference.
 - 2. Pre-Installation Conferences.
 - 3. Coordination Meetings.
 - 4. Progress Meetings.
- B. Construction schedules are specified in Spec Section 01310 "Construction Schedules".

1.3 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than (14) fourteen calendar days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments. Note: Multiple meetings may be required.
- B. Attendees: The Owner (represented by Macomb County Facilities and Operations and the County Clerk, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule.
 - 2. Critical work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions and Change Orders.
 - 5. Procedures for processing Applications for Payment.
 - 6. Distribution of Contract Documents.
 - 7. Submittal of Shop Drawings, Product Data and Samples.

8. Preparation of record documents.
9. Use of the premises.
10. Office, Work and storage areas.
11. Equipment deliveries and priorities.
12. Safety procedures.
13. First aid.
14. Security.
15. Housekeeping.
16. Working hours.

1.4PRE-INSTALLATION CONFERENCES

A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
 - a. Contract Documents.
 - b. Options.
 - c. Related Change Orders.
 - d. Purchases
 - e. Deliveries.
 - f. Shop Drawings, Product Data and quality control Samples.
 - g. Possible conflicts.
 - h. Compatibility problems.
 - i. Time schedules.
 - j. Weather limitations.
 - k. Manufacturer's recommendations.
 - l. Compatibility of materials.
 - m. Acceptability of substrates.
 - n. Temporary facilities.
 - o. Space and access limitations.
 - p. Governing regulations.
 - q. Safety.
 - r. Inspection and testing requirements.
 - s. Required performance results.
 - t. Recording requirements.
 - u. Protection.

2. Record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Architect.
3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 COORDINATION MEETINGS

- A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
- C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 PROGRESS MEETINGS

- A. Conduct progress meetings at the Macomb County Facilities and Operations Dept. at regularly scheduled intervals. Notify the Macomb County Facilities and Operations Department, County Clerk and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request. Note: Separate meetings for each building may be required.
- B. Attendees: In addition to representatives of the Macomb County Facilities and Operations Department, County Clerk and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 2. Review the present and future needs of each entity present, including such items as:
 - a. Interface requirements.
 - b. Time.
 - c. Sequences.
 - d. Deliveries.
 - e. Off-site fabrication problems.
 - f. Access.
 - g. Site utilization.
 - h. Temporary facilities and services.
 - i. Hours of Work.
 - j. Hazards and risks.
 - k. Housekeeping.
 - l. Quality and Work standards.
 - m. Change Orders.
 - n. Documentation of information for payment requests.
- D. Reporting: No later than (3) three days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01200



SUBSTITUTION REQUEST (During the Bidding Phase)

Project: _____ Substitution Request Number: _____

 _____ From: _____
 To: _____ Date: _____

 Re: _____ A/E Project Number: _____
 _____ Contract For: _____

Specification Title: _____ Description: _____
 Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
 Manufacturer: _____ Address: _____ Phone: _____
 Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____
 Signed by: _____
 Firm: _____
 Address: _____
 Telephone: _____

A/E's REVIEW AND ACTION

- Substitution approved - Make submittals in accordance with Specification Section 01340.
- Substitution approved as noted - Make submittals in accordance with Specification Section 01340.
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

Supporting Data Attached: Drawings Product Data Samples Tests Reports _____

**SUBSTITUTION
REQUEST**
(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Phone: _____

Address: _____

Trade Name: _____ Model No.: _____

Installer: _____ Phone: _____

Address: _____

History: New Product 1-4 years old 5-10 years old More than 10 years old

Differences between proposed substitution and specified product: _____

Point-by-point comparative data attached.

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed Substitution affects other parts of work: No Yes; explain _____

Savings to Owner for accepting substitution: _____ (\$_____).

Proposed substitution changes Contract Time: No Yes [Add] [Deduct] _____ days.

Supporting Data Attached: Drawings Product Data Samples Tests

Reports _____

**SUBSTITUTION
REQUEST**
(After the Bidding/Negotiating Phase)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
 - Same warranty will be furnished for proposed substitution as for specified product.
 - Same maintenance service and source of replacement parts, as applicable, is available.
 - Proposed substitution will have no adverse effects on other trades and will not affect or delay progress schedule.
 - Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
 - Proposed substitution does not affect dimensions and functional clearances.
 - Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
 - Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.
-

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

A/E's Review Action

- Substitution approved – Make submittals in accordance with Specification Section 01340.
- Substitution approved as noted – Make submittals in accordance with Specification Section 01340.
- Substitution rejected – Use specified materials.
- Substitution Request received too late – Use specified materials.

Signed by: _____ Date: _____

Additional Comments: Contractor Subcontractor Supplier Manufacturer
 A/E Other

SECTION 01310 - CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF REQUIREMENTS:

- A. General: This section specifies the particular administrative and procedural requirements for progress time scheduling and progress reporting for the performance of the work, as indicated in the AIA A201 General Conditions 2017 Edition and elsewhere in the Contract Documents. Refer also to the General Conditions and to the "Contractor" for definition and specific dates of the Contract Time.
- B. Scheduling Responsibility: Submission of Contractor's progress schedule to the Owner or Architect shall not relieve the Contractor of his total responsibility for scheduling, sequencing and pursuing the work to comply with the requirements of the Contract Documents, including adverse effects such as delays resulting from ill-timed work; refer to General Conditions.

1.03 FORM OF SCHEDULES:

- A. Contractor shall prepare a "Plan of Operations and Progress Schedule" which shall show concisely the manner in which different phases of the work are to be started, methods and speed for the inter-relationship of the work under the various contracts, times upon which different phases of the work are to be started, methods and speed for progressing the different phases and dates upon which the certain subcontractors are dependent upon that under other subcontracts.
- B. The plan of operations and progress schedule shall be "weighed" to schedule each trade in proportion to the entire project, both physically and financially.
- C. In preparing the above plan of operations and progress schedule, the Contractor shall assure that the methods, dates and other pertinent matters are acceptable to the Architect and, when completed, he shall submit to and obtain approval from the Architect.

- D. After approval of the above plan of operations and progress schedule, the Contractor shall be responsible for seeing that it is adhered to and for ascertaining that proper coordination is maintained between work of all Contracts.

1.04 PROGRESS REVISIONS:

- A. Indicate progress of each activity to date of submission.
- B. Show changes occurring since previous submission of schedule:
 - 1. Major changes in scope.
 - 2. Activities modified since previous submission.
 - 3. Revised projections of progress and completion.
 - 4. Other identifiable changes.
- C. Provide a narrative report as needed to define:
 - 1. Problem areas, anticipated delays, and the impact on the schedule.
 - 2. Corrective action recommended and its effect.
 - 3. The effect of changes on schedules of other contractors.

1.05 SUBMISSIONS:

- A. Submit initial schedules within (14) fourteen calendar days after award of Contract.
 - 1. Architect, Macomb County Facilities & Operations Department and the County Clerk will review schedules and return review copy within (10) ten working days after receipt.
 - 2. Resubmit within (10) ten working days after return of review copy.
- B. Submit revised progress schedules and narratives with each application for payment.

1.06 DISTRIBUTION:

- A. Distribute copies of the reviewed schedules and narratives to:
 - 1. Job site file.
 - 2. Subcontractors.
 - 3. Other concerned parties.
- B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.

1.07 DAILY REPORTS:

- A. Contractor shall prepare a daily report, recording the following information concerning events at the site and submit duplicate copies to the Architect and Owner at regular intervals not exceeding weekly intervals.
 - 1. List of subcontractors at the site.
 - 2. List of separate contractors at the site.
 - 3. Count of personnel at the site.
 - 4. High/low temperatures, general weather conditions.
 - 5. Accidents (refer to accident reports).
 - 6. Meetings and significant decisions.
 - 7. Unusual events.
 - 8. Stoppages, delays, shortages, losses.
 - 9. Emergency procedures, field orders.
 - 10. Orders/requests by governing authorities.
 - 11. Change orders received, implemented.

PART 2 and 3 - PRODUCTS AND EXECUTION - Not Applicable

END OF SECTION 01310

SECTION 01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

- A. Submit shop drawings, product data and samples as required by the Contract Documents. Individual submittal requirements are specified in applicable sections for each unit of work. Receive, check and coordinate all submittals of contractors as provided herein.

B. Definitions:

1. Shop Drawings are drawings, diagrams, schedules and other data specifically prepared for the Work by the Contractor or any subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.
2. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.
3. Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the work will be judged.

1.03 SUBMITTAL REQUIREMENTS:

- A. Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for the same work, and for interfacing units of work, so that one will not be delayed for coordination with another. No extension of time will be allowed because of failure to properly coordinate and sequence submittals.

- B. Submit PDF of each shop drawing, including fabrication, erection, layout and setting drawings and such other drawings as required under various sections of the Specifications, until final acceptance is obtained. Prepare drawings legible, drawing plans, elevations, sections and details in scales required and on drawing sheets not larger than 30" x 42" nor smaller than 8-1/2" x 11". Submit copies of manufacturer's descriptive data including catalog sheets for materials, equipment and fixtures, showing dimensions, performance characteristics and capacities, wiring diagrams and controls, schedules, and other pertinent information as required. Where printed materials describe more than one product or model, clearly identify which is to be furnished.
- C. Shop drawings, product data and samples shall be dated including Contractor and Subcontractor dates of submittal and approval, and marked to show the names of the Project, Architect, Contractor, origination Subcontractor, manufacturer or supplier, and separate detailer if pertinent. Shop drawings shall completely identify Specification section and locations at which materials or equipment are to be installed. Reproductions of Contract Drawings are acceptable as Shop Drawings only when specifically authorized in writing by the Architect.
- D. Submission of shop drawings, product data and samples shall be accompanied by a copy of a transmittal letter containing Project name, Contractor's name, number of drawings, and samples, titles and other pertinent data. Transmittal shall bear signature of the Contractor as evidence he checked same and found them in conformance with the Contract Documents.
- E. The Contractor shall review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the Owner or any separate contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents.
- F. By approving and submitting Shop Drawings, Product Data and Samples, the Contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto, or will do so, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

- G. The Contractor shall not be relieved of responsibility for the deviation from the requirements of the Contract Documents by the Architect's acceptance of Shop Drawings, Product Data or Samples under Paragraph 13.12 of the AIA A201 General Conditions 2017 edition, unless the Contractor has specifically informed the Architect in writing of such deviation at the time of subdeviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the Architect's acceptance thereof.
- H. The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the Architect on previous submittals.
- I. No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been accepted by the Architect as provided in Paragraph 13.12 of the AIA A201 General Conditions 2017 edition. All such portions of the Work shall be in accordance with approved submittals.
- J. Architect will review Shop Drawings, Product Data and Samples as provided in Paragraph 13.12 of the AIA A201 General Conditions 2017 edition. He will mark each such submittal as follows:
1. Accepted - Where no comment made.
 2. Accepted as Noted - Where comments indicated on submittal qualifying, modifying, or otherwise changing it; however, submittal can be used for ordering, fabrication and erection at contractor's own risk until revised submittals have been made, reviewed and stamped acceptable.
 3. Revise & resubmit - Where comments indicated on submittal require revisions and resubmission prior to ordering and/or fabrication and erection.
 4. Rejected - Where proposed submittals do not conform to the contract documents.
- K. Contractor is responsible for obtaining and distributing required prints of shop drawings to his subcontractors and material suppliers; after as well as before final approval. Prints of reviewed shop drawings shall be made from transparencies which carry the Architect's appropriate stamp.

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L. Obtain copies of all shop drawings, product data and samples
submitted to date and accepted from other contractors.

PARTS 2 and 3 - PRODUCT AND EXECUTION

Not applicable.

END OF SECTION 01340

SECTION 01370 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to other Sections of Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. Submit to the Architect a Schedule of Values allocated to the various portions of the work, within seven (7) calendar days after award of contract.
- B. Upon request of the Architect, support the values with data which will substantiate their correctness.
- C. The Schedule of Values, unless objected to by the Architect or Owner, shall be used only as the basis for the Contractor's Applications for Payment.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES:

- A. Use AIA Form G702.
- B. Schedule shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. Follow the table of contents of Sections as the format for listing component items.
 - 1. Identify each line item with the number and title of the respective major section of the specifications.
- D. For each major line item list sub-values of major products or operations under the item.
 - 1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
- E. The sum of all values listed in the schedules shall equal the total Contract Sum.

PARTS 2 AND 3 - PRODUCTS AND EXECUTION - Not Applicable

END OF SECTION 01370

SECTION 01400 - QUALITY CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

- A. Specific quality control requirements for the work are indicated throughout the contract documents. The term "Quality Control" includes, but is not necessarily limited to, inspection and testing and associated requirements. This section does not specify or modify Architect's duties relating to quality control and Contract enforcement.
- B. Coordinate quality control programs of separate contractors including submittals, conferences and on site programs.

1.03 RESPONSIBILITY:

- A. Residual Contractor Responsibility: Whatever required, inspection, testing and similar quality control provisions to be performed by independent agencies (not directly by the Contractor), and not indicated to be Owner's responsibility, shall be the Contractor's responsibility. The costs for those required services by independent testing laboratories are recognized to be included in Contract Sum.
- B. Contractor's General Responsibility: No failure of test agencies, whether engaged by Owner or Contractor, to perform adequate inspections or tests or to properly analyze or report results, shall relieve Contractor of responsibility for fulfillment of requirements of contract documents. It is recognized that required inspection and testing program is intended to assist the Contractor, Owner, Architect, and governing authorities in nominal determination of probable compliances with requirements for certain elements of work. The program is not intended to limit the Contractor's regular quality control program, as needed for general assurance of compliances.

1.04 QUALITY ASSURANCE:

- A. General Workmanship Standards: Comply with recognized workmanship quality standards within the industry as applicable to each unit of work, including ANSI standards where applicable. It is a requirement that each category of trades person or installer performing the work be prequalified, to the extent of being familiar with applicable and recognized quality standards for that category of work, and being capable of workmanship complying with those standards.
- B. Qualification of Quality Control Agencies: Except where another qualification standard is indicated, and except where it is specifically indicated that use of prime product manufacturer's test facilities is acceptable, engage independent testing laboratories complying with "Recommended Requirements for Independent Laboratory Qualifications" as published by American Council of Independent Laboratories, and specializing in type(s) of inspections and tests required.

1.05 SUBMITTALS:

- A. General: Refer to Section 01340, "Shop Drawings, Product Data and Samples" for requirements applicable to inspection and test reports, quality control samples, maintenance agreements, warranties, and similar documentation of quality compliances as required. Refer to individual work sections of Division 2 through 28 for specific certification and submittal requirements.
- B. Copies and Distribution: Where inspection and test reports and certifications are required by governing authorities, provide additional copies as required, and where required, send copies directly from inspection or testing agency to governing authority.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING:

- A. General: Handle, store and protect materials and products, including fabricated components, by methods and means which will prevent damage, deterioration and losses including theft (and resulting delays), thereby ensuring highest quality results as performance of the work progresses. Control delivery schedules so as to minimize unnecessary long-term storage at project site prior to installation.

PART 2 - PRODUCTS
Not applicable.

PART 3 - EXECUTION:

3.01 PREPARATION FOR INSTALLATION:

A. Pre-Installation Conferences: Well in advance of installation of every major unit of work which requires coordination with other work, meet at the project site with installers and representatives of manufacturers and fabricators who are involved in or affected by the unit of work, and in its coordination or integration with other work which has proceeded or will follow. Advise Architect and Owner of scheduled meeting dates. At each meeting, review progress of other work and preparations for particular work under consideration, including requirements of contract documents, options, related change orders, purchases, deliveries, shop drawings, product data, quality control samples, possible conflicts, compatibility problems, time schedule, weather limitations, temporary facilities, space and access limitations, structural limitations, governing regulations, safety, inspection and testing requirements required performance results, recording requirements, and protection. Record significant discussions of each conference, and agreements and disagreements along with final plan of action. Distribute record of meeting promptly to everyone concerned, including Architect and Owner.

1. Do not proceed with the work if associated pre-installation conference cannot be concluded successfully. Instigate actions to resolve impediments to performance of the work, and reconvene conference at earliest data feasible.

B. Installer's Inspection of Conditions: Require Installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 COORDINATION OF TEST AGENCY WORK:

A. Coordination with Owner's Agencies: Afford access and reasonable time in construction sequence for Owner's inspection and tests to be performed. Cooperate with agencies and provide incidental labor and services needed for the removal and delivery of test samples, and for inspections and taking measurements. Provide patching and

restoration services where test samples have been removed, complying with individual technical sections of Divisions 2 through 28.

1. Except for specialized laboratory sampling equipment, and except as otherwise indicated, supply and operate tools and construction equipment needed to obtain test samples from the work, including cutting devices for sawing, drilling, flame-cutting, coring and similar operations. Assist agencies in labeling and packing of test samples removed from the work.

B. Coordination with Contractor's Independent Agencies: Except for required independent agency activities of inspection, measuring, testing, analyzing, reporting and similar activities, the assignment of labor, equipment, cutting, Patching and similar necessary activities associated therewith are Contractor's option recognizing that entire activity is Contractor's responsibility.

C. Test Agency Responsibilities:

1. Test agencies, regardless of whether engaged by Owner or Contractor, are not authorized to change or negate requirements of Contract Documents. Each agency shall coordinate its assigned work with construction schedule as maintained by Contractor, and shall perform its work promptly so as not to delay the work. Observances (by agencies) having a bearing on the work shall be reported to Architect in most expeditious way possible, and shall be recorded in writing by agency. Agency personnel shall not interfere with or assume duties of Contractor.
2. Reports: The testing agency shall prepare reports of inspections and laboratory tests, including analysis and interpretation of test results where applicable. Properly identify each report and, where required, provide agency's certification of test results. Describe test methods used, and compliance with recognized test standards (if any). Complete and submit report at earliest possible date in each case.

3.03 INSTALLATION QUALITY CONTROL:

A. Manufacturer's Instructions: Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicate in contract documents.

- B. Inspect each item of materials or equipment, immediately prior to installation, and reject damaged and defective items.
- C. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerances, if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual effect choices to Architect for final decision.
- D. Recheck measurements and dimensions of the work, as an integral step of starting each installation.
- E. Install work during conditions of temperature, humidity, exposed, forecasted weather, and status of project completion which will ensure best possible results for each unit of work, in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.
- F. Coordinate enclosure (closing-in) of work with required inspections and tests, so as to avoid necessity of uncovering work for that purpose.
- G. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. Refer questionable mounting height choices to Architect for final decision.
- H. Adjust, clean, lubricate, restore, marred finished, and protect newly installed work, to ensure that it will remain without damage or deterioration during the remainder of construction period.

END OF SECTION 01400

SECTION 01500 - TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include but are not limited to:
 - 1. Temporary electric power and light.
- C. Temporary construction and support facilities required include but are not limited to:
 - 1. Field offices.
 - 2. Waste disposal services.
 - 3. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, lights.
 - 3. Environmental protection.

1.3 SUBMITTALS

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, Fire Department and Rescue Squad rules.
 - 5. Environmental protection regulations.

- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.
 2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

2.2 EQUIPMENT

- A. General: Provide new equipment; if acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.

- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- E. Lamps and Light Fixtures: Provide general service LED lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F First Aid Supplies: Comply with governing regulations.
- G. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
 - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. 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. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
 - 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect, and will not be accepted as a basis of claims for a Change Order.
- B. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
 - 1. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, and other temporary construction and support facilities for easy access, and at locations approved by the MC Facilities & Operations & Court Administrator.
 - 1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

- B. Toilets: Use of the Owner's existing toilet facilities will be permitted, so long as facilities are cleaned daily and maintained in a condition acceptable to the Owner.
- C. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Remove all waste from site daily. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Architect.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

- F. Environmental Protection: Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the 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 the Contractor. The Owner reserves the right to take possession of Project identification signs.
 - 2. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
 - a. Replace air filters and clean inside of ductwork and housings in all areas affected by construction.

END OF SECTION 01500

SECTION 01600 - MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

- A. Material and equipment incorporated into the work:

1. Conform to applicable specifications and standards.
2. Comply with size, make, type and quality specified, or as specifically approved in writing by the Architect.
3. Manufactured and Fabricated Products:
 - a. Design, fabricate and assemble in accord with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
 - c. (2) Two or more items of the same kind shall be identical, by the same manufacturer.
 - d. Products shall be suitable for service conditions.
 - e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.03 MANUFACTURER'S INSTRUCTIONS:

- A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such, including three copies to Architect.
 1. Maintain (1) one set of complete instructions at the job site during installation and until completion.

- B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.
 - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Architect for further instructions.
 - 2. Do not proceed with work without clear instructions.
- C. Perform work in accord with manufacturer's instructions. Do not omit preparatory step or installation procedure unless specifically modified or exempted by contract documents.

1.04 TRANSPORTATION AND HANDLING:

- A. Arrange deliveries of products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.
 - 1. Immediately on delivery, inspect shipments to assure compliance with requirements of contract documents and approved submittals, and that products are properly protected and undamaged.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.05 STORAGE AND PROTECTION:

- A. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
 - 1. Store products subject to damage by the elements in weathertight enclosures.
 - 2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

B. EXTERIOR STORAGE:

- 1. Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.

2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

D. Preparation After Installation:

1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.06 SUBSTITUTIONS AND PRODUCT OPTIONS:

A. Products List:

1. Within (15) fifteen days after contract date, submit to Architect a complete list of major products proposed to be used, with the name of the manufacturer and the installing subcontractor. Comply with provisions for Contractor's Options and Substitutions.

B. Contractor's Options:

1. For products specified only by reference standard, select any product meeting that standard.

2. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named, which complies with the specifications.

3. For products specified by naming one or more products or manufacturers and "or equal," Contractor must submit a request as for substitutions for any product or manufacturer not specifically named.

4. For products specified by naming only one product and manufacturer, there is no option.

C. Substitutions:

1. For a period of (15) fifteen days after contract date, Architect will consider written requests from Contractor for substitution of products.

2. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including:
 - a. Comparison of the qualities of the proposed substitution with that specified.
 - b. Changes required in other elements of the work because of the substitution.
 - c. Effect on the construction schedule.
 - d. Cost data comparing the proposed substitution with the product specified.
 - e. Any required license fees or royalties.
 - f. Availability of maintenance service, and source of replacement materials.
3. Architect shall be the sole judge of the acceptability of the proposed substitution except where a change in cost is involved.

D. Contractor's Representation:

1. A request for a substitution constitutes a representation that Contractor:
 - a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
 - b. Will provide the same warranties or bonds for the substitution as for the product specified.
 - b. Will coordinate the installation of an accepted substitution into the work, and meet such other changes as may be required to make the work complete in all respects.
 - d. Waives all claims for additional costs, under his responsibility which may subsequently become apparent.

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E. Architect will review requests for substitutions with reasonable promptness, and notify the Contractor, in writing, of the decision to accept or reject the requested substitution.

PARTS 2 AND 3 PRODUCTS AND EXECUTION

Not applicable.

END OF SECTION 01600

SECTION 01700 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Inspection procedures.
 - 2. Project record document submittal.
 - 3. Operating and maintenance manual submittal.
 - 4. Submittal of warranties.
 - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 12 and also the Mechanical and Electrical Specifications contained on the Drawings.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Architect/Engineer will repeat inspection when requested and assured that the Work has been substantially completed. NOTE: Contractor will be responsible to the Owner for additional fees to pay for Architects services if multiple inspections are required to review incomplete punch list items and/or close punch list items out.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
4. Submit consent of surety to final payment.
5. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

- B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.
1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, reinspection will be repeated. NOTE: Contractor will be responsible to the Owner for additional fees to pay for Architects services if multiple inspections are required to review incomplete punch list items and/or close punch list items out.

1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect/Engineer's reference during normal working hours.
- B. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:
1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the work, and change orders.
 2. Include locations of concealed elements of the work.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
 4. Field changes of dimension and detail.
 5. Details not on original drawings.
- C. Record Specifications: Maintain (1) one complete copy of the Project Manual, including addenda, and one (1) copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

1. Upon completion of the Work, submit record Specifications to the Architect/Engineer for the Owner's records.

- D. Record Product Data: Maintain (1) one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
 1. Upon completion of mark-up, submit complete set of record Product Data to the Architect/Engineer for the Owner's records.

- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect/Engineer for the Owner's records.

- G. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
 1. Emergency instructions.
 2. Copies of warranties.
 3. Recommended maintenance.
 4. Inspection procedures.
 5. Product Data.

- H. Submit (2) hard copies and one thumb drive with PDF electronic files of marked-up and final documents to Architect/Engineer with claim for final Application for Payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
 - 1. Maintenance manuals.
 - 2. Record documents.
 - 3. Hazards.
 - 4. Cleaning.
 - 5. Warranties and bonds.
 - 6. Maintenance agreements and similar continuing commitments.

3.2 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and as required under applicable specifications sections (Division 2 thru 12).
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
 - 1. Clean transparent materials, including glass in doors and windows from any construction debris. Replace chipped or broken glass (from construction debris) and other damaged (during construction activities) transparent materials.
 - 2. Clean exposed exterior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Leave concrete floors broom clean.

3. Clean the construction site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits.
 4. Execute final cleaning prior to final inspection.
 5. Clean interior and exterior surfaces exposed to view. Vacuum carpeted and soft surfaces.
 6. Clean, Replace filters of operating equipment.
 7. Remove waste and surplus materials, rubbish, and construction facilities from site.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01700

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SECTION 01800 - GUARANTEE - WARRANTY

PART ONE - GENERAL

1.01 GUARANTEE PERIOD

- A. The General Contractor shall and hereby does guarantee and warrant that all work for each building, under this Contract, shall be free from defects or faulty labor and/or materials for a period of **two (2) years** from the date of Final Acceptance of same, except when longer periods are herein specified, which develop within any guarantee periods.

1.02 FINAL PAYMENT

- A. Final payment is contingent upon the Owner's Representative's receipt of such guarantees and/or warranties from the General Contractor.

END OF SECTION 01800

SECTION 02070 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section requires the selective removal and subsequent offsite disposal of the following:
 - 1. Removal of interior partitions as indicated on drawings.
 - 2. Removal of doors and frames indicated "remove."
 - 3. Removal of built-in casework indicated "remove."
 - 4. Removal of existing flooring and ceilings where noted and/or as required for new construction.
 - 5. Removal and protection of existing fixtures, materials, windows, doors and equipment items indicated "salvage" or "return to Owner".
 - 6. Removal of portions of exterior masonry walls.
 - 7. Removal of portion of concrete floor as required for high density storage system.
- B. Removal work specified elsewhere:
 - 1. Cutting nonstructural concrete floors and masonry walls for piping, ducts, and conduits is included with the work of the respective mechanical and electrical specification sections in Divisions 23 and 26.
- C. Related work specified elsewhere:
 - 1. Remodeling construction work and patching are included within the respective sections of specifications, including removal of materials for reuse and incorporation into remodeling or new construction.

2. Relocation of pipes, sprinkler heads/system, conduits, ducts, and other mechanical and electrical work is specified in other Divisions.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Schedule indicating proposed sequence of operations for selective demolition work to the Architect and Owner for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
- C. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations are to be filed with the Owner prior to the start of work.

1.4 JOB CONDITIONS

- A. Occupancy: Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.
- B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.
 1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within the structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.

- C. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to the Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
 - 1. Storage or sale of removed items on site will not be permitted.

- D. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.
 - 1. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to occupied portions of building.
 - 2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
 - 3. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
 - 4. Protect floors with suitable coverings when necessary.
 - 5. Construct temporary minimum one hour fire rated, insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
 - 6. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
 - 7. Remove protections at completion of work.

- E. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

- F. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- G. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.
- H. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
 2. Maintain fire protection services during selective demolition operations.
- I. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

1. Cease operations and notify the Architect and Owner immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
2. Cover and protect furniture, equipment, and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.
3. Erect and maintain minimum one hour fire rated dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.
 - a. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall Type 'X' (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation.
 - b. Provide weatherproof closures for exterior openings resulting from demolition work.
4. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.
 - a. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

3.2 DEMOLITION

- A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
 1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
 3. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
- B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to the Architect in written, accurate detail. Pending receipt of directive from the Architect, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3 SALVAGED MATERIALS

- A. Salvaged Items: Where indicated on Drawings as "Salvage - Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain receipt.
1. Historic artifacts, including cornerstones and their contents, commemorative plaques and tablets, antiques, and other articles of historic significance, remain property of Owner. Notify the Architect if such items are encountered and obtain acceptance regarding method of removal and salvage for Owner.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.
1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
 2. Burning of removed materials is not permitted on project site.

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3.5CLEANUP AND REPAIR

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
 - 1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02070

SECTION 02925 - CLEANUP AND RESTORATION

PART 1 - GENERAL

- A. The Contractor shall restore areas disturbed by construction activities to a condition reasonably close to their condition before the project, unless shown otherwise on the plans. Restoration work should be performed as soon as possible after construction work is completed in a particular area.
- B. Upon the completion of work in an area, all excess materials, debris, equipment, and similar items shall be removed from the project area by the Contractor, and disposed of properly.

PART 2 - MATERIALS

Not Applicable.

PART 3 - EXECUTION

3.01 Restoration

- A. Unless otherwise provided; aggregate surfaces, bituminous pavements, and concrete pavements shall be restored by construction of similar replacement surfaces. Aggregate surfaces shall be replaced with the new materials and thicknesses to match existing. Bituminous pavement shall be replaced with new in cross sections(s) to match existing. Concrete pavement shall be replaced with pavement in accordance with the specification for Concrete.
- B. Turf areas shall be restored with sod to match existing.
- C. Mailboxes, fences, signs, ornaments, and similar items shall be replaced at the completion of construction. Posts shall be installed plumb. Items that are lost or stolen shall be repaired or replaced at the Contractor's expense. Repairs or replacements shall meet the Owner's approval.

3.02 Temporary Restoration of Driving Surfaces

- A. Where a pavement or gravel surface is removed as a result of construction activities, a temporary surface shall be provided and maintained by the Contractor until the permanent surface is provided. Unless otherwise directed, the temporary surface shall be twelve inches of aggregate compacted to at least 95 percent of its maximum density (ASTM D1557) and graded to meet the adjacent, remaining surfaces. Aggregate shall meet the requirements of Series 23A as described in the 2020 Michigan Department of Transportation Specifications.

- B. The Contractor shall regrade the temporary surface and add additional aggregate at intervals necessary to maintain them in a relatively smooth condition.

END OF SECTION

SECTION 03001 - CONCRETE

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

- A. Work included in this section includes furnishing all labor, materials, equipment and incidentals required for complete installation of formwork, reinforcement, accessories, cast-in-place concrete, finishing and curing. This section pertains to building concrete work.
- B. Related work specified elsewhere:
 - 1. Section 03300 - Bonding Agents for Concrete
 - 2. Section 03730 - Concrete Rehabilitation

1.03 SUBMITTALS

- A. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement". Indicate reinforcement sizes, spacings, locations, and quantities, bending and cutting schedules, supporting and spacing devices.
- B. See Structural and/or Architectural drawings for General Notes and Special Conditions.
- C. Provide data on joint devices, attachment accessories, mix design for each type concrete, proportions of all ingredients, admixtures, slump range, expected strength and water cement ratio. Provide historical test data with each proposed mix design.

1.04 QUALITY ASSURANCES

- A. Building Code Requirements for Structural Concrete (ACI 318) and latest supplements thereto.

- B. Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete (ACI 211.1).
- C. Hot Weather Concreting (ACI-305R).
- D. Cold Weather Concreting (ACI-306R).
- E. Guide for Measuring, Mixing, Transporting and Placing Concrete (ACI 304R).
- F. Guide to Curing Concrete (ACI 308R).
- G. Specifications for Structural Concrete (ACI 301).
- H. Guide for Concrete Floor and Slab Construction (ACI 302.1R).
- I. Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete (ASTM C618).
- J. Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type) - (ASTM D994).
- K. Guide to Formwork for Concrete (ACI 347).
- L. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice.
- M. Design and workmanship of all concrete shall be in accordance with referenced specifications and code listed above. Quality, tolerances, and level of performance of work shall be as specified therein. Contractor shall keep on file, in project office, current copies of all references listed above.

PART 2. PRODUCTS

2.01 FORM MATERIALS

- A. Form Material for Exposed Concrete: Plywood; 5/8" APA B-B plyform Class 1, exterior. Use plywood thickness sufficient to support concrete at temperature and rate of pour. Use only sound, undamaged sheets with clean, true edges. Furnish in largest sizes to minimize joints.

- B. Form Material for Unexposed Concrete: Plywood; 5/8" APA B-B-G-2, exposure 1, exterior, plywood graded per PS-1 standards for construction and industrial plywood. Use plywood thickness sufficient to support concrete at temperature and rate of pour. Use only sound, undamaged sheets with clean, true edges. Lumber shall be standard grade or better.
- C. In lieu of "A" above, the material specified under "B" may be used for exposed concrete if a 3/16" smooth one side, treated, pressed fiberboard liner is utilized.
- D. Lumber for light framing (less than 6" wide): standard grade and species. Framing (6" wider and from 2" to 4" thick): provide No. 1 grade in one of the following species:
 - 1. Douglas Fir (WWPA).
 - 2. Southern Pine (SPIB).
 - 3. Redwood (RIS).
- E. Prefabricated steel or metal shall be minimum 16 ga. as approved to produce surfaces equal to those specified for wood. Forms shall be matched, tight fitting, and stiffened to support weight of concrete.
- F. Metal Form Deck: Utilized to support exterior slabs; shall be S.D.I. approved and equal to Vulcraft. Spacing of slab reinforcing shall be adjusted if required to match corrugations of metal deck.
- G. Form Ties: Bolt and rod type so designed that upon removal of the form no metal shall be within 1-1/2" of the concrete surface and no holes larger than 1" in diameter. Concrete exposed to the exterior shall utilize galvanized ties.
- H. Dovetail Anchor Slots: Galvanized steel, foam filled, release tape sealed slots, bond tab anchors as manufactured by Heckmann, Hohmann & Barnard, Inc. or approved.
- I. Form Release Agent: Colorless mineral oil which will not stain the concrete or impair natural bonding characteristics of coating intended for use on concrete.

- J. Formed Construction Joints for Slab-on-Grade: Galvanized steel, tongue and groove type profile with knockout holes to receive doweling, min. 26 gage unless noted otherwise. Size and profile as indicated on drawings or as required to fit field conditions.
- K. Slab Edge Joint Filler: ASTM D994, premolded asphaltic board, thickness as indicated or (if not indicated, 1/2" thick minimum).
- L. Vapor Barrier: Conforming to ASTM E1745 Class A, non-woven, .01 permeance, not less than 15 mils thick.
 - 1. Acceptable Manufacturers:
 - a. Stego wrap 15 mil vapor barrier by Stego Industries.
 - b. WR Meadows Perminator 15 mil.
 - c. Zero-perm by Alumiseal.
 - d. Vaporblock VB15 by Raven Industries.
- M. 6 mil thick, clear polyethylene film (for bond break between walls and floor), type recommended for below grade application.
- N. Nails, spikes, lag bolts, through bolts, anchorages: Size as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Bars: ASTM A 615 Grade 60 deformed.
- B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

D. Inert fiber reinforcement: Polypropylene fiber meeting ASTM-C1116; Fibermesh, Forta Corporation, or other Architect approved U.L. Listed. Add to plant mixed concrete at a rate of 1.5 lbs. per cubic yard of mix.

2.03 CONCRETE MATERIALS

A. Cement; controlling specification for Portland Cement, ASTM C150, Type I-Normal or Type II.

B. Aggregates shall conform to ASTM C-33. Maximum size of aggregate shall not be larger than 1/5 of narrowest dimension between forms of member for which concrete is to be used, nor larger than 3/4 of minimum clear spacing between reinforcing bars, nor larger than 1/3 of slab depth.

C. Lightweight aggregates shall conform to ASTM C 330.

D. Water: Clean and potable.

E. Air Entrainment Admixture: ASTM C260, as manufactured by Master Builders, Euclid, or W.R. Grace.

F. Chemical Admixtures: ASTM C494; Type 'A' - water reducing; Type 'B' - retarding, Type 'C' - accelerating, Type 'D' - water reducing and regarding, Type 'E' - water reducing and accelerating, Type 'F' - water reducing high range; Type 'G' - water reducing high range and retarding. Calcium chloride or admixtures containing more than .05 percent chloride ions by weight of admixture shall not be used. Each admixture shall not contribute more than 5 ppm by weight, of chloride ions to the total concrete constituent. Use admixtures in strict compliance with manufacturer's directions.

G. Fly Ash: ASTM C618, Type 'C' or 'F'.

H. Bonding Agent: Refer to Spec Section 03300 "Bonding Agents for Concrete".

- I. Non-Shrink Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents. Capable of developing a minimum compressive strength of 7000 psi at 28 days.
- J. Adhesive Anchoring: Injectable adhesive or self-contained capsule as manufactured by:
 1. 'Hilti' HIT System, or Architect approved/reviewed equal.

2.04 CURING COMPOUNDS & SEALERS

- A. Curing Compound/Sealer: Liquid curing compound, water base, concrete curing-sealing compound, VOC (volatile organic content) compliant, containing fugitive dye that does not leave residue (resin, varnish, wax, etc.). Fugitive dye must disappear in 7 days, as manufactured by:
 1. Sonneborn Building Products, Kure-N-Seal W.
 2. Dayton Superior Corporation, Safe Cure & Seal (J-18).
 3. Burke by EDOCO Spartan-Cote WB Cure Seal Hardener.
 4. MasterKure 100W, Master Builders, Inc.
 5. Vocomp-20, W.R. Meadows.
- B. Absorptive Mats: Burlap cloth, commercial quality suitable for purpose. Constructed of jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M182, Class 2.
- C. Moisture retaining cover, complying with ASTM C171; one of the following: waterproof paper, polyethylene film, or polyethylene coated burlap.
- D. Crack Repair Material: Floor slabs - 2 part, 100% solid epoxy adhesive in formulation recommended by manufacturer for application, as manufactured by:
 1. W.R. Meadows Reziweld 1000 or Architect approved/reviewed equal.

E. Cure/Sealer Interior Exposed Concrete Floors: Curing compound, non-residual or dissipating resin curing compound. Product of sealer manufacturer and meeting sealer manufacturer's requirements. Manufacturers to include:

1. Dayton Superior Corp "Day-Chem Sil-Cure" (J-13).
2. L & M Cure or Cure R.

2.05 CONCRETE MIX

A. Mix concrete in accordance with ACI 304 and deliver concrete in accordance with ASTM C94.

B. Quality working stresses for the design of this project shall be based on specific minimum 28-day compressive strength of concrete or on specified minimum compressive strength at earlier age at which concrete may be expected to receive full load. Provide concrete of the following properties:

1. Exterior concrete; i.e. entry slabs, ramps, etc. - 4,000 psi. 28-day compressive strength; water-cement ratio, 0.40 maximum (air entrained).
2. Interior slab on ground - 4000 psi. 28-day compressive strength; water-cement ratio, 0.44 maximum (non-air entrained).
3. Footings, walls, supported slabs and all other concrete - 3500 psi. 28-day compressive strength; water-cement ratio, 0.51 maximum (non-air-entrained), 0.46 maximum (air entrained).

C. Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement as follows:

1. Ramps and Sloping Surfaces: Not more than 3".
2. Reinforced Foundation Systems: Not less than 1" and not more than 4".
3. All Other Concrete: Not less than 1" & not more than 4".
4. Concrete containing high-range water-reducing admixture (superplasticizer). Not more than 8 inches after adding admixture to site-verified 2-3 inch slump concrete.
5. Site added water to increase slump is strictly prohibited.

- D. Proportions of aggregate to cement shall be such as to produce a mixture which will work readily into corners, angles of forms, and around reinforcement without permitting materials to segregate. Excess free water shall not collect on concrete surface.
- E. Fly ash shall not exceed 25% of cement content by weight. No fly ash shall be used in slabs.
- F. Select admixture proportions for normal weight concrete in accordance with ACI 301, Method 1 and in strict accordance with manufacturer's instructions.
- G. Air Entraining Agent: Use in all exterior concrete exposed to weather; i.e. exposed foundation walls, supported slabs, ramps, etc. Air entrainment shall be accomplished by use of approved additives used in accordance with manufacturer's instructions. Limit air to 4% minimum to 7% maximum.
- H. Adjustment to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather or other circumstances warrant, as accepted by the Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

PART 3. EXECUTION

3.01 FORMWORK ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements. Fabricate forms for easy removal without hammering or prying against exposed concrete surfaces.
- B. Provide bracing to ensure stability of formwork.
- C. Apply form release agent to formwork in accordance with manufacturer's instructions, prior to placing for accessories and reinforcement.
- D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent.

- E. Clean forms as erection proceeds, to remove foreign matter.
- F. Footings and foundations shall be formed, notched and/or sleeved as indicated to provide for installation of mechanical, electrical or plumbing piping/conduit.
- G. Forms shall conform to shape, lines and dimensions of members as called for, substantially and sufficiently tight to prevent leakage of concrete.
- H. Forms shall be properly braced, and tied together so as to maintain position and shape. Forms for exposed concrete shall be braced so as to provide dimensions called for, and have taped joints.
- I. Construction joints, whether indicated on drawings or not, shall be made or located so as to least impair strength of the structure. Where joint is to be made, the surface of the concrete shall be thoroughly cleaned and all latency removed. In addition, vertical joints shall be keyed.

3.02 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

- A. Provide formed openings where required for work to be embedded in and passing through concrete members.
- B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.
- C. Install concrete accessories straight, level, and plumb.

3.03 REINFORCEMENT PLACEMENT

- A. Place reinforcement, supported and secured against displacement.
- B. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.
- C. Provide for continuity of reinforcing around corners in footings and walls. Lap corner bars 30 bar diameters.

- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.04 PLACING CONCRETE

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.

- B. Install vapor barrier under interior slab-on-grade.

- 1. Installation shall be in accordance with manufacturer's instructions and ASTM E164 3-98.

- a. Unroll vapor barrier with the longest dimension parallel with the direction of the pour.
 - b. Lap vapor barrier over footings and seal to foundation walls.
 - c. Overlap joints 6 inches and seal with manufacturers tape.
 - d. Seal all penetrations (including pipes) per manufacturer's instruction.
 - e. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
 - f. Repair damaged areas by cutting patches of vapor barrier material overlapping the damaged area 6 inches and taping all four sides with tape.

- C. Separate exterior slabs-on-grade from vertical surfaces with $\frac{1}{2}$ inch thick joint filler, extended full thickness of slab. Also, provide filler strips at supported slabs and vertical surfaces. At interior slabs-on-grade locations, provide bond break from vertical surfaces consisting of 6 mil polyethylene film or 15# asphalt building paper and where indicated on plans.

- D. Place concrete continuously between predetermined control and construction joints. Do not break or interrupt successive pours such that cold joints occur. Where applicable, construction joints shall occur at control joint locations, unless noted otherwise.

- E. Concrete slabs on grade shall be constructed of thickness indicated. If thickness is not indicated, provide a minimum thickness of 4". Minimum thickness at pipes embedded in concrete shall not be less than three times o.d. of the pipe. All buried piping shall have been tested before placement of concrete.
- F. Provide interior control joints where called for on drawing as detailed. When interior construction joints occur, they shall also be considered as control joints. Provide sawed groove similar to a control joint at all construction joints.
- G. Concrete shall be conveyed from the mixer to place of final deposit by methods which will prevent separation and loss of material.
- H. All equipment used for transporting equipment shall be cleaned of all debris. Ice shall be removed from all places to be occupied by concrete forms, and masonry fillers shall be thoroughly wetted except where air temperatures are below 40 degrees F.
- I. Equipment for chuting, pumping, pneumatically conveying concrete, shall be such size and design as to insure practically continuous flow of concrete at delivery and without separation of materials.
- J. Concrete shall be deposited as soon as practicable in its final position to avoid segregation due to re-handling, flowing. Concreting shall be carried on at such rate that concrete is at all times plastic and flow readily into space between bars. No concrete that has partially hardened or has been contaminated by foreign materials shall be deposited on work, nor shall re-tempered concrete be used.
- K. Concreting, once started, shall be carried on as a continuous operation until placing of panel or section is completed. Top surface shall be generally level.
- L. All concrete shall be thoroughly compacted by suitable means during operation of placing and shall be thoroughly worked around reinforcement, embedded fixtures, and into

corners of forms. Vibrator shall not be used to flow concrete.

- M. Where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-shrink grout or chemical adhesive. Follow manufacturer's recommendations for installation.
 - N. Screed floors slabs-on-grade and concrete base for toppings level, maintaining surface flatness of maximum 1/8 inch in 10 ft.
 - O. Construct all concrete site work items to shape, size, thickness and elevations shown. Concrete supported slabs shall be 4" thick on 1" form deck with reinforcing as indicated, unless otherwise shown. Side form all work. Slope surfaces of supported slabs, 1/4" per foot to low side or as directed by Architect/Engineer.
 - P. Provide 1/2" bituminous expansion joint filler along all joints where supported slabs abut other walks, building walls, etc.
 - Q. Protecting and sealing: Protect concrete supported slabs, ramps, platforms, slabs, etc., from pedestrian traffic for three days after pouring. Concrete shall be cured using two layers of burlap kept wet for minimum of 5 days; or at Contractor's option, he may use sprayed-on compound according to manufacturer's recommendations as approved by Architect. Curing method used shall not discolor original color of concrete, nor shall white liquid curing compound be used.
 - R. Provide concrete pads, bases, foundations, etc., as indicated and/or required by mechanical, electrical or other equipment supplier. Set anchor bolts for machine and equipment to templates or measurements provided.
- 3.05 FORM REMOVAL
- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

- B. Remove formwork progressively and in accordance with code requirements.

3.06 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.
- B. Uniformly spread, screed, and float concrete.
- C. Wood float surfaces which will receive quarry tile or ceramic tile with full bed setting system.
- D. Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring, epoxy terrazzo. Scarify floors to receive all thin set quarry or ceramic tile. Steel trowel corridor slabs (3 passes) and finish to ACI 302.1R, Class 5 floor.
- E. Maintain surface flatness, with maximum variation of 1/8 inch in 10 ft. Corridor slabs to have overall FF=40, local FF=20.
- F. In areas with floor drain, maintain floor level at walls and pitch surfaces uniformly to drains.
- G. Apply concrete hardener on all floor surfaces not receiving resilient flooring tile, hard tile, carpet, epoxy flooring, etc. Apply in accordance with manufacturer's instructions.
- H. Floor shall be finished without excessive floating. Delay troweling until concrete is sufficiently hard to prevent water working to surface. Bring finish to smooth level surface with minimum troweling possible.
- I. Finishes, other than floors, exposed on exterior or interior shall be formed true, free from marks, irregularities. Remove any loose material, grind all projections, fill any honeycombing or holes, finish smooth. Use carborundum stone to hand rub and provide smooth, even surface where directed.
- J. Thoroughly clean and prepare concrete floors scheduled to receive a sealer. Apply in strict accordance with manufacturer's instructions.

3.07 CURING

- A. Place absorptive matting and dampen as required.
- B. Immediately after placement, protect concrete from premature drying.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- D. Provisions shall be made for maintaining concrete in moist condition for at least (5) five days after placement, except high early concrete which shall be cured for at least (2) two days.
- E. Cold Weather Requirements:
 - 1. General: Except as modified herein, all work shall be in accordance with ACI 306R.
 - 2. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near freezing weather. No frozen materials or materials containing ice shall be used.
 - 3. All concrete materials, all reinforcement, forms, fillers, ground with which concrete is to come in contact shall be free from frost. Whenever temperature of surrounding air is below 40° F., all concrete placed in forms shall have a temperature of between 70° F., 80°F. Adequate means shall be provided for maintaining temperature of not less than 70° F. for 3 days, 50° F. for 5 days, except high-early concrete shall have temperature maintained at not less than 70° F. for 2 days, 50° F. for 3 days, or for as much more time as necessary to insure proper curing. Housing, covering, other protection used in connection with curing shall remain in place at least 24 hours after artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for prevention of freezing.

F. Weather Conditions:

1. In hot weather, sprinkle and cover all concrete for at least 24 hours longer than specified for normal curing periods. In hot weather work shall be in accordance with ACI 305R.
2. In weather when temperature falls below freezing, and in any event between December 1 and April 1, no concrete shall be poured without adequate frost protection.

3.08 CONCRETE FINISHING

- A. Provide concrete surfaces to be left exposed, concrete walls, columns, etc., with smooth rubbed finish not later than one day after form removal.
1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

3.09 FIELD QUALITY CONTROL

- A. Inspection and testing shall be performed by an independent firm selected by the Owner and retained by the Construction Manager, in accordance with Division 1.
- B. The Contractor shall notify the Architect/Engineer and the Testing Lab at least (5) five days prior to the commencement of concrete operations.
- C. See Division 1 for inspection and testing requirements.
- D. Specimens shall be molded and cured as per ASTM C31. Three specimens per test, not less than one test for each day's pour, each 50 yards concrete poured, each building unit, or each strength concrete. Specimens shall be laboratory cured.
- E. Specimens shall be tested in accordance with ASTM C39. One specimen shall be tested at 7 days, two at 28 days.

- F. When average strength of laboratory control cylinders fall below required compressive strength, Architect shall have right to order change in proportions and water content for remainder of structure. Architect shall have right to require tests as per ACI Building Code; Chapter 20 where load tests show concrete does not conform with drawings or specifications. Deficiency shall be corrected without additional cost to Owner.
- G. PDF copy of test reports at 7 days, 28 days, shall be sent directly to the Architect by the Testing Laboratory, with all required information shown.
- H. Slump tests per ASTM C-172 and C-143, minimum of one test for each set of cylinders, or more as conditions warrant. Deliveries exceeding specified slump shall be rejected.

3.10 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by the Architect/Engineer.
- B. Failure of concrete topping to bond to substrate (as evidenced by a hollow sound when tapped), or disintegration or other failure of topping to perform as a floor finish, will be considered failure of materials and workmanship. Repair or replace toppings in areas of such failures, as directed.

END OF SECTION 03001

SECTION 03300 - BONDING AGENTS FOR CONCRETE

PART 1. GENERAL

1.01 SUMMARY

- A. This specification describes the use of a bonding bridge between new portland-cement mortar or concrete and hardened portland-cement mortar or concrete.

1.02 QUALITY ASSURANCE

- A. Manufacturing qualifications: The manufacturer of the specified product shall have in existence a recognized quality assurance program and be ISO 9001 Certified, a program of training, certifying and technically supporting a nationally-organized Approved Contractor Program with a re-certification program of its participants for a minimum of 5 years.
- B. Contractor qualifications: Contractor shall be an Approved Contractor of the manufacturer of the specified product, who has completed a program of instruction in the use of the specified coating material, and provides a certification from the manufacturer attesting to its Approved Contractor status.
- C. Install materials in accordance with all safety and weather conditions required by manufacturer, or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.03 DELIVERY, STORAGE AND HANDLING

- A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
- B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.
- C. Condition the specified product as recommended by the manufacturer.

1.04 JOB CONDITIONS

- A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 40°F (5°C) and rising.
- B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified coating.

1.05 SUBMITTALS

- A. Submit PDF copy of manufacturer's literature, to include: Product Data Sheet, System Data Sheet, Application Guide, and appropriate Material Safety Data Sheets (MSDS).
- B. Submit copy of Certificate of Approved Contractor status by manufacturer.

1.06 WARRANTY

- A. Provide a written warranty from the manufacturer against defects of materials for a period of (5) five years, beginning with date of substantial completion of the project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Sika Armatec 110 EpoCem, as manufactured by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071 is considered to conform to the requirements of this specification.

2.02 MATERIALS

- A. Epoxy resin/portland cement adhesive shall be Sika Armatec 110 EpoCem.
 - 1. Component "A" shall be an epoxy resin/water emulsion containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
 - 2. Component "B" shall be primarily a water solution of a polyamine.
 - 3. Component "C" shall be a blend of selected portland cements and sands.
 - 4. The material shall not contain asbestos.

2.03 PERFORMANCE CRITERIA

- A. Properties of the mixed epoxy resin/portland cement adhesive.
1. Pot Life: 90 minutes @ 73°F.
 2. Contact Time:
 - 95°F (35°C) 6 hours
 - 68°F (20°C) 12 hours
 - 50°F (10°C) 16 hours
 - 40°F (5°C) 24 hours
 3. Color: Dark gray
- B. Properties of the cured epoxy resin/portland cement adhesive.
1. Compressive Strength (ASTM C-109)
 - a. 3 day: 4500 psi (31.0 MPa)
 - b. 7 day: 6500 psi (44.8 MPa)
 - c. 28 day: 8500 psi (58.6 MPa)
 2. Splitting Tensile Strength (ASTM C-496)
 - a. 28 days: 600 psi (4.1 MPa)
 3. Flexural Strength (ASTM C-348)
 - a. 1250 psi (8.6 MPa)
 4. Bond Strength ASTM C-882 at 14 days
 - a. Wet on Wet, 0-hr. open time: 2800 psi (19.3 MPa)
 - b. 24-hr. open time: 2600 psi (17.9 MPa)
 5. Bond of Steel Reinforcement to Concrete (Pullout Test)
 - a. Sika Armatec 110 coated: 625 psi (4.3 MPa)
 - b. Epoxy coated: 508 psi (3.5 MPa)
 - c. Plain Reinforcement: 573 psi (3.95 MPa)
 6. The epoxy resin/portland cement adhesive shall not produce a vapor barrier.
 7. Material must be proven to prevent corrosion of reinforcing steel when tested under the procedures as set forth by the Federal Highway Administration Program Report No. FHWA/RD86/193. Proof shall be in the form of an independent testing laboratory corrosion report showing prevention of corrosion of the reinforcing steel.

Note: Tests above were performed with material and curing conditions at 73°F and 45-55% relative humidity.

PART 3 - EXECUTION

3.01 MIXING AND APPLICATION

- A. Mixing the epoxy resin: Shake contents of Components "A" and Component "B". Completely empty both components into a clean, dry mixing pail. Mix thoroughly for 30 seconds using a jiffy paddle with a low-speed (400-600 rpm) drill. Slowly add the entire contents of Component "C" while continuing to mix for 3 minutes until uniform with no lumps. Mix only that quantity that can be applied within its pot life.
 - B. Placement procedure for Bonding bridge:
 1. Apply to prepared surface with a stiff-bristle brush, broom or "hopper-type" spray equipment.
 - a. For hand-applied mortars-Place fresh, plastic concrete/mortar while the bonding bridge adhesive is "wet" or within open times indicated in section 2.03.A.2.
 - b. For machine-applied mortars-Apply while the bonding bridge adhesive is "wet" or within the open times indicated in section 2.03.A.2.
 - C. Placement procedures for anti-corrosion coating:
 1. Apply to prepared steel surface with a stiff-bristle brush, or "hopper type" spray equipment at 20 mils minimum thickness. Properly coat the underside of the totally exposed steel. Allow to dry (approx 2-3 hours) then apply a second coat at 20 mils minimum thickness. Allow drying again before placing repair mortar.
- *During the anti-corrosion coating method, after applying the second coat Sika Armatec 110 EpoCem, a mortar can be applied to "wet" Sika Armatec 110 EpoCem or within open times indicated in section 2.03.A.2 to achieve the benefit of bonding bridge.
- D. Adhere to all limitations and cautions for the epoxy resin/portland cement adhesive in the manufacturer's current printed literature.

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3.02 CLEANING

- A. The uncured epoxy resin/portland cement adhesive can be cleaned from tools with water. The cured epoxy resin/portland cement adhesive can only be removed mechanically.
- B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION 03300

SECTION 03540 - SELF-LEVELING CONCRETE TOPPING

PART 1. GENERAL

1.01 SUMMARY

- A. This is the recommended specification for ARDEX K-500 Self-Leveling Concrete Topping for use over new or old interior standard absorbent concrete: unfinished, rough, rained-on, frozen, spalled or otherwise deteriorated concrete.

1.02 SECTION INCLUDES

- A. ARDEX K-500 Self-Leveling Concrete Topping.
- B. ARDEX P-51 Primer.

1.03 QUALITY ASSURANCE

- A. Installation of the ARDEX K-500 must be by an applicator using mixing equipment and tools approved by the manufacturer.
- B. Topping shall be able to be installed from $\frac{1}{4}$ " to $1 \frac{1}{2}$ " in one pour and up to 5" with the addition of the appropriate aggregate. It can also be tapered to match existing elevations.
- C. Topping to be applied to a minimum thickness of $\frac{1}{4}$ " over highest point in the subfloor.
- D. Topping material shall achieve compressive strength of 5300 psi after 28 days per ASTM C109/mod (air cure only).
- E. Topping shall be walkable after 3 hours, and coated after 24 hours at 70° F.
- F. Manufacturer's certification that the product is cement-based having an inorganic binder content which is a minimum 80% Portland cement when tested per ASTM C150: Standard Specification for Portland Cement.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in their unopened packages and protect from extreme temperatures and moisture. Protect liquids from freezing.

1.05 SITE CONDITIONS

- A. ARDEX K-500 is a cementitious material. Observe the basic rules of concrete work. Do not install below 50°F surface temperature. Install quickly if floor is warm and follow hot weather precautions available from the ARDEX Technical Service Department. Never mix with cement or additives other than ARDEX-approved products.

PART 2. PRODUCTS

2.01 MATERIALS

- A. The cement-based self-leveling topping shall be ARDEX K-500 Self-Leveling Concrete Topping.
- B. Primer for standard concrete shall be ARDEX P-51 Primer.
- C. Aggregate shall be well graded, washed gravel (1/8" to 1/4" or larger) for use when topping is installed over 1 1/2" thick.
- D. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).
- E. The finished K-500 surface must be coated with a sealer 24 hours after installation.

2.02 MIX DESIGNS

- A. Standard mixing ratio: ARDEX K-500 is mixed in 2-bag batches at one time. Mix each bag of ARDEX K-500 (55 lb.) with 5 1/2 quarts of water. Product shall be mixed in an ARDEX T-10 Mixing Drum using an ARDEX T-1 Mixing Paddle and a 1/2" heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written instructions per the ARDEX K-500 bag label.

- B. Aggregate Mix: For areas to be installed over 1 ½" thick, aggregate may be added to reduce material costs. Mix ARDEX K-500 with water first, then add from 1/3 up to 1 part by volume of aggregate (1/8" to ¼" or larger). Do not use sand.
- C. For pump installations, ARDEX K-500 shall be mixed using the ARDEX Levelcraft Automatic Mixing Pump. Start the pump at 165 gallons of water per hour and then adjust to the minimum water reading that still allows self-leveling properties. DO NOT OVERWATER! Check the consistency of the product on the floor to ensure a uniform distribution of the sand aggregate at both the top surface and bottom of the pour. If settling is occurring, reduce the water amount and recheck. Conditions during the installation, such as variations in water, powder, substrate, and ambient temperature, require that the water setting be monitored and adjusted carefully to avoid overwatering.

PART 3. EXECUTION

3.01 PREPARATION

- A. All standard absorbent concrete surfaces must be sound, solid, cleaned, and primed.
 - 1. All subfloors must be of adequate strength, clean, and free of all oil, grease, dirt, curing compounds and any substance which might act as a bondbreaker before priming. Mechanically clean, if necessary, using shot-blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.
 - 2. All cracks in the subfloor shall be repaired to minimize telegraphing through the topping.
 - 3. Substrates shall be inspected and corrected for moisture or any other conditions that could affect the performance of the topping or the finish coating.

B. Joint Preparation

1. Moving Joints-honor all expansion and isolation joints up through the topping.
2. Saw Cuts and Control Joints - fill all non-moving joints with ARDEX SD-F Feather Finish or ARDEX SD-P InstantPatch as required.

C. Priming

1. Primer for standard absorbent concrete subfloors:
Mix ARDEX P-51 1:1 with water and apply evenly with a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow drying to a clean, thin film (min. 3 hours, max. 24 hours). Underlayment shall not be applied until the primer is dry. Primer coverage is approximately 400 to 600 sq. ft. per gallon.
2. Primer for extremely absorbent concrete subfloors:
Make an initial application of ARDEX P-51 mixed with 3 parts water using a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow drying thoroughly before proceeding with the standard application of primer as described above for standard absorbent concrete.

3.02 APPLICATION OF CEMENTITIOUS TOPPING

- A. Pour or pump the liquid ARDEX K-500 and spread in place with the ARDEX T-4 Spreader. Use the ARDEX T-5 Smoother for featheredge and touch-up. Wear baseball shoes with non-metallic cleats to avoid leaving marks in the liquid ARDEX K-500.
- B. Topping can be walked on in 3 hours at 70°F.

3.03 SEALING OF CEMENTITIOUS TOPPING

- A. Topping shall be protected from wear, oil, salt and water by applying a suitable concrete wear protection system. Thin-layer coating (20 mils or less) can proceed 24 hours after installation of ARDEX K-500 at 70°F and 50% relative humidity. Surface traffic can proceed once the coating has thoroughly dried per the coating manufacturer's recommendation. Please consult ARDEX prior to installing thicker coatings or epoxy systems.

3.04 FIELD QUALITY CONTROL

- A. Where specified, field sampling of the Ardex topping is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform compressive strength testing in accordance with ASTM C109/modified: air-cure only. There are no in situ test procedures for the evaluation of compressive strength.

3.05 PROTECTION

- A. Prior to the installation of the sealer, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, Masonite or other suitable protection course.

END OF SECTION 03540

SECTION 03730 - CONCRETE REHABILITATION

PART 1. GENERAL

1.01 SUMMARY

- A. This specification describes the patching or overlay of interior horizontal surfaces with a polymer-modified, portland cement mortar/cement.

1.02 QUALITY ASSURANCE

- A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
- B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of (5) five years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.
- C. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.03 DELIVERY, STORAGE AND HANDLING

- A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
- B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.
- C. Condition the specified product as recommended by the manufacturer.

1.04 JOB CONDITIONS

- A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 45°F (7°C) and rising.
- B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified coating.

1.05 SUBMITTALS

- A. Submit PDF copy of manufacturer's literature, to include: Product Data Sheets, and appropriate Material Safety Data Sheets (MSDS).

1.06 WARRANTY

- A. Provide a written warranty from the manufacturer against defects of materials for a period of (5) five years, beginning with date of substantial completion of the project.

PART 2. PRODUCTS

2.01 MANUFACTURER

- A. SikaTop 111 Plus, as manufactured by Sika Corporation, is considered to conform to the requirements of this specification.

2.02 MATERIALS

- A. Polymer-modified portland cement mortar:
 - 1. Component A shall be a liquid polymer emulsion of an acrylic copolymer base and additives.
 - a. pH: 4.5-6.5
 - b. Film Forming Temperature: 73°F max.
 - c. Tear Strength: 950-psi min.
 - d. Elongation at Break: 500% min.
 - e. Particle Size: less than 0.1 micron
 - 2. Component A shall contain an organic, penetrating corrosion inhibitor which has been independently proven to reduce corrosion via ASTM G3 (half-cell potential tests). The corrosion inhibitor shall not be calcium nitrite, and shall have a minimum of 5 years of independent field testing to document performance on actual construction projects.

3. Component B shall be a blend of selected portland cements, specially graded aggregates, admixtures for controlling setting time, water reducers for workability, and an organic accelerator.
 4. The materials shall be non-combustible, both before and after cure.
 5. The materials shall be supplied in a factory-proportioned unit.
 6. The polymer-modified, portland cement mortar must be placeable from $\frac{1}{2}$ -in. to 1-in. in depth per lift for horizontal applications.
- B. To prepare a polymer-modified portland cement concrete: aggregate shall conform to ASTM C-33, The factory-proportioned unit shall be extended with 42-lb. max. of a $\frac{3}{8}$ in. (No. 8 distribution per ASTM C-33, Table II) clean, well-graded, saturated surface dry aggregate, having low absorption and high density. Aggregate must be approved for use by the engineer.

2.03 PERFORMANCE CRITERIA

- A. Typical Properties of the mixed polymer-modified, portland cement mortar:
1. Working Time: Approximately 30 minutes.
 2. Finishing Time: 50-120 minutes
 3. Color: Concrete gray
- B. Typical Properties of the cured polymer-modified, portland cement mortar:
1. Compressive Strength (ASTM C-109 Modified)
 - a. 1 day: 2500 psi min. (17.2 MPa)
 - b. 7 day: 5500 psi (37.9 MPa)
 - c. 28 day: 7000 psi (48.3 MPa)
 2. Flexural Strength (ASTM C-293) @ 28 days: 1500 psi (10.3 MPa)
 3. Splitting Tensile Strength (ASTM C-496) @28 days 700 psi (4.8 MPa)
 4. Bond Strength (ASTM C-882 Modified) @ 28 days: 2500 psi (17.2 MPa)
 5. The portland cement mortar shall not produce a vapor barrier.

6. Density (wet mix): 136 lbs./cu. ft. (2.18 kg/l)
7. Permeability (AASHTO T-277 @ 28 days approximately 500 Coulombs)

Note: Tests above were performed with material and curing conditions at 71°F - 75°F and 45-55% relative humidity.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Areas to be repaired must be clean, sound, and free of contaminants. All loose and deteriorated concrete shall be removed by mechanical means. Mechanically prepare the concrete substrate to obtain a surface profile of +/- 1/16" (CSP 5 or greater as per ICRI Guidelines) with a new exposed aggregate surface. Area to be patched shall not be less than 1/2" in depth.
- B. Where reinforcing steel with active corrosion is encountered, sandblast the steel to a white metal finish to remove all contaminants and rust. Where corrosion has occurred due to the presence of chlorides, the steel shall be high pressure washed after mechanical cleaning. Prime steel with 2 coats of Sika Armatec 110 EpoCem as directed by manufacturer. (See Spec Component SC-201-0699).

3.02 MIXING AND APPLICATION

- A. Mechanically mix in appropriate sized mortar mixer or with a Sika jiffy paddle and low-speed (400-600 rpm) drill. Pour approximately 4/5 gal Component A into the mixing container. Add Component B while continuing to mix. Mix to a uniform consistency for a maximum of 3 minutes. Add remaining Component A to mix if a more loose consistency is desired. Should smaller quantities be needed, be sure the components are measured in the correct ratio and that the Component B is uniformly blended before mixing the components together. Mix only that amount of material that can be placed in 30 minutes. Do not retemper material.
- B. Mixing of the polymer-modified portland cement concrete: Pour all (1-gal) of Component A into the mixing container. Add Component B while continuing to mix. Add correct amount of the pre-approved coarse aggregate, and continue mixing to a uniform consistency. Mixing time should be 3 minutes maximum.

- C. Placement Procedure: At the time of application, the substrate should be saturated surface dry with no standing water. Mortar and/or concrete must be scrubbed into substrate filling all pores and voids. While the scrub coat is still wet, force material against edge of repair, working toward center. If repair area is too large to fill while scrub coat is still wet use Sika Armatec 110 EpoCem in lieu of scrub coat (See Spec Component SC-200). After filling, consolidate, then screed. Allow mortar or concrete to set to desired stiffness, then finish with trowel, manual or power, for smooth surface. Broom or burlap for rough surface. Areas where the depth of the repair is less than 1-inch shall be repaired with polymer-modified portland cement mortar. In areas where the depth of the repair is greater than 1 inch, the repair shall be made with polymer-modified portland cement concrete.
- D. As per ACI recommendations for portland cement concrete, curing is required. Moist cure with wet burlap and polyethylene, a fine mist of water or a water-based* compatible curing compound. Moist curing should commence immediately after finishing and continue for 48 hours. Protect newly applied material from rain, sun and wind until compressive strength is 70% of the 28-day compressive strength. To prevent from freezing cover with insulating material. Setting time is dependent on temperature and humidity.
- * Pretesting of curing compound is recommended.
- E. Adhere to all procedures, limitations and cautions for the polymer-modified portland cement mortar in the manufacturer's current printed technical data sheet and literature.

3.03 CLEANING

- A. The uncured polymer-modified portland cement mortar can be cleaned from tools with water. The cured polymer-modified portland cement mortar can only be removed mechanically.
- B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION 03730

SECTION 04100 - MORTAR & GROUT

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification. Refer to Structural Drawings for additional information.

1.02 SECTION INCLUDES

- A. Work included in this section consists of furnishing all labor, materials, equipment, and incidentals required for complete installation of mortar and grout for masonry.
- B. Related work specified elsewhere:
 - 1. Section 03001 "Concrete" (Non-shrink grout).

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Recommended Practices for Hot and Cold Weather Masonry Construction as published by the Masonry Industry Council.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type 1 provide natural color or white cement as required to provide mortar color indicated.
- B. Mortar Aggregate: ASTM C144, standard masonry type.
- C. Hydrated Lime: ASTM C207, Type 'S', or 'N'.
- D. Masonry Cement: ASTM C91.
- E. Premix Mortar: ASTM C387.
- F. Grout Aggregate: ASTM C404.
- G. Grout Fine Aggregate: ASTM C144, 100% passing #8 sieve, maximum 5-30% passing #50 sieve.

- H. Water: Clean and potable.
- I. Integral water repellent additive meeting ASTM E-514.
- J. Plasticizer:
 - 1. SIKA Chemical Corporation "Intraplast Z".
 - 2. Euclid Chemical Co. "Eucon BK-S".
- K. Storage of all material shall prevent the intrusion of foreign matter. Store all masonry units on the ground, protected against damage and intrusion of excess moisture. No damaged or deteriorated materials shall be used.

2.02 MORTAR MIXES

- A. Mortar for exterior load bearing walls and all exterior masonry work below grade; ASTM C270, Type 'M' or 'S', using the property method unless noted otherwise on structural drawings. Use ASTM C270 Type 'N' above grade at exterior veneers.
- B. Mortar for interior non-load bearing walls and partitions: ASTM C270, Type 'S' or 'NS', using the property method.
- C. Mortar for reinforced masonry ASTM C270, Type 'S', using the property method.
- D. Pointing mortar for masonry veneers ASTM C270, Type 'N', using the property method.
- E. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in approved type mixing machine in quantities needed for immediate use in accordance with ASTM C270 or C780. Discharge mixer completely before recharging.
- B. All exterior above grade mortar exposed to moisture shall be fabricated with integral water repellent additive.
- C. Blend admixtures in accordance with manufacturer's instructions.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.

2.04 GROUT MIXES

- A. Bond beams, lintels, engineered masonry, reinforced masonry walls: min. 3000 psi strength at 28 days unless noted otherwise; 8-10 inches slump; pre-mixed grout in accordance with ASTM C94, or batch mixed in accordance with ASTM C476 for fine or course grout.

PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Apply bonding agent to existing concrete surfaces.

3.02 INSTALLATION

- A. Install pre-mix mortar and grout in accordance with manufacturer's instructions.
- B. Work grout into masonry cores and cavities to eliminate voids. Do not displace reinforcement. Reinforcing shall be mechanically anchored in masonry cores to prevent displacement during grouting.

END OF SECTION 04100

SECTION 04300 - UNIT MASONRY

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

- A. Work included in this section consists of furnishing all labor, materials, equipment and incidentals required for complete installation of concrete masonry including tuckpointing and repair of existing SGFT and CMU including installation of reinforcement, anchorage and accessories.

- B. Related work specified elsewhere:

- 1. Section 04100 - Mortar & grout.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days.

- 1. For concrete Unit Masonry: As follows, based on net area:
 - a. f'm = 2000 psi.

1.04 SUBMITTALS

- A. Provide data on concrete masonry units including proposed reinforcing.

- B. If specifically requested by the Architect/Engineer, provide samples for verification as follows.

- 1. Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
- 2. Accessories embedded in the masonry.

1.05 QUALITY ASSURANCE

- A. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.
- B. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.
- C. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Hot and Cold weather requirements: Recommended Practices for Hot or Cold Weather Masonry Construction as published by the Masonry Industry Council.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2. PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete block (CMU): ASTM C90, medium weight (105-125 pcf). Use for above and below grade, exterior or interior wall applications.
- B. Texture of exposed faces of block shall be uniform for all block used in this project. Solid units may be used for bearing under structural members. No units with exposed chipped surfaces will be permitted in areas where exposed.
- C. Provide shapes such as special units at pilaster blocks, bullnose all external corners, sash recesses, square ends, lintel blocks and other, as required by drawings or specifications.

2.02 REINFORCEMENT AND ANCHORAGE

- A. All single wythe joint reinforcement shall be ladder type wire reinforcing consisting of No. 9 gauge deformed side rods, with No. 9 gauge standard ladder type cross rods. All rods shall be hot-dip galvanized using ASTM A153, Class B-2 standards. Out to out spacing of side rods shall be approximately 2" less than the nominal wall thickness. Provide pre-fabricated corners and tee units as required.
- B. For anchorage to steel framing, provide manufacturer's standard anchors with crimped 1/4 inch (6.4 mm) diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1 inch (25 mm) of masonry face and wire diameter of 0.25". Provide one tie on each side of framing where masonry abuts. Ties to be spaced at 16" o.c. vertical.

C. Manufacturers:

1. AA Wire Products Co.
2. Dur-O-Wal.
3. National Wire.
4. Hohmann and Barnard, Inc.
5. Wire Bond
6. Other Architect Approved.

- D. Reinforcing Steel: ASTM A615, 60-ksi-yield grade deformed steel bars unprotected finish.

2.05 FLASHINGS

- A. Flexible Flashing: For flashing not exposed to the exterior, use the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz/sq ft. (1.5-kg/sq. m) copper sheet bonded with asphalt between 2 layers of glass-fiber cloth.

a. Products:

1. Advanced Building Products, Inc; Copper Fabric Flashing.
2. Dayton Superior Corporation, Dur-O-Wall Division, Copper Fabric Thru-Wall Flashing.
3. Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
4. Phoenix Building Products; Type FCC-Fabric Covered Copper.
5. Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
6. York Manufacturing, Inc.; Multi Flash 500.

- B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.06 ACCESSORIES

- A. Building Paper: 15# asphalt saturated felt.
- B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, recommended by masonry unit manufacturer.
- C. Column Wrap: Waxed corrugated cardboard or 15# asphalt saturated felt.
- D. Weep Vents: Plastic Weep Vent: One-piece, flexible extrusion manufactured from ultraviolet-resistant polypropylene copolymer, designed to weep moisture in masonry cavity to exterior, sized to fill head joints with outside face held back 1/8 inch from exterior face of masonry, in color selected from manufacturer's standard.

2.07 LINTELS

- A. Lintels shall be steel, precast or cast-in-place in accordance with details as shown or scheduled on the drawings.

PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and ready to receive work. Examine rough-in and built-in construction to verify locations prior to installation.
- B. Coordinate placement of anchors supplied to other sections.
- C. Employ skilled mechanics, experienced supervision. Lay masonry plumb, true to line, with level, accurately spaced courses. Break vertical joints unless otherwise indicated. Keep bond plumb. Rack courses, where necessary, without tothing. Lay out facing before setting, minimize cutting closures, jumping bond.

- D. Do not wet concrete masonry. Lay masonry with complete bearing in full beds of mortar. Butter sides for full vertical joints. Shove units into place. Anchor walls not otherwise bonded with ties every 8", every four (4) courses.
- E. Cover top of exterior masonry work at end of day's work with reinforced waterproof non-staining membrane. When air temperature is below 40°F., heat masonry materials, provide cold weather protection necessary to maintain temperature from 40°F. for 48 hours, both sides of masonry.
- F. Mix units for exposed unit masonry from several pallets as they are placed to provide a uniform blend of colors and textures.

3.02 COURSING

- A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness. Lay out walls in advance for accurate spacing of openings, movement type joints, returns, etc. Avoid units of less than half size at corners and jambs.
- B. Block unit shall be laid in stack or running bond, as indicated on drawings or if not indicated to match existing with vertical joints aligned plumb, horizontal joints level. Joints in back-up work shall be worked out to provide bonding with facing masonry. Joints shall be uniform in width, thickness not to exceed 1/3". Exposed joints in finish work shall be tooled slightly concave, others shall be cut flush.
- C. Initial block course (first course above foundation) in walls (interior or exterior) shall be laid in full mortar beds on shells and cross webs; in other locations, units shall be laid in full mortar beds on shells only. Solid block units shall be laid same as brick. Vertical joints between units shall be filled with mortar between shell ends.

- D. All non-bearing walls and partitions shall terminate against beam soffits, roof, or structural ceilings, unless otherwise shown on drawings, or as stated below. Build wall to within 3/8" of overhead structure on roof, fill top joint and all voids with non-combustible insulation board which has width of 1" less than wall, then caulk joints.
- E. Both bearing and non-bearing masonry walls which enclose corridors, storage or mechanical rooms, shops, and other rooms requiring a rated separation from adjacent areas, must have the top joint as well as all voids at roof deck and elsewhere in or over these walls, filled with cement grout, mortar, or plaster bed of at least 2" in width. Where no ceilings occur in the room, said fill shall be troweled flush with the wall surface or surfaces on the exposed side of the wall.
- F. All interior and exterior block walls shall have control joints 20'-0" o.c. maximum for exterior and 25'-0" to 30'-0" at interior walls. Line up control joints with joints in foundation wall and joints in the veneer. Leave exposed faces on joints ready for caulking. Provide vertical reinforcing in grouted core on each side of exterior masonry control joints. Reinforcing to match vertical wall steel.
- G. Bond each course at corners and break vertical joints at least 2". Tee shaped or cross shaped intersecting walls shall have vertical continuous joint. These joints shall be caulked. Provide for continuity of joint reinforcing by providing pre-fabricated "T" shaped or "L" shaped units.
- H. Provide welded steel masonry reinforcing placed in every second horizontal course in all block walls with at least one layer below a window sill level and one layer above a lintel level. Lay reinforcing on wall and cover with mortar, bed unit as usual. Longitudinal wire shall be lapped not less than 32 diameters at splices. At corners, cut inside rod and bend to proper angle.

- I. Construct bond beams as indicated with concrete grout. Maintain accurate location of reinforcing steel during grout placement.
- J. Grout course solid (or use solid units) immediately below veneer, where masonry serves as support for the veneer (i.e. brick ledges).
- K. Grout course solid (or use solid units immediately below window and door openings or other locations where masonry serves as a support for a sill.
- L. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

3.03 PLACING AND BONDING

- A. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- B. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with fire rated compressible joint filler.

3.04 WEEPS AND VENTS

- A. Install weep holes in veneer at 24 inches on center horizontally or as indicated on drawings above through-wall flashing, above shelf angles, and at bottom of walls. Weeps shall be laid with masonry. Weep holes shall not be drilled, cut or carved into mortar joints.

3.05 REPAIR OF AREAS AND OPENINGS DURING DEMOLITION BY MASON OR OTHERS

- A. All masonry openings sawcut by mason or by demolition work of other trades shall have new masonry units toothed in the existing adjacent masonry units to remain unless noted otherwise on the drawings. This includes all areas under construction or in the area of construction whether shown on the drawings or not.

3.06 REINFORCEMENT & ANCHORAGES - SINGLE WYTHE MASONRY

- A. Walls laid up with concrete block, including where used as back-up shall be reinforced with horizontal steel wall reinforcing as specified. Reinforcing shall be of proper width for block wythe, to have side wires over block shells. Place joint reinforcement at 16" o.c. vertical and continuous in first and second joint below top of walls.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum of 3'-0" beyond each side of opening.
- C. Terminate reinforcing each side of control joints; lap end joints 12", form corners by cutting and lapping inside wire, bending outside wire; form intersections by cutting and lapping reinforcing from one wall with other wall. Bed side wires completely in mortar.

3.07 MASONRY FLASHINGS

- A. Extend flashings under, over and through veneer. Turn up minimum 8 inches and bed into mortar joint of backup masonry.
- B. Lap end joints and seal watertight.
- C. All discontinuous flashing shall be turned up one head joint past the opening jamb to form an end dam.
- D. Use flashing manufacturer's recommended adhesive and sealer.

3.08 LINTELS

- A. Install loose steel lintels over window openings, door openings and other miscellaneous openings as indicated on the architectural plans.
- B. Construct concrete block lintels over window openings, door openings and other openings as indicated on the architectural plans or otherwise required.
- C. Maintain minimum bearing each side of opening of 8" or as specified on structural drawings. Align end of lintel with vertical block joints.

3.09 GROUTED COMPONENTS

- A. Reinforce bond beam and pilasters as detailed.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At beam bearing locations, fill masonry cores with grout for a minimum 12 inches either side of member and three courses vertical, unless otherwise noted.

3.10 ENGINEERED MASONRY

- A. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
- B. Reinforce masonry unit cores and cavities with reinforcement bars and grout as indicated. Provide vertical bars in corners. Provide vertical bars at each side of all masonry openings. Vertical bars to continue at noted spacing above openings.
- C. Secure vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement 48 bar diameters, minimum 12".
- D. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces; bevel back and upward. Permit mortar to cure 3 days before placing grout.
- E. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout spaces 2 inches or greater in width with coarse grout using high or low lift grouting techniques.
- F. When grouting is stopped for more than one hour, terminate grout 1-1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.

G. Low Lift Grouting: Place first lift of grout to a height of 60 inches maximum and consolidate by mechanical vibration. Place subsequent lifts in maximum 60 inch increments and vibrate grout for consolidation. Ensure mortar has gained sufficient strength to withstand pressure prior to grouting. "Puddling" may be used in lieu of mechanical vibration if grout lifts are limited to 12 inches maximum.

H. High Lift Grouting:

1. Provide cleanout opening no less than 4 inches high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.
2. Clean out masonry cells and cavities with high-pressure water spray. Permit complete water drainage. Cells and cavities may be "cleaned" by using steel rod to remove excess mortar protrusions.
3. Request that Architect/Engineer inspect the cells. Allow three days advance notice.
4. After cleaning and cell inspection, seal openings with masonry units.
5. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.
6. Limit grout lift to 60 inches and mechanically vibrate for grout consolidation. Wait 30 to 60 minutes before placing next lift.

3.11 CONTROL AND EXPANSION JOINTS

- A. Do not extend horizontal joint reinforcement through control joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the masonry unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Form control joints where indicated on drawings as detailed.

3.12 BUILT-IN WORK

- A. As Work progresses, build in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built in the Work furnished by other Sections.
- B. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.13 POINTING AND CLEANING

- A. In areas of construction, point up all exposed existing masonry where required, fill all holes and joints; remove loose mortar, cut out defective joints, and repoint where necessary.

3.14 TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Variation from Level Coursing: 1/8 inch in 3 ft. and 1/4 inch in 10 ft.; 1/2 inch in 30 ft.

3.15 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items. Coordinate with other Sections of Work to provide correct size, shape, and location.
- B. Form slots, grooves, chases, recesses, other items required for other trades. Build in all required structural steel, miscellaneous metal, frame anchors, precast concrete anchors, other items. Bed in mortar to line and level. Check all requirements in advance to eliminate cutting.
- C. Do necessary cutting of masonry for installation of items not otherwise provided for. Patch walls, maintain structural stability, appearance, weather resistance.

- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.16 REPAIRING, POINTING AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, opening, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.
- C. Remove excess mortar and mortar smears.
- D. Clean soiled surfaces with cleaning solution.
- E. On completion of pointing and re-pointing of all masonry work, interior and exterior, clean thoroughly with "Sure Klean 600", "Craft Klean" or similar prepared detergent, applied strictly according to the manufacturer's instructions with stiff fiber brushes. Drench with clean water immediately after cleaning. Do not use job mixed acid on this project. All cleaning shall be done prior to installation of any finished floor, wall mounted light fixtures, aluminum frames or items subject to damage. Protect hollow metal and aluminum frames, other built-in items.

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3.17 MASONRY WASTE DISPOSAL

- A. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.

END OF SECTION

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

- A. Work included in this Section consists of furnishing all labor, materials, equipment and incidentals required for complete installation of all load and non-load bearing exterior structural steel studs, interior structural steel studs where indicated and joist framing, fasteners and accessories. Refer to Section 09250 for lightweight metal framing and furring. Refer to Structural Drawings for additional information.
- B. Related work specified elsewhere:
 - 1. Section 06100 - Rough Carpentry

1.03 SYSTEM DESCRIPTION

- A. Size components to withstand design live and dead loads per design drawings or as follows:
 - 1. Vertical Assembly: Exterior, 30 PSF (wind load) positive or negative; Interior 5 PSF positive or negative.
 - 2. Horizontal Assembly: 40 PSF live load.
- B. Maximum allowable deflection: Per Structural Drawings or 1/360 of span.
- C. Design wall system to provide for movement of components without damage. Contribution from sheathing shall not be considered for lateral deflection.

- D. Design system to accommodate construction tolerances, deflection of building structural members, including metal deck and clearances of intended openings.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate component details, framed openings, bearing required, loading, welds, type and location of fasteners and describe framing connections.
- B. Provide stud and joist layout.
- C. Product Data: Describe materials and finish, product criteria, and limitations.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance, and who is a current member in good standing of the Steel Stud Manufacturer's Association (SSMA).
- B. AISI - American Iron and Steel Institute, Cold-Formed Steel Design Manual.
- C. ASTM A446 - Steel Sheet, Zinc Coated (Galvanized) by Hot-Dip Process, Physical (Structural) Quality.
- D. ASTM A525 - Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process.
- E. ASTM A570 - Hot-Rolled Carbon Steel Sheet and Strip Structural Quality.
- F. ASTM A611 - Steel, Cold-Rolled Sheet, Carbon, Structural.
- G. ASTM C955 - Load Bearing (Transverse and Axial) Steel Studs, Runners (Track) and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.

- H. AWCI (Association of Wall & Ceiling Industries) - Specification Guide for Cold-Formed Structural Members.
- I. AWS D1.1 - Structural Welding Code - steel.
- J. AWS D1.3 - Structural welding code - Sheet Steel.
- K. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.
- L. MFMA (Metal Framing Manufacturers Association) - Guidelines for the Use of Metal Framing.

PART 2. PRODUCTS

2.01 FRAMING MATERIALS

A. Manufacturers

- 1. Clark Dietrich Building Systems
- 2. Jaimes Industries, Inc.
- 3. Marino/Ware
- 4. Other Architect approved current member in good standing of the SSMA.

B. Studs: ASTM A653, sheet steel 'C' channel shape, solid web, minimum 18-gage unless noted otherwise; (minimum 16-gage for studs serving as backup for brick veneer), size as noted on drawings, galvanized to G-90 coating class, complying with ASTM C955. Yield strength of 33,000 psi minimum. 25-gage studs are acceptable for interior applications unless noted otherwise.

C. Joists: ASTM A653, Grade 33, sheet steel 'C' channel shape, solid web, 18-gage or size as noted on drawings, galvanized to G-90 coating class.

D. Stud Track: Formed steel, channel shaped; same width and gage as stud, solid web, galvanized to G-90 coating class, complying with ASTM C955.

2.02 ACCESSORIES

- A. Bracing, Furring, Bridging, Plates, Gussets, Kickers, Stiffeners, Clips: Formed steel, thickness, same as stud or determined for conditions encountered; same finish as framing members.
- B. Screws: ASTM A123, hot dip galvanized to 1.25-oz./sq. ft., self-drilling, self-tapping, #10 screws (minimum).
- C. Anchorage Devices: Power driven, power actuated or drilled expansion joint as required relative to substrate.
- D. Welding: In accordance with AWS D1.1 or D1.3.
- E. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 with dry film containing minimum of 94 percent zinc dust by weight.

2.03 FABRICATION

- A. Fabricate assemblies of sizes and profiles required; with framing members fitted, reinforced and braced.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.
- C. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.

PART 3. EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that substrate surfaces and building framing components are ready to receive work.
- B. Beginning of installation means acceptance of existing conditions and substrate.

3.02 ERECTION OF STUDDING

- A. Install components in accordance with manufacturer's instructions.
- B. Align top and bottom tracks; locate to wall layout. Secure with fasteners at maximum 24-inches o.c.
- C. Place studs at 16-inches o.c. unless noted otherwise on drawings; not more than 2-inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method. Wire tying of framing members is not permitted.
- D. Construct corners using minimum three studs. Double stud each wall opening, door, and window jamb. Install intermediate studs above and below openings to match wall stud spacing.
- E. Erect load bearing studs one-piece full length. Splicing of studs is not permitted.
- F. Allow for deflection, directly below horizontal building framing, metal decking, etc., for non-load bearing framing.
- G. Attach cross studs and furring channels to studs for attachment of fixtures anchored to walls and for attachment of mechanical and electrical items within walls.
- H. Touch-up field welds and damaged prefinished surfaces with primer.
- I. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- J. Coordinate installation of all wood blocking for installation of items supplied by other trades.
- K. Coordinate installation of all framing to accommodate openings required by architectural, mechanical and electrical trades.

3.03 ERECTION OF JOISTS

- A. Install components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Place joists at 16-inches o.c. unless noted otherwise on drawings; position not more than 2-inches from abutting walls. Connect joists to supports using fastener method. Fasten joists to both flanges of joist track.
- D. Set joists parallel with lateral bracing and bridging.
- E. Locate joist end bearing directly over load bearing studs or provide load-distributing member to top of stud track.
- F. Provide web stiffeners at reaction points.
- G. Touch up field welds and damaged prefinished surfaces with primer.

3.04 TOLERANCES

- A. Maximum variation from true position: 1/4-inch.
- B. Maximum variation of any member from plane: 1/4 inch.

END OF SECTION 05400

SECTION 05500 - METAL FABRICATIONS

PART 1. GENERAL

1.01 RELATED DOCUMENTS

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.02 SECTION INCLUDES

- A. Work included in this section consists of furnishing all labor, materials, equipment and incidentals required for complete installation of miscellaneous metal work shown on the drawings, as specified herein, and/or as needed for a complete and proper installation whether shown or not.

1.03 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society.
- C. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the work.
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel," AWS D1.2 "Structural Welding Code-Aluminum," and AWS D1.3 "Structural Welding Code-Sheet Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.04 SUBMITTALS

- A. Comply with pertinent provisions of Division 1.
- B. Product Data: Within (35) calendar days after the contractor has received the Notice of Intent, submit:
 - 1. Shop drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this section with the work of adjacent trades. Provide templates for anchors and bolts specified for installation under other sections.
 - 2. Submit signed and sealed calculations for steel pipe railings by the registered professional engineer registered in the State of Michigan responsible for their preparation.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Check Actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
 - 1. Where field measurements cannot be made without delaying the work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2. PRODUCTS

2.01 MATERIALS

- A. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, rolled trade names, and roughness.

B. Comply with following standards as pertinent:

1. Steel plates, channels, angles and bars: ASTM A36.
2. Steel W-shapes: ASTM A992.
3. Steel plates to be bent or cold-formed: ASTM A283, Grade C.
4. Steel HSS tubing: ASTM A500, Grade B.
5. Cold-finished steel bars: ASTM A108.
6. Cold-rolled carbon steel sheets: ASTM A336.
7. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525.
8. Steel pipe: ASTM A53, Grade B, standard weight, black finish unless otherwise noted.
9. For exterior installations and where indicated, provide members with hot-dip galvanizing coat per ASTM A53.
10. Concrete inserts:
 - a. Threaded or wedge type galvanized ferrous castings of malleable iron complying with ASTM A27.
 - b. Provide required bolts, shims, and washers, hot-dip galvanized in accordance with ASTM A153.

2.02 FASTENERS

A. General:

1. For exterior use and where built into exterior walls, provide zinc-coated fasteners.
2. Provide fasteners of type, grade, and class required for the particular use.

B. Comply with following standards as pertinent:

1. High-strength bolts, nuts and washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade C, heavy-hex carbon steel nuts, and ASTM F436, Type 1, hardened carbon steel washers; all with plain finish.
2. Lag bolts: Provide square-head type complying with Fed. Spec. FF-B-561.
3. Machine screws: Provide cadmium plated steel type complying with Fed. Spec. FF-S-111.

4. Washers:
 - a. Plain washers: Comply with Fed. Spec. FF-W-92, round, carbon steel.
 - b. Lock washers: Comply with Fed. Spec. FF-W-84, helical spring type carbon steel.
5. Toggle bolts: Provide type, class and style needed but complying with Fed. Spec. FF-B-588.
6. Anchorage devices: Provide expansion shield complying with Fed. Spec. FF-S-325.

2.03 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by contractor subject to the approval of the Architect.

2.04 SHOP PAINT

- A. Primer: Use "10-99 Tnemec Primer" or Architect/Engineer equal product by Rustoleum.
- B. For repair of galvanizing, use a high zinc-dust content paint complying with SSPC-paint 20. Dry film containing not less than 94 percent zinc dust by weight.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.05 FABRICATION

- A. Except as otherwise shown on the drawings or the approved shop drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.
- B. Fabricate with accurate angles and surfaces which are true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.

- C. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the items.
- D. On surfaces inaccessible after assembly or erection, apply two coats of the specified primer. Change color of second coat to distinguish it from the first.
- E. Shear and punch metals cleanly and accurately. Remove burrs.
- F. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- G. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

2.06 MISCELLANEOUS METAL FABRICATIONS

- A. Rough Hardware:
 - 1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Section 06100 "Carpentry".
 - 2. Manufacture or fabricate items of sizes, shapes, and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

B. Loose Bearing and Leveling Plates:

1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

C. Loose Steel Lintels:

1. Provide loose structural steel lintels for opening and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit where indicated. Provide not less than 8" bearing at each side of openings, unless otherwise shown.
2. Size lintels as follows, unless otherwise indicated.
 - a. Up to 4'-0" span: One 3 1/2" x 4" x 5/16" steel angle supporting each 4" thick module of masonry.
 - b. Spans 4'-0" to 7'-0": One 5" x 3-1/2" x 5/16" steel angle supporting each 4" thick module of masonry.
 - c. Over 7'-0": Consult Architect if not indicated.
3. Hot dip galvanized loose steel lintels to be installed in exterior walls.

D. Steel Pipe Railings:

1. Provide railings and handrails capable of withstanding the following loads applied as indicated when tested per ASTM E 935.
 - a. Concentrated loads of 200 lbs. Applied at any point in any direction.
 - b. Uniform load of 50 lbs. Per linear ft. applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.

- d. Infill of Guards:
Concentrated load of 50 lbs. applied horizontally on an area 1 sq. ft.
Uniform load of 25 lb./ft. applied horizontally.
Infill load and other loads need not be assumed to act concurrently.
 - e. Provide X-Strong pipe (Schedule 80).
- 2. Interconnect railing by butt-welding or welding with internal connectors, at fabricator's option.
 - 3. At tee and cross intersections provide coped joints.
 - 4. At bends interconnect pipe by means of prefabricated elbow fittings or flush radius bends, as applicable.
 - 5. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of pipe.

E. Miscellaneous Roof Framing and Supports:

- 1. Provide miscellaneous steel framing and supports as required to complete work.
- 2. Fabricate miscellaneous units to sizes, shapes, and profiles shown or, if not shown, or required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes, plates, and steel bars of welded construction using metered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- 3. Hot dip galvanize exterior miscellaneous frames and supports.

PART 3. EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

A. General:

1. Set work accurately into position, plumb, level, true and free from rack.
2. Anchor firmly into position.
3. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correcting welding work.
4. Grind exposed welds smooth and touch up shop prime coats.
5. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.

- B. Immediately after erection, clean the field welds, bolted connections and abraded areas of shop priming. Paint the exposed areas with same material used for shop priming.

END OF SECTION 05500

SECTION 06100 - CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of the carpentry work is shown on the Drawings.

1.03 QUALITY ASSURANCE:

- A. Lumber Standard: Comply with U.S. Department of Commerce Product Voluntary Standards PS 1-07, "Structural Plywood", PS 2-04 Performance Standard for "Wood based structural use panels" and PS 20-05 American Softwood Lumber Standard, except as otherwise indicated.
- B. Factory mark each piece of lumber and plywood with type, grade, mill, and grading agency: West Coast Lumber Assoc. (WBLC) or Western Wood Products Association (WWPA).

1.04 SUBMITTALS:

- A. Wood Treatment Data:
 - 1. Submit treatment manufacturer's instructions for proper use of each type of treated material.
 - a. Pressure Treatment: For each type specified, include certification by treating plant stating chemicals and process used, net amount of preservative retained, and conformance with applicable standards.
 - b. For water-borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 15% prior to shipment to project site.

B. Product Data:

1. Submit manufacturer's specifications and other data for each carpentry anchorage, fastening, and miscellaneous material. Provide material certificates for all lumber and plywood. Transmit a copy of each instruction to the Installer.

1.05 PRODUCT HANDLING:

- A. Delivery and Storage: Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood and provide air circulation within stacks.

1.06 JOB CONDITIONS:

- A. Coordination: Fit carpentry work to other work, scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow proper attachment of other work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Lumber - General:

1. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20-05, for the moisture content specified for each use. Use dressed lumber, surfaced four sides (SFS) seasoned with 19% maximum moisture content at time of dressing.

B. Framing Lumber (2" through 4" thick):

1. For light framing (less than 6" wide), provide Construction Grade Douglas Fir as graded by the West Coast Lumber Bureau (WCLB) or equivalent species and grade with minimum fiber stress rating (bending) of 1000 psi (Fb), and modulus of elasticity of 1,500,000 psi.

2. For structural framing (6" and wider and from 2" to 4" thick) provide dense No. 1 Grade Douglas Fir as graded by the West Coast Lumber Bureau (WCLB) or equivalent species and grade with minimum fiber stress rating (bending) of 1500 psi (Fb), and modules of elasticity of 1,700,000 psi.

C. Boards (less than 2" thick):

1. Produce lumber of 19% maximum moisture content (S-DRY) and of the following species and grade.
 - a. Redwood Construction Common (RIS).
 - b. Southern Pine No. 2 Boards (SPIB).
 - c. Or any species graded construction Boards (WCLB or WWPA).

D. Plywood:

1. Provide only Douglas Fir Plywood in accordance with grading requirements of the APA - The Engineered Wood Association as follows:
 - a. Treated non-combustible AC standard with exterior glue.

E. Anchorage and fastening Materials:

1. Select proper type, size, material, and finish for each application. Comply with the following:
 - a. Nails and Staples: FS FF-N-105.
 - b. Wood Screws: FS FF-S-111.
 - c. Bolts and Studs: FS FF-B-575.
 - d. Nuts: FS FF-N-836.
 - e. Washers: FS FF-W-92.
 - f. Lag Screws or Lag Bolts: FS FF-B-561.
 - g. Masonry Anchoring Devices: For expansion shields, nails, and drive screws, comply with FS FF-S-325.
 - h. Toggle Bolts: FS FF-B-588.
 - i. Bar or Strap Anchors: ASTM A 575 carbon steel bars.

2.02 WOOD TREATMENT:

- A. Preservation Treatment: Where lumber or plywood is indicated as "Treated" or is specified herein to be treated, comply with the applicable requirements of the American Wood Preservers Association (AWPA) AWPA P23-08, ASTM D-1625 and Federal Specification TT-W-50.
- B. Pressure-treat above-ground items with water-borne preservatives complying with AWPA P5-09, ASTM D-1760, and Federal Specification TT-W-571. After treatment, kiln-dry to a maximum moisture content of 19%. Treat indicated items and the following, except where fire retardant treated.
 - 1. Wood cants, nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing members less than 12 inches above grade excepting timber.
- C. Fire Retardant Treated:
 - 1. Wood blocking and similar items installed within the building shall be pressure impregnation with retardant chemicals to achieve a flame spread rating of not more than 25 when tested in accordance with UL Test 723, ASTM E 84, or NFPA Test 355.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the substrates and supporting structure and the conditions under which the carpentry work is to be installed and notify the General Contractor, in writing, of conditions detrimental to the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 INSTALLATION:

A. General:

1. Discard units of material with defects which might impair the quality of the work, and units which are too small to fabricate the work with minimum joints or the optimum joint arrangement.
2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
3. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required. Provide washers under bolt heads and nuts in contact with wood. Nail plywood in accordance with the recommendations of APA-The Engineered Wood Association.
4. Use common wire nails, except as otherwise shown or specified herein. Use finishing nails for exposed work. Do not wax or lubricate fasteners that depend on friction for holding power. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required. Do not drive threaded friction type fasteners; turn into place. Tighten bolts and lag screws at installation and retighten as required for tight connections prior to closing in or at completion of work.

B. Wood Grounds, Nailers, Blocking and Sleepers:

1. Provide wherever shown and where required for screening or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to form work before concrete placement.

3. Provide permanent grounds of dressed, pressure preservative treated key-bevelled lumber not less than 1-1/2" wide and of the thickness required to bring face of ground to exact thickness of finished material involved. Remove temporary grounds when no longer required.

C. Wood Furring:

1. Install plumb and level with closure strips at all edges and openings. Shim with wood as required for tolerance of finished work.

D. Wood Framing:

1. Provide framing members of sizes and on spacings shown and frame openings as shown, or if not shown, comply with recommendations of "The Wood Frame Construction Manual" 2015 Ed. of the American Wood Council. Do not splice structural members between supports.
2. Anchor and nail as shown, and comply with the "Recommended Nailing Schedule - Table I of the Manual for Housing Framing: and other recommendations of the N.F.P.A.

E. Installation of Plywood:

1. Comply with recommendations of the Engineered Wood Association (APA) for the installation of plywood.

END OF SECTION 06100

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Plastic laminate countertops (Alternate #1).
 - 2. Interior miscellaneous standing & running trim and rails and other ornamental items.
 - 3. Custom cabinetry (laminated clad millwork)
 - 4. Hardware schedule for new custom cabinets.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 6 Section 06100 "Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.
 - 2. Division 8 Section 08210 "Flush Wood Doors" for doors specified by reference to architectural woodwork standards.
 - 3. Division 9 Section 09900 "Painting" for final finishing of installed architectural woodwork.
 - 4. Division 12 Section 12300 "Plastic Laminate Casework".
 - 5. Division 12 Section 12364 "Quartz Surfaces".

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

- B. Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
- C. Fire-retardant treatment data for material impregnated by pressure process to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.
- D. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Plastic laminate.
 - 2. Factory-applied opaque finishes.
- E. Samples for verification purposes of the following:
 - 1. Lumber with or for transparent finish, 50 square inches, for each species and cut, finished on one side and one edge.
 - 2. Veneer leaves representative of and selected from flitches to be used for transparent finished woodwork.
 - 3. Lumber and panel products with factory-applied opaque finish, 8- 1/2 inches by 11 inches for panels and 50 square inches for lumber, for each finish system and color, with one half of exposed surface finished.
 - 4. Laminate clad panel products, 8-1/2 inches, by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
 - 5. Corner pieces as follows:
 - a. Cabinet front frame joints between stiles and rail as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
 - 6. Exposed cabinet hardware, one unit of each type and finish.

- F. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.
- G. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.4QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Single-Source Responsibility: Arrange for production by a single firm of architectural woodwork with sequence matched wood veneers.
- C. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.
- D. Installer Qualifications: Arrange for installation of architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.
- E. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

1.5DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

- B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high pressure decorative laminates which may be incorporated in the work include but are not limited to the following:
- B. Manufacturer: Subject to compliance with requirements, provide high pressure decorative laminates of one of the following:
 - 1. Formica Corp.
 - 2. Laminart.
 - 3. Nevamar Corp.
 - 4. Wilsonart International
 - 5. Arborite - Div. of ITW Canada

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:
1. Hardboard: ANSI/AHA A135.4
 2. High Pressure Laminate: NEMA LD 3-2005.
 - a. Fire rated laminate: ASTM E84/UL723 and NEMA LD3-2005.
 3. Medium Density Fiberboard: ANSI A208.2.
 4. Particleboard: ANSI A208.1
 5. Softwood Plywood: PS 1.
 6. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
 - a. Particleboard: NPA 8.
 - b. Medium Density Fiberboard: NPA 9.
 - c. Hardwood Plywood: HPM FE.
- B. Fire-Retardant Particleboard: at all areas of Clerk Storage in the Clemens Center, provide panels complying with the following requirements that have fire-retardant chemicals bonded to softwood particles at time of panel manufacture to achieve products identical to those tested for flame spread of 20 or less and for smoke developed of 25 or less per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
1. For 45-lb-density panels and thicknesses of 3/4 inch and less, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of elasticity and screw-holding capacity on face and edge shall be 300,000 psi, 250 lb, and 225 lb, respectively.

2. For 44-lb-density panels and thicknesses of 13/16 inch to 1-1/4 inch, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of rupture, modulus of elasticity, internal bond, linear expansion, and screw-holding capacity on face and edge shall be 1300 psi, 250,000 psi, 60 psi, 0.50 percent, 250 lb, and 175 lb, respectively.
3. Product: Subject to compliance with requirements, provide "Duraflake FR" by Duraflake Div.; Willamette Industries, Inc.

2.3 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
 2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.
- C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2.4 FIRE-RETARDANT-TREATED LUMBER

- A. Low-Hygroscopic Formulation: Interior Type A per AWPA C20.
- B. Fire Performance Characteristics: Provide materials identical to those tested for the following fire performance characteristics per ASTM test methods indicated by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify treated lumber with classification marking of inspecting and testing organization in the form of separable paper label or, where required by authorities having jurisdiction, of imprint on lumber surfaces that will be concealed from view after installation.
 - 1. Surface Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for 30 minutes with no evidence of significant combustion.
 - a. Flame Spread: 25.
 - b. Smoke Developed: 50.
- C. Mill lumber after treatment, within limits set for wood removal that does not affect listed fire performance characteristics, using a woodworking plant certified by testing and inspecting organization.
- D. Kiln-dry woodwork after treatment to levels required for untreated woodwork. Maintain moisture content required by kiln drying before and after treatment.
- E. Discard treated lumber that does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective lumber.
- F. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include but are not limited to the following:
 - 1. Koppers Company, Inc.
 - 2. Osmose Wood Preserving, Inc.

2.5 STANDING AND RUNNING TRIM AND RAILS FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 300.
- B. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.
- C. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- D. Grade: Premium.
- E. Lumber Species:
 - 1. Clemens Center: Red oak plain sawn.
- F. Lumber Species: Match species and cut indicated for other types of transparent finished architectural woodwork located in same area of building unless otherwise indicated.
 - 1. Provide split species on trim that face areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

2.6 STANDING AND RUNNING TRIM AND RAILS FOR OPAQUE FINISH

- A. Quality Standard: Comply with AWI Section 300.
- B. Grade: Custom.
- C. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.
- D. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- E. Lumber Species: Red Oak.

- 2.7 ARCHITECTURAL CABINET TOPS (ALTERNATE #1-PLASTIC LAMINATE COUNTERTOPS)
- A. Quality Standard: Comply with AWI Section 400 and its Division 400C.
 - B. Type of Top: High pressure decorative laminate complying with the following:
 - 1. Grade: Custom.
 - 2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:
 - a. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1) Match Architect's sample.
 - 3. Edge Treatment: As indicated.
 - C. Fire Performance Characteristics: Provide paneling composed of panels of wood veneer density and fire-retardant particleboard that are identical in construction to units tested for the following surface burning characteristics per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify panels with appropriate markings of applicable testing and inspecting organization on surfaces that will be concealed from view after installation.
 - 1. Flame Spread: 75 or less.
 - 2. Smoke Developed: 40 or less.
- 2.8 INTERIOR MISCELLANEOUS ORNAMENTAL ITEMS FOR TRANSPARENT FINISH
- A. Quality Standard: Comply with AWI Section 700.
 - B. Grade: Premium
 - C. Lumber Species:
 - 1. Clemens Center: Red oak-plain sliced

2.9 INTERIOR MISCELLANEOUS ORNAMENTAL ITEMS FOR OPAQUE FINISH

- A. Quality Standard: Comply with AWI Section 700.
- B. Grade: Custom.
- C. Lumber Species: Eastern white pine, sugar pine, or Idaho white pine.

2.10 CUSTOM CABINETRY (LAMINATE CLAD MILLWORK)

- A. Quality Standard: Comply with AWI Section 400 and its Division 400B "Laminate Clad Cabinets."
- B. Grade: Custom.
- C. AWI Type of Cabinet Construction: As indicated.
- D. Laminate Cladding: High pressure decorative laminate complying with the following requirements: (provide fire-rated laminate where indicated on the documents).
 - 1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - a. Provide selections made by Architect from laminate manufacturer's full range of standard colors and finishes in the following categories:
 - 1) Solid colors.
 - 2) Patterns.
 - 2. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.
 - a. Horizontal Surfaces Other Than Tops: GP-50 (0.050-inch nominal thickness).
 - b. Postformed Surfaces: PF-42 (0.042-inch nominal thickness).
 - c. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).
 - d. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).

3. Semiexposed Surfaces: Provide surface materials indicated below:
 - a. High pressure laminate, GP-28.

- E. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers except where located directly under tops.

2.11 FASTENERS AND ANCHORS

- A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

- B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

- C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.
- C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.
- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer including those for adhesives where are used to install woodwork.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- F. Standing and Running Trim and Rails: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.
- G. Tops: Anchor securely to base units and other support systems as indicated.
- H. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.
- I. Refer to the Section 09900 "Painting" for final finishing of installed architectural woodwork.

3.3 ADJUSTMENT AND CLEANING

- A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

3.5 HARDWARE SCHEDULE

- A. Drawer slide (Precision single extension) No. 8300 Truc-Trac.
- B. Wire Pulls: #6032-3SC-P 3-1/2" c/c (89mm c/c) Finish: satin chrome finish by Advantage Wire Pulls.
- C. Locks: TLCB250 by Timberline with Masterkey and all associated accessories for mounting.
- D. Grommets: Mockett 2" o.d. Black: TG Series with flip top tab
- E. Hinges - BLM 120° + clip top self closing straight arm, screw on hinge. Provide with mounting plate and all associated hardware to mount. 7IT5550.
- F. Shelf Supports: Injection molded, clear polycarbonate, adjustable on 32mm holes, with two integral support pins and automatic lock down tabs for $\frac{3}{4}$ inch and 1 inch thick shelves to prevent accidental tipping of shelf. Each shelf assembly to support a minimum of 1,200 pounds, evenly distributed without failure.

END OF SECTION 06402

SECTION 07600 - FLASHING AND SHEET METAL

PART ONE - GENERAL

1.01 WORK INCLUDED

- A. Counterflashings for the rooftop mechanical equipment.

1.02 RELATED WORK

- A. Section 06100 - Carpentry

1.03 QUALITY ASSURANCE

- A. Requirements of current edition of "Architectural Sheet Metal Manual" published by Sheet Metal and Air Conditioning Contractors' National Association, Inc. ("SMACNA") shall form a part of these Specifications except as otherwise specified or shown on Drawings.

1.04 SUBMITTALS

- A. The Installer shall submit a list of materials and description of installation methods proposed for this work for review by the Construction Manager and Architect.
- B. Shop drawings and color samples will be required for metal copings in accordance with the General Conditions and Supplementary General Conditions. Fabrication of the work shall not commence until shop drawings bearing Installer's final corrections have been reviewed and returned by the Construction Manager and Architect.

1.05 WARRANTY/GUARANTEE

- A. The Installer shall furnish a written Guarantee warranting all sheet metal including metal flashing to remain serviceable and in good condition for (2) two years from date of final acceptance of the building and to promptly repair and place in good condition without additional expense to the Owner any sheet metal and metal flashings which become defective within that period.

- B. Manufacturer's Standard Warranty: Warranted materials shall be free of defects in material and workmanship for five years after shipment. If, after inspection, the manufacturer agrees that materials are defective, the manufacturer shall, at their option, repair or replace them. For decorative finish warranty, consult manufacturer.

PART TWO - PRODUCTS

2.01 MATERIALS

- A. Exposed and concealed metal flashings, including metal counterflashings and metal drip edge for concealed fabric flashing shall be of soft stainless steel cold rolled sheet or strip of Type 302/304 alloy having a 2-D dull fully annealed finish, which shall have at least its exposed portions custom color painted after fabrication in a color to match adjoining metal work as selected by the Owner's representative.
 - 1. Counterflashing and curbs shall be two-piece type, with flashing of at least 26 gauge stainless steel having a receiver of at least 28 gauge stainless steel.
 - 2. Metal drip flashing shall be placed over concealed flashing at lintels and all other metal flashings shall be of at least 18 gauge stainless steel.

PART THREE - EXECUTION

3.01 INSTALLATION

- A. Provide counterflashing for all base flashings where indicated. Turn metal down at least four inches over upper portion of such base flashings.
- B. Provide and install drip flashings for fabric concealed flashing over steel lintels at heads of openings, doors, and windows, and where else shown in exterior walls.
- C. Insulate sheet metal from other materials using roofing felt, roofer's mastic, bituminous paint or other materials acceptable to the Architect.

END OF SECTION 07600

SECTION 07840 - FIRESTOPPING

PART I - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this section.

1.02 DESCRIPTION OF WORK:

- A. Provide labor and materials necessary for complete installation of firestopping materials and systems. Section includes firestopping for the following:
 - 1. Penetrations through fire resistance rated walls and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 - 2. Penetrations through fire resistance rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits and other penetrating items.
 - 3. Penetrations through smoke barriers and construction enclosing compartmentalized area involving both empty openings and openings containing penetrating items.
 - 4. Sealant joints in fire resistance rated construction.

1.03 SUBMITTALS:

- A. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL or other nationally recognized independent testing laboratories firestop systems to be used and manufacturer's installation instructions.
 - 1. Submit material safety data sheets (MSDS) provided with product delivered to jobsite.

- B. Product certificates signed by manufacturers of firestopping products certifying that their products and installation comply with specified requirements. Certification shall be signed by the Installer.

1.04 QUALITY ASSURANCE:

- A. Conform to applicable governing codes, including local governing authorities, but not limited to the following:
 - 1. 2015 Michigan Building Code
- B. Meet requirements of ASTM E814-02 or UL 1479-94 tested assemblies that provide a fire rating equal to that of construction being penetrated and other ASTM Standards as applicable for the installation.
 - 1. ASTM E84-04 "Test Method for Surface Burning Characteristics of Building Materials".
 - 2. ASTM E119-00 "Test Methods for Fire Tests of Building Construction and Materials".

PARTS 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with through-penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products by one of the following:
 - 1. Hilti Construction Chemicals, Tulsa, OK
 - 2. Specified Technologies Inc. (STI) Sommerville, NJ
 - 3. 3M Fire Protection Products, St. Paul, MN
 - 4. The REctorseal Corp., Houston, TX
 - 5. Tremco, Inc. Beachwood, OH

2.02 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

1. All materials shall comply with ASTM E814-02 or E119-00 (UL 1479-94, with revisions through August 2000) and shall be manufactured of non-toxic, non-hazardous, asbestos free materials and unaffected by water or moisture when cured.
 2. Primers: Conform to manufacturer's recommendations for primers required for various substrate and conditions.
 3. Backup materials: Backup materials, supports, and anchoring devices shall be provided as required by UL testing.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance rated system. Accessories include but are not limited to the following items:
1. Permanent forming/damming/backing materials must be noncombustible and may include the following:
 - a. Semirefractory fiber (mineral wool) insulation.
 - b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - c. Joint fillers for joint sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.03 FIRE STOPPING, MATERIALS

- A. Use only firestopping products that have been UL 1479 or ASTM E814 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire rating involved for each separate instance.

- B. For penetrations by noncombustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:
1. Hilti CP 601s Elastomeric Firestop Sealant
 2. STI SpecSeal Sealant SSS Intumescent Sealant
 3. 3M Fire Barrier CP25WB+ caulk
 4. The RectorSeal Corp. Metacaulk 1000, 950, 835+, Metacaulk Putty and Putty Pads, & Metacaulk Fire Rated Mortar.
 5. Fyre-Sil, Tremco, Inc.
 6. Biofireshield K10 and K2 Mortar, Biostop 500+, Biootherm 100/22200 & Biostop Putty, (The RectorSeal Corp.)
- C. For penetrations by combustibile items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are acceptable:
1. Hilti FS One Intumescent Firestop Sealant
 2. STI Intumescent Wrap Strip SSW Series
 3. 3M Fire Barrier FS-195+ Wrap/Strip
 4. The Rectorseal Corp. Metacaulk Wrap Strip, Metacaulk Pipe Collars, Metacaulk 1000, 950 & 835+.
 5. Biostop Intumescent Wrap Strip, Collar, and Biostop 500+ (The Restorseal Corp.)
- D. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following materials are acceptable:
1. Hilti CP637 Trowelable Firestop Compound
 2. STI SpecSeal Series Mortar SSM Series or SSP Putty and Putty Pads.
 3. 3M Fire Barrier CS-195+ Composite Sheet
 4. The Rectorseal Corp. Metacaulk Fire Rated Mortar
 5. Tremco: Tremstop Fire Mortar
 6. Biofireshield K-10 & K2 mortar (The Rectorseal Corp.)

- E. For fire-rated construction joints and other gaps with movement, the following materials are acceptable:
1. Hilti CP 601s Elastomeric Firestop Sealant
 2. STI Pen 300 Silicone Sealant
 3. 3M 2000 Silicone Sealant
 4. The Rectorseal Corp. Metacaulk 1000 & 1100
 5. Fyre-Sil, Tremco, Inc.
 6. Biofireshield, Biostop 700, Biostop 500+ (The Rectorseal Corp.)
- F. Provide a firestopping system with an "F" rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form release agent from concrete.

3.03 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross sectional shapes and depths required to achieve fire ratings of designate through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories and penetrating items.
 - 2. Apply materials so they contact and adhere to substrate formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 INSTALLING FIRE RESISTIVE JOINT SEALANTS

- A. General: Comply with the manufacturer's installation instructions and drawings pertaining to products and application indicated.

3.05 CLEANING

- A. Clean off excess fill materials and sealant adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

END OF SECTION 07840

SECTION 07910 - JOINT FILLERS AND GASKETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of each type of joint filler and gasket work is indicated on the drawings and by provisions of this section, and is hereby defined to include required fillers and gaskets not specified in other sections of these specifications.
- B. The required applications of joint fillers and gaskets include, but are not necessarily limited to, the following general types and locations:
 - 1. Joint fillers around penetrations of equipment and services through roofs & decks and slabs on grade.

1.03 SUBMITTALS:

- A. Product Data:
 - 1. Submit manufacturer's specifications, installation instructions and recommendations for each type of material required.
- B. Samples:
 - 1. Submit three, 12 inches long samples of each joint filler or gasket.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

- A. Size and Shape: Provide sizes and shapes of units as shown or, if not shown, as recommended by manufacturer for joint size and condition shown. Where joint movement is a factor in a determination of size, consult with Architect to determine nature and magnitude of anticipated joint movements for the temperature and condition of project at time of installation.

- B. Compressibility: Specified hardness and compressibilities are intended to establish requirements for normal or average conditions of installation and use. Where a range of hardness or compressibility is available for a product, comply with manufacturer's recommendations for specific condition of use.
- C. Color: Provide each concealed material in manufacturer's standard color which has best overall performance characteristics for application shown. Provide exposed materials in black, except where another color is indicated.
- D. Compatibility: Before purchase of each filler or gasket material, confirm that it is compatible with substrate, sealants and other materials in joint system.
- E. Adhesives: Pressure sensitive adhesives, compatible with each material in joint system may be applied (at installer's option) to one face of joint fillers and gaskets to facilitate installation and permanent anchorage. Do not allow adhesives to contaminate sealant bond surface (if any) in joint system.

2.02 CONCRETE CONTROL/EXPANSION JOINT FILLERS:

A. Bituminous and Fiber Joint Filler:

- 1. Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D 1751, FS HH-F-341, Type 1 and AASHO M 213.
- 2. Provide one of the following products:
 - a. Flexcell-Knight-Celotex Corporation
 - b. Expansion-Joint Filler; BASF/Sonneborn
 - c. FF-14. Asphalt Fiber-Board; Progress Unlimited
 - d. Fibre Expansion Joint; W.R. Meadows, Inc.
 - e. Conflex Fiber Expansion Control Joint Filler, JD Russell

2.03 CELLULAR/FOAM EXPANSION JOINT FILLERS:

A. Closed-Cell PVC Joint Filler:

- 1. Provide flexible expanded polyvinyl chloride complying with ASTM D 1667. Grade VE 41 BL (3.0 psi compression deflection); except provide higher compression deflection grades as may be necessary to withstand installation forces.

2. Provide one of the following products:

- a. FF2 PVC: Progress Unlimited, Inc.
- b. Vinyl "U" 1000 Series: Williams Products, Inc.

2.04 GASKETS:

A. Molded Neoprene Gasket:

1. Provide extruded neoprene or EPDM gaskets complying with ASTM D 2000, Designation 2BC 415 to 3BC 620, black (40 to 60 Shore A durameter hardness); of the profile shown or, if not shown, as required by the joint shape, size and movement characteristics to maintain a watertight and airtight seal.
2. Provide products by one of the following manufacturers:
 - a. D.S. Brown Company
 - b. Hohmann & Barnard, Inc.
 - c. Kirkhill Rubber Company
 - d. Progress Unlimited, Inc.
 - e. JD Russell
 - f. Williams Products, Inc.

2.05 MISCELLANEOUS MATERIALS:

A. Oakum Joint Filler:

1. Provide untreated hemp or jute fiber rope, free of oil, tar and other compounds which might stain surfaces, contaminate joint walls or not be compatible with sealants.

B. Fire-Resistant Joint Filler:

1. Glass fiber or other inorganic non-combustible fiber formed with minimum of binder into resilient joint filler strips or blankets of sizes and shapes indicated, recommended by manufacturer specifically for increasing fire resistance or endurance of joint systems of type indicated, for service temperatures up to 2300 degrees F, 80% (min.) recovery 50% compression.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine joint surfaces of units to receive fillers or gaskets and conditions under which the work is to be performed and notify the General Contractor, in writing, of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

- A. Comply with manufacturer's instructions and recommendations for installation of each type of joint filler or gasket required, unless more stringent requirements are shown or specified.
- B. Set units at proper depth of position in joint to coordinate with other work, including installation of bond breakers, backer rods, and sealants. Do not leave voids or gaps between ends of joint filler units.
- C. Recess exposed edges or faces of gaskets and exposed joint filler slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.
- D. Bond ends of gaskets together with adhesive or by means as recommended by manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends at corners except where molded corner units are provided.

END OF SECTION 07910

SECTION 07920 - SEALANTS AND CAULKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of each type of sealant and caulking work is indicated on the drawings and by provisions of this section.
- B. The required applications of sealants and caulking include, but are not necessarily limited to, the following general locations:
 - 1. Flashing reglets and retainers.
 - 2. Exterior wall joints.
 - 3. Masonry control joints, interior and exterior.
 - 4. Interior sound-sealed and air-sealed joints.
 - 5. Flooring joints.
 - 6. Isolation joints, between structure and other elements.
 - 7. Paving and sidewalk joints.
 - 8. Joints at penetrations of walls, decks and floors by piping and other services and equipment.
 - 9. Joints between items of equipment and other construction.
 - 10. Joints between dissimilar materials.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms with not less than (5) five years of successful experience in production of types of sealants and caulking compounds required for this project.
 - 1. Obtain elastomeric sealants from a manufacturer which will, upon request, send a qualified technical representative to the project site for purpose of advising installer on proper procedures for use of products.

- B. Installer: A firm with a minimum of (5) five years of successful experience in application of types of materials required.

1.04 SUBMITTALS:

A. Product Data:

- 1. Submit manufacturer's specifications, recommendations and installation and instructions for each type of sealant, caulking compound and associated miscellaneous material required.

B. Samples:

- 1. Submit (3) three, 12" long samples of each color required for each type of sealant and caulking compound exposed to view. Install sample between (2) two strips of material similar to or representative of typical surfaces where compound will be used, held apart to represent typical joint widths.

1.05 JOB CONDITIONS:

- A. Pre-Installation Meeting: At General Contractor's direction, installer, sealant manufacturer's technical representative, and other trades involved in coordination with sealant work shall meet with the General Contractor at project site to review procedures and time schedule proposed for installation of sealants in coordination with other work. Review each major sealant application required on project.

- B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended temperature range for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Where joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in lower third of the manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures. Coordinate time schedule with General Contractor to avoid delay of project.

- C. Statement of Non-Compliance: Where it is necessary to proceed with installation of sealants or caulking compound under conditions which do not fully comply with requirements (because of time schedule or other reasons which the General Contractor determines to be crucial to project), prepare written statement for Owner's record (with copy to Architect) indicating the nature of non-compliance, reasons for proceeding, precautionary measures taken to ensure best possible work and names of individuals concurring with decision to proceed with installation.

1.06 SPECIAL PROJECT WARRANTY (GUARANTEE):

- A. Sealant Warranty: Provide written warranty, signed by the General Contractor/installer, agreeing to, within warranty period of (10)ten years (or maximum warranty provided by manufacturer for polyurethane sealants) after date of substantial completion, replace/repair defective materials and workmanship defined to include: Instances of significant leakage of water or air; failures in joint adhesion, material cohesion, abrasion resistance, strain resistance or general durability; failure to perform as required and the general appearance of deterioration in any other manner not clearly specified in manufacturer's published product literature as an inherent characteristic of the sealant material. Warranty includes responsibility for removal and replacement of other work (if any) which conceals or obstructs the replacement of sealants.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

- A. Colors: Provide black or other natural color where no other standard or custom color is available. Where material is not exposed to view, provide manufacturer's standard color which has best overall performance characteristics for application shown.
1. Provide manufacturer's standard colors as selected by Architect from manufacturer's standard colors.

- B. Hardnesses shown and specified are intended to indicate general range necessary for overall performance. Consult manufacturer's technical representative to determine actual hardness recommended for conditions of installation and use. Upon request, Architect will furnish information concerning anticipated joint movement related to actual joint width and installation temperature. Except as otherwise indicated or recommended, provide compounds within the following range of hardness (Shore A, fully cured, at 75 degrees F.).
1. 5 to 20 for high percentage of movement and minimum exposure to weather and abrasion (including no exposure to vandalism).
 2. 15 to 35 for moderate percentage of movement and moderate exposure to weather and abrasion.
 3. 30 to 60 for low percentage of movement and maximum exposure to weather and abrasion (including foot traffic on horizontal joints).
- C. Modulus of Elasticity: For joints subjected to movement, either thermal expansion or dynamic movement, select sealants from among available variations which have lowest modulus of elasticity which is consistent with exposure to abrasion or vandalism. For horizontal joints subject to traffic, select sealants with high modulus of elasticity as required to withstand indentation by stiletto heels. Comply with manufacturer's recommendations where no other requirements are indicated.
- D. Compatibility: Before selection and purchase of each specified sealant, investigate its compatibility with joint surfaces, joint fillers and other materials in joint system. Provide only materials (manufacturer's recommended variation of specified materials) which are known to be fully compatible with actual installation conditions as shown by manufacturer's published data or certification.

2.02 SEALANTS:

- A. One Part Elastomeric Sealant (Silicone)
 - 1. One component elastomeric sealant, complying with ASTM C 920, Class 25, Type NS (nonsag), unless Type S (self-leveling) recommended by manufacturer for the application shown.
 - a. Acceptable Standard
 - 1. "Pecora 864 Architectural Silicone Sealant; Pecora Corp.
 - 2. Dow Corning 791; Dow Corning Corp.
 - 3. Silpruf; General Electric
 - 4. MasterSeal NP100, BASF Corporation Building Systems Inc.
 - 5. Spectrem 2; Tremco Mfg. Co.
 - 6. Sikasil WS 295; Sika Corp.
 - 2. One-Component mildew resistant silicone sealant: (Around countertops and backsplashes and other wet interior locations).
 - a. Acceptable Standard
 - 1. Rhodorsil 6B white; Rhone-Poulenc Inc.
 - 2. Dow Corning 786; Dow Corning Corp.
 - 3. Sanitary 1700; General Electric
 - 4. Sikasil GP; Sika Corp.
 - 3. One Component high movement joints (+100/-50): Where locations of high movement are indicated.
 - a. Dow Corning 790; Dow Corning Corp.,
 - b. Spectrem 1; Tremco
 - c. Sikasil WS 290; Sika Corp.
- B. Elastomeric Sealant (Polyurethane)
 - 1. One component polyurethane sealant, complying with ASTM C 920, Type S, Grade NS, Class 25 (nonsag).
 - a. Acceptable Standard
 - 1. MasterSeal NP 1; BASF Corporation Building Systems, Inc.
 - 2. Dymonic; Tremco Mfg. Co.
 - 3. Dynatrol I; Pecora Corp.
 - 4. Vulkem 921; Mameco
 - 5. CS 2130; Hilti
 - 6. Sikaflex 1A; Sika Corp.
 - 7. Sikaflex 15LM; Sika Corp.

2. Two Component polyurethane sealant, complying with ASTM C 920, Type M, Grade NS, Class 25 (nonsag).
 - a. Acceptable Standard
 1. MasterSeal NP 2; BASF Corporation Building Systems Inc.
 2. Dymeric; Tremco Mfg. Co.
 3. Dynatrol II; Pecora Corp.
 4. Vulkem 922; Mameco
 5. Sikaflex 2cNSEZ; Sika Corp.

- C. One-part self-leveling polyurethane sealant (for traffic areas).
 1. One Component polyurethane self-leveling sealant, complying with ASTM C 920, Type S, Grade P, Class 25.
 - a. Acceptable Standard
 1. MasterSeal SL 1; BASF Corporation Building Systems, Inc.
 2. NR-201 Urexpan; Pecora Corp.
 3. Vulkem 45; Mameco
 4. Sikaflex 1cSL; Sika Corp.

 2. Two-component polyurethane self-leveling sealant, complying with ASTM C 920, Type M, Grade P, Class 25.
 - a. Acceptable Standard
 1. MasterSeal SL 2; BASF Corporation Building System, Inc.
 2. NR-200 Urexpan; Pecora Corp.
 3. Vulkem 245; Mameco
 4. THC900/THC901; Tremco
 5. Sikaflex 2cSL; Sika Corp.

- D. Security Sealant (Polyurethane)
 1. One component or two component polyurethane sealant, complying with ASTM C 920, Grade NS, Class 12.5, with a Shore A Hardness of 55.
 - a. Acceptable Standard
 1. Dynaflex; Pecora Corp.
 2. Ultra; Sonneborn Building Products, Inc.

2.04 CAULKING COMPOUNDS:

A. Caulking Compounds: (Acrylic Latex Sealant)

1. Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer's standard, one part, nonsag, mildew resistant, acrylic emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.
2. Acceptable Standard
 - a. MasterSeal NP520, BASF Corporation Building Systems, Inc.
 - b. Acrylic Latex Caulk 834, Tremco Inc.
 - c. Acrylic Latex Caulk with Silicone, DAP
 - d. AC-20, Pecora Corp.

2.05 MISCELLANEOUS MATERIALS:

- A. Joint Cleaner: Provide type of joint cleaning compound recommended by sealant or caulking compound manufacturer, for joint surfaces to be cleaned.
- B. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer, for joint surfaces to be primed or sealed.
- C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.
- D. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer.
- E. Provide size and shape of rod which will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize possibility of sealant extrusion when joint is compressed.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. The installer must examine joint surfaces, backing and anchorage of units forming sealant rabbet and condition under which sealant work is to be performed and notify the General Contractor in writing of conditions detrimental to proper completion of the work and performance by sealants. Do not proceed with sealant work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 SELECTION OF MATERIAL

- A. Caulking compounds shall be used for interior nonmoving joints and at locations indicated.
- B. One component elastomeric silicone sealants shall be used at exterior and interior joints where thermal or dynamic movement is anticipated including, but not limited to, the following locations:
 1. Metal to metal joints.
 2. Sheet metal flashing, preformed metal caps, fascias, extenders, trim and panels.
- C. One or two component elastomeric polyurethane sealants shall be used at exterior and interior joints where weatherproofing or waterproofing is required and at exterior joints between dissimilar materials including, but not limited to, the following locations:
 1. Expansion and control joints.
 2. Exterior side of hollow metal frames to adjacent materials.
 3. Exterior side of aluminum frames to adjacent dissimilar materials.
 4. Lintels and shelf angles to masonry construction.
 5. Vertical interior expansion joints and horizontal interior and exterior control joints and expansion joints in the building.
 6. Joints in concrete site improvements (supported slabs & sidewalks) and the joint between the concrete slabs and dissimilar materials.
 7. Sealant in pipe sleeves where materials must perforate the floor slab.
 8. Perimeter of floor slabs or concrete curbs which abut vertical surfaces.

9. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by the various methods of construction to make watertight.
 10. Exterior locations which are noted "caulked" or "sealant" and not specifically listed herein or included in the work of other sections of the Specifications.
 11. Interior joints between dissimilar materials where the joining of the 2 surfaces leave a gap between the meeting materials and components.
- D. One or two part self-leveling polyurethane sealants shall be used for exterior and interior horizontal joints subject primarily to pedestrian traffic and light and moderate vehicular traffic.
- E. Security sealant shall be used in vertical control joints in the interior side of building.

3.03 JOINT SURFACE PREPARATION:

- A. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.
- B. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with paragraph 4.3.9. of FS TT-S-00227 has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.
- C. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

- D. Roughen joint surfaces on vitreous coated and similar non-porous materials, where sealant manufacturer's data indicated lower bond strength than for porous surfaces. Rub with fine abrasive to produce a dull sheen.

3.04 INSTALLATION:

- A. Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.
- B. Prime or seal joint surfaces where shown or recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- C. Install sealant backer rod for liquid sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.
- D. Install bond breaker tape where shown and where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.
- E. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
- F. Install sealants to depths as shown or if not shown as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead.
 - 1. For sidewalks, pavement and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width and neither more than 5/8" deep nor less than 3/8" deep.

2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
 3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75% to 125% of joint width.
- G. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces including exposed aggregate panels and similar rough textures. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces but either primer/sealer or the sealant/caulking compound.
- H. Remove excess and spillage of compounds promptly as the work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage without damage to adjoining surfaces or finishes.

3.05 CURE AND PROTECTION:

- A. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner which would significantly alter materials modulus of elasticity or other characteristics.
- B. Installer shall advise the General Contractor of procedures required for curing and protection of sealants and caulking compounds during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

END OF SECTION 07920

SECTION 08112 - HOLLOW METAL WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of hollow metal work is shown on the drawings and schedules.
- B. This section includes hollow metal doors and pressed steel frames for doors and related openings.

1.03 QUALITY ASSURANCE:

- A. Provide doors and frames complying with ANSI A258.8-1998 (SDI-100) "Recommended Specifications for Standard Steel Doors and Frames" and as herein specified.
- B. Fire-rated door assemblies shall be Underwriter Laboratory.: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests for Door Assemblies". All metal labels to be riveted to door and frames mylar labels not acceptable.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications for fabrication and installation, including data substantiating that products comply with requirements.
- B. Shop Drawings: Submit shop drawings for the fabrication and installation of hollow metal work. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections.
 - 1. Provide a schedule of doors and frames using same reference numbers for details and openings as those on the contract drawings.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.
- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided the finish items are equal in all respects to new work and acceptable to the Architect; otherwise remove and replace damaged items as directed.
- C. Store doors and frames at the building site under cover. Place units on at least 4" high wood sills or on floors in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If the cardboard wrappers on doors become wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. ASTM A653/A653M - Standard Specification for sheet steel, zinc coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot dip process (A60). .
- B. ASTM A924 - Specification for general requirements for steel sheet metallic coated by the hot dip process (A60).
- C. ASTM A 1009/A1008M - Standard specification for steel sheet, cold rolled, carbon, high strength low-alloy, high strength low alloy with improved formability, solution hardened, and bake hardenable.
- D. Supports and Anchors: Fabricate of not less that 16 gage sheet metal. Galvanize after fabrication units to be built into exterior walls, complying with ASTM A 153, Class B.
- E. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.
- F. Shop-Applied Paint: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as base for specified finish paints on steel surfaces.

2.02 FABRICATION, GENERAL:

- A. Fabricate hollow metal units to be rigid, neat in appearance, and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment to assure proper assembly at the project site. Weld exposed joints continuously; grind, dress, and make smooth, flush, and invisible. Metallic filler to conceal manufacturing defects is not acceptable.
- B. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.
- C. Finish Hardware Preparation:
 - 1. Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling, and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.
 - 2. Reinforce hollow metal units to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
 - 3. Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.
- D. Shop Painting:
 - 1. Clean, treat and paint exposed surfaces of fabricated hollow metal units, including galvanized surfaces.
 - 2. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.
 - 3. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC-PT-2), hot phosphate solution (SSPC-PT4) or basic zinc chromate-vinyl butyral solution (SSPC-PT3).

4. Apply shop coat or prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 2.0 mils, comply with ANSI A250.18.

E. Manufacturer: Provide hollow metal work by one of the following:

1. Ceco Door Products
2. Amweld Building Products
3. Steelcraft (A Division of Ingersoll-Rand)

2.03 DOORS:

A. General:

1. Provide flush design doors, 1-3/4" thick, seamless hollow construction, unless otherwise indicated. Bevel both vertical edges 1/8" in 2".
2. Insulated doors: Interior core of doors to be foamed in place, closed cell, polyurethane foam chemically bonded to door face sheets. Voids in foam will not exceed 1/2" in any direction. Compressive strength of polyurethane to be minimum of 20 PSI. Foam density not less than 1-8 PCF. Polystyrene core doors not acceptable. Doors to have R factor of not less than 14.81 U factor of .068.

B. Exterior Doors:

1. Provide doors meeting SDI Grade III, extra heavy duty, 1³/₄" thick (level A) Model 2 or seamless hollow steel construction. Fabricate exterior doors of 2 outer, galvanized, stretcher-level steel sheets not less than 16 gage. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges except around glazed or louvered panel inserts. Provide weephole openings in the bottom of doors to permit escape of entrapped moisture.
2. Reinforce inside of doors with vertical galvanized sheet steel sections not less than 22 gage. Space vertical reinforcing 6" o.c. and extend full door height. Spot-weld at not more than 5" o.c. to both face sheets.

- a. Continuous truss-form inner core of 28 gage galvanized sheet steel reinforcing may be provided as inner reinforcement in lieu of above. Spot-weld truss-form reinforcement 3" o.c. vertically and horizontally over entire surface of both sides.
3. Reinforce tops and bottoms of doors with 16 gage horizontal steel channels welded continuously to outer sheets. Close top and bottom edges to provide weather seal as integral part of door construction or by addition or inverted steel channels.

2.04 FRAMES:

- A. Provide hollow metal frames for doors, side-lights, borrowed lights, and other openings of sizes and profiles as indicated.
- B. Fabricate frames of full-welded unit construction with corners mitered, reinforced, continuously welded full depth and width of frame, unless otherwise indicated.
 1. Knock-down type frames are not acceptable.
- C. Form frames of galvanized steel sheets for exterior and either cold or hot-rolled sheet steel for interior.
 1. Gage: Not less than 14, for exterior openings up to and including 4'-0" wide.
 2. Gage: Not less than 14, for interior openings up to and including 4'-0" wide.
 3. For openings over 4'-0" wide: Not less than 12 gauge.
- D. Finish Hardware Reinforcement: Reinforce frames for required finish hardware as follows:
 1. Hinges and Pivots: Steel plate 3/16" thick x 1-1/2" wide x 6" longer than hinge, secured by not less than six spot-welds.
 2. Strike Plate Clips: Steel plate 3/16" thick x 1-1/2" wide x 3" long.
 3. Surface-Applied Closers: 12 gage steel sheet, secured with not less than six spot-welds.

4. Concealed Closers: Removable steel access plate, 12 gage internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.
- E. Head Reinforcing: Where installed in masonry, leave vertical mullions in frames open at top for grouting.
- F. Jamb Anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 18 gage galvanized steel.
1. Masonry Construction: Adjustable, flat, corrugated or perforated T-shaped to suit frame size, with leg not less than 2" wide by 10" long. Furnish at least three anchors per jamb up to 7'-6" height; four anchors up to 8'-0" jamb height; one additional anchor for each 24" or fraction thereof over 8'-0" height.
 2. Metal Stud Partitions: Insert type with notched clip to engage metal stud, welded to back of frames. Provide at least four anchors for each jamb for frames up to 7'-6" in height; five anchors up to 8'-0" jamb height; one additional anchor each 24" or fraction thereof over 8'-0" height.
 3. In-Place Concrete or Masonry: Anchor frame jambs with minimum 3/8" concealed bolts into expansion shields or inserts at 6" from top and bottom and 26" o.c., unless otherwise shown. Reinforce frames at anchor locations. Apply removable stop to cover anchor bolts unless otherwise indicated.
- G. Floor Anchors: Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14 gage galvanized steel sheet as follows:
1. Monolithic Concrete Slabs: Clip type anchors with two holes to receive fasteners, welded to bottom of jambs and mullions.
- H. Head Anchors: Provide two anchors at head of frames exceeding 42" wide for frames mounted in steel stud walls.
- I. Head Strut Supports: Provide 3/8" x 2" vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.

- J. Structural Reinforcing Members: Provide as part of frame assembly, where indicated at mullions, transoms, or other locations which are to be built into frame.
- K. Head Reinforcing: For frames over 4'-0" wide in masonry wall openings, provide continuous steel channel or angle stiffener not less than 12 gage for full width of opening welded to back of frame at head.
- L. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
- M. Rubber Door Silencers: Except on weatherstripped doors, drill stops to receive three silencers on single-door frames and four silencers on double door frames. Install plastic plugs to keep holes clear during construction.
- N. Plaster Guards: Provide 26 gage steel plaster guards or dust cover boxes, welded to frame at back of finish hardware cutouts where mortar or other materials might obstruct hardware installation.

2.05 STOPS AND MOLDINGS:

- A. Provide stops around glazed panels in hollow metal units and in frames to receive doors where indicated.
- B. Form fixed stops integral with frame, unless otherwise indicated.
- C. Provide removable stops and molds where indicated or required, formed of not less than 20 gage steel sheets matching steel on frames. Secure with countersunk machine screws spaced uniformly not more than 12 o.c.. Form corners with butted hairline joints.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine substrate and conditions under which hollow metal work is to be installed and must notify the General Contractor, in writing, of any conditions detrimental to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION:

- A. Install hollow metal units and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Setting Masonry Anchorage Devices:
 - 1. Provide masonry anchorage devices where required for securing hollow metal frames to in-place concrete or masonry construction.
 - 2. Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.
 - 3. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on final shop drawings.
- C. Placing Frames:
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After all construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 2. Protective Coating: In masonry walls, protect inside (concealed) faces of door frames using fibered asphalt emulsion coating. Apply approximately 1/8" thick over shop primer and allow to dry before handling.
 - 3. In masonry construction, building-in of anchors and grouting of frames is included in Section 04300 "Masonry Work" of these specifications.
 - 4. At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.
 - 5. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
 - 6. Make field splices in frames as detailed on final shop drawings, welded and finished to match factory work.

7. Remove spreader bars only after frames or bucks have been properly set and secured.

D. Door Installation:

1. Fit hollow metal doors accurately in their respective frames with the following clearances:
 - a. Jambs and Head: 3/32".
 - b. Meeting Edges, Pairs of Doors: 1/8".
 - c. Bottom: 1/4" at threshold or carpet.
 - d. Bottom: 1/4" to threshold or tile
 - e. Top: 1/8" to bottom of head or transom panel.
2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
3. Finish Hardware installation is specified in Section 08710 "Door Hardware".

3.03 ADJUST AND CLEAN:

- A. Final Adjustments: Check and re-adjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper operating conditions. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.
- B. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

END OF SECTION 08112

SECTION 08210 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior Flush Wood Veneer Doors:
 - 1. Five-ply flush bonded doors.
 - 2. Flush fire-rated wood doors.

1.2 RELATED SECTIONS

- A. Section 08112 - Hollow Metal Work
- B. Section 08710 - Door Hardware
- C. Section 08800 - Glass & Glazing

1.3 REFERENCES

- A. ANSI A208.1 - Particleboard.
- B. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- C. ASTM E 413 - Classification for Rating Sound Insulation.
- D. AWI/AWMAC/WI Architectural Woodwork Standards, Edition 1, Section 9 - Doors.
- E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
- F. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
- G. WDMA Finish System TR-6, Catalyzed Polyurethane.
- H. WDMA I.S. 1A-11 - Architectural Wood Flush Doors.
- I. Michigan Building Code - 2015 edition

1.4 SUBMITTALS

- A. Comply with Section 01340 - "Shop Drawings, Product Data & Samples"
- B. Product Data: Submit manufacturer's product data, including door construction description and WDMA I.S.1-A and AWS classifications.
- C. Schedules: Submit manufacturer's schedules, including door dimensions, cutouts, species, finish, and hardware. Reference individual door numbers as indicated on the Drawings.
- D. Samples: Submit manufacturer's door finish samples, showing range of color variation.
- E. Cleaning Instructions: Submit manufacturer's cleaning instructions for doors.
- F. Warranty: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

- A. Tolerances for Warp, Telegraphing, Squareness, and Prefitting Dimensions: WDMA I.S.1-A.
- B. Identifying Label: Each door shall bear identifying label indicating:
 - 1. Door manufacturer.
 - 2. Order number.
 - 3. Door number.
 - 4. Fire rating, if applicable.
- C. Fire-Rated Doors: Labeled by Intertek/Warnock Hersey or UL.
 - 1. Construction Details and Hardware Application: Approved by labeling agency.

D. Positive Pressure Opening Assemblies: UL 10C.

1. Core:

a. Particleboard Core:

- 1) Forest Stewardship Council (FSC) certified.
- 2) Pre-consumer recycled material.
- 3) No added urea formaldehyde.
- 4) CARB NAF / ULEF

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver doors to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
2. Package doors individually in polybags.

B. Storage:

1. Store doors in accordance with manufacturer's instructions.
2. Store doors in clean, dry area indoors, protected from damage and direct sunlight.
3. Store doors flat on level surface.
4. Do not store doors directly on concrete.
5. Keep doors completely covered. Use covering which allows air circulation and does not permit light to penetrate.
6. Store doors between 50 and 90 degrees F (10 and 32 degrees C) and 30 to 50 percent relative humidity.

C. Handling:

1. Handle doors in accordance with manufacturer's instructions.
2. Protect doors and finish during handling and installation to prevent damage.
3. Handle doors with clean hands or clean gloves.
4. Lift and carry doors. Do not drag doors across other doors or surfaces.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not subject doors to extreme conditions or changes in temperature or relative humidity in accordance with WDMA I.S.1-A.

1.8 WARRANTY

- A. Warrant solid core, interior doors for life of installation against warpage, delamination, and defects in materials and workmanship.
- B. Defects noted during warranty period shall be corrected at no cost to Owner. Corrective work shall include labor and material for repair, replacement, refinishing, and rehangng as required.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. VT Industries, Inc., (Basis of Design)
- B. Masonite Architectural Algoma/Marshfield Door Systems Architectural Aspiro Series, select wood veneer.
- C. Poncraft Door Company.
- D. Graham Manufacturing Corporation.

2.2 GENERAL

- A. Glass Mouldings:
 - 1. Non-rated Flush Doors: VT Industries Style VT1.
 - 2. Fire-Rated Doors: VT Industries Style 110, steel vision frame, beige prime finish.
- B. Glazing: As specified in Section 08800.

2.3 FIVE-PLY FLUSH BONDED DOORS

- A. Five-Ply Flush Bonded Doors: Heritage Collection.
 - 1. Model:
 - a. PC-5, particleboard core, non-rated and 20-minute rated, positive pressure.
 - 2. Compliance: WDMA I.S.1-A.
 - a. Aesthetic Grade: Custom.
 - b. Duty Level: Extra heavy duty.
 - c. Type: PC-5.
 - 3. Seven-Ply and Non-Bonded Core Construction: Not acceptable.
 - 4. Door Thickness: 1-3/4 inches.
 - 5. STC Rating:
 - a. Model PC-5: STC 34

6. Stiles:
 - a. Structural Composite Lumber (SCL) With Wood Edge:
Compatible species as face veneer.
7. Rails:
 - a. Structural composite lumber (SCL). Factory Sealed.
8. Core:
 - a. Material: Particleboard.
 - b. Particleboard and Agrifiber Compliance: ANSI A208.1,
Grade 1-LD-2.
 - c. Stave Lumber Core Compliance: Blocks and strips not
more than 2-1/2 inches wide, one species of wood.
9. Door Assembly:
 - a. Stiles and Rails: Bonded to core.
 - b. Sand entire assembly flat as a unit to ensure
minimal telegraphing of core components through
face veneers.
10. Composite Crossbands:
 - a. Apply to core in hot press using Type I, exterior,
water-resistant adhesive, before application of
hardwood edges.
 - b. Exposed Crossbanding: Not allowed along stile edges.
11. Veneers:
 - a. Apply to crossbanded core in hot press using Type
I, exterior, water-resistant adhesive.
 - b. Species: Red Oak
 - c. Cut:
 1. Clemens Center: Plain sliced
 - d. Match: Book.
 - e. Assembly: Running.
 - f. Minimum Thickness Before Sanding: 1/42 inch.
12. Positive Pressure:
 - a. Where UL 10C standards for positive pressure apply,
doors shall be constructed in accordance with
Category A guidelines as published by
Intertek/Warnock Hersey.
 - b. Smoke Gasketing: Apply smoke gasketing around frame
perimeter and between door and pairs to meet Smoke
(S) rating.
 - c. Intertek/Warnock Hersey Category A Guidelines: Edge
sealing systems not allowed on frames.

2.4 FABRICATION

- A. Prefit Doors:
 - 1. Prefit and bevel doors at factory to fit openings.
 - 2. Prefit Tolerances: WDMA I.S.1-A and AWS Section 9.
- B. Factory-machine doors for mortised hardware, including pilot holes for hinge screws and lock fronts required.

2.5 FINISHES

- A. Doors shall receive factory finishing.
- B. Factory Finishing: .WDMA System TR-8, UV cured urethane, premium grade.
 - 1. Stain coat.
 - 2. Sealer: minimum 3 coats.
 - 3. Sanding: Sand.
 - 4. Topcoat: 2 coats.
- C. Stain Color:
 - 1. Clemens Center: Submit standard finishes for selection by Architect
- D. Top and Bottom Rails: Factory sealed.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine locations to receive doors. Notify Engineer/Architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.
- B. Ensure frames are solidly anchored, allowing no deflection when doors are installed.
- C. Ensure frames are plumb, level, square, and within tolerance.

3.2 PREPARATION

- A. Allow doors to become acclimated to building temperature and relative humidity for a minimum of 24 hours before installation.

3.3 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions.
- B. Install doors at locations indicated on the Drawings.
- C. Install doors plumb, level, and square.
- D. Install door hardware as specified in Section 08710.

3.4 ADJUSTING

- A. Adjust doors to swing freely, without binding in frame.
- B. Adjust hardware to operate properly.
- C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- D. Remove and replace damaged doors that cannot be successfully repaired, as determined by Architect.

3.5 CLEANING

- A. Clean doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.6 PROTECTION

- A. Protect installed doors from damage during construction.

END OF SECTION

SECTION 08410 - FRP ENTRANCE DOORS-ALUMINUM FRAMING SYSTEMS

1. GENERAL

1.1. RELATED DOCUMENTS

- A. Drawings and General Provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work in this section.

1.2. DESCRIPTION OF WORK

- A. The extent of each type of door and frame is shown on the drawings and in schedules.
- B. The following types of doors and frames are required:
 - 1. FRP flush doors.
 - 2. Aluminum Framing Systems

1.3. RELATED WORK SPECIFIED ELSEWHERE

- A. For Finish Hardware, refer to Section 08710.
- B. For Sealants & Caulking, refer to Section 07920.

1.4. SYSTEM PERFORMANCE
FRP FLUSH DOORS

- A. Provide door assemblies that have been designed and fabricated to comply with requirements for system performance characteristics listed below, as demonstrated by testing manufacturer's corresponding stock systems according to test methods designated.
- B. Thermal Transmission (exterior doors); U-value of not more than 0.09 (BTU/Hr. x sf x degrees F.) per AAMA 1503.01.
- C. Flame Spread/Smoke Developed: Provide FRP doors and panels with the following ratings in accordance with ASTM E 84-79a: Flame Spread: Exterior faces not greater than 145 (Class C); interior faces not greater than 10 (Class A). Smoke Developed: Exterior faces not greater than 345 (Class C); interior faces not greater than 320 (Class A).

- D. Additional Criteria: Provide FRP doors and panels with the following performance:

ASTM D 256 - nominal value of 13.5
ASTM D 1242 - nominal value of .23 percent
ASTM D 570 - nominal value of .20 to .40 percent
ASTM D 2583 - nominal value of 50

1.5. QUALITY ASSURANCE - **ALL BIDDERS SHALL BE FACTORY DIRECT AUTHORIZED DISTRIUTORS OF THE SPECIFIED PRODUCTS.**

- A. Standards: Comply with the requirements and recommendations in applicable specification and standards by NAAMM and AAMA, including the terminology definitions and specifically including the "Entrance Manual" by NAAMM, except to the extent more stringent requirements are indicated.
- B. Performance: A minimum (10) ten year record of production of frames, doors and panels and completion of similar projects in type and size.
- C. Instruction: The manufacturer or his representative will be available for consultation to all parties engaged in the project including instruction to installation personnel.
- D. Field Measurement: Field verify all information prior to fabrication and furnish of materials. Furnish and install materials omitted due to lack of verification at no additional cost to Owner.
- E. Regulation and Codes: Comply with the current edition in force at the project location of all local, state and federal codes and regulations, including the Americans with Disabilities Act-Current Regulations.

1.6. SUBMITTALS

- A. Product Data: Submit Manufacturer's product data, specifications and instructions for each type of door and frame required in accordance with Section 01340 "Shop Drawings, Product Data & Samples" and the following:

1. Include details of core, stile and rail construction, trim for lites and all other components.
 2. Include details of finish hardware mounting.
 3. Include sample of each aluminum alloy to be used on this project. Where normal finish color and texture variations are expected, include two or more samples to show the range of such variations.
 4. Include (1) one sample of typical fabricated section, showing joints, fastenings, quality of workmanship, hardware and accessory items before fabrication of the work proceeds.
- B. Submit shop drawings for the fabrication and installation of the doors and frames, and associated components. Details to be shown full scale. Include any glazing details and finish hardware schedule.
- 1.7. PRODUCT DELIVERY, STORAGE AND HANDLING
- A. Deliver materials to jobsite in their original, unopened packages with labels intact. Inspect materials for damage and advise manufacturer immediately of any unsatisfactory materials.
 - B. Package door assemblies in individual corrugated cartons so no portion of the door has contact with the outer shell of the container. Package and ship frames preassembled to the greatest possible extent.
- 1.8. PROJECT WARRANTY
- A. Provide a written warranty signed by manufacturer, installer and contractor, agreeing to replace, at no cost to the Owner, any doors, frames or factory hardware installation which fail in materials or workmanship, within the warranty period. Failure of materials or workmanship includes: excessive deflection, faulty operation of entrances, deterioration of finish, or construction in excess of normal weathering and defects in hardware installation. The minimum time period of warranty is (10) ten years from acceptance.

2. PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of the following:
1. Special-Lite, Inc., Decatur, Michigan.

2.2. MATERIALS AND ACCESSORIES

- A. Aluminum Members: Alloy and temper as recommended by manufacturer for strength, corrosion resistance and application of required finish and control of color; ASTM B 221 for extrusions, ASTM B 209 for sheet/plate with aluminum wall thickness of 0.125".
- B. Components: Furnish door and frame components from the same manufacturer. "Splitting" of door and frame components is not permitted.
- C. Fasteners: Aluminum non-magnetic stainless steel or other non-corrosive metal fasteners, guaranteed by the manufacturer to be compatible with the doors, frames, stops, panels, hardware, anchors and other items being fastened. For exposed fasteners (if any) provide oval Phillips head screws with finish matching the item to be fastened.
- D. Glazing Gaskets: For glazing factory-installed glass, and for gaskets which are factory-installed in "captive" assembly of glazing stops. Manufacturer's standard stripping of molded neoprene, complying with ASTM D 2000 (Designation 2BC415 to 3BC620), or molded PVC complying with ASTM C 509 Grade 4.

2.3. FABRICATION

- A. Sizes and Profiles: The required sizes for door and frame units, and profile requirements are shown on the drawings.
- B. Coordination of Fabrication: Field measure before fabrication, and show recorded measurements on final shop drawings.

- C. Complete the cutting, fitting, forming, drilling and grinding of all metal work prior to assembly. Remove burrs from cut edges, and ease edges and corners to a radius of approximately 1/64".
- D. No welding of doors or frames is acceptable.
- E. Maintain continuity of line and accurate relation of planes and angles. Secure attachments support at mechanical joints, with hairline fit at contacting members.
- F. Attachment of all hardware shall be made using machine screws which are supplied by the manufacturer.
- G. All holes shall be drilled and tapped using the recommended drill size for the tap required.
- H. Frames stops shall be applied stops, Minimum 5/8" high x Minimum 1 1/4" wide.
- I. Door attachment points shall be minimum of 1/8" thickness.
- J. Where hardware is to be attached to frame stop (Example: exit device strike, door closer shoe, O.H. stop & Etc.) a piece of solid bar stock aluminum sized to fill the frame stop void x 18" long shall be securely attached to the frame tube
- K. Where it is to practical to have solid bar stock reinforcement at attachment points, use "RIV-NUTS for attachment of hardware items.

2.4. FIBERGLASS REINFORCED POLYESTER FRP FLUSH DOORS

A. Materials and Construction

- 1. Construct 1-3/4" thickness doors of 6063 T5 aluminum alloy stiles and rails minimum 25/16" depth. Provide joinery of 3/8" diameter full width tie rods through extruded splines top and bottom as standard .125" tubular shaped stiles and rails reinforced to accept hardware as specified.

2. Extrude top and bottom rail legs for interlocking continuous rail rigidity weather bar. Lock face sheet material in place with extruded interlocking edges to be flush with aluminum stiles and rails.
3. Door face sheeting. Spec Lite 3, 120" thickness fiberglass reinforced polyester. SL17 FRP/Aluminum Hybrid Door with pebble-like embossed pattern. Color: As selected by Architect.
4. Core of Door Assembly: Minimum five pounds per cubic foot density poured-in-place polyurethane free of CFC and HCFC. Minimum "R" value of 11. Meeting stiles on pairs of doors, and weather bars with nylon brush weather-stripping.
5. Manufacture doors with cutouts for visor-lites, louvers or panels as scheduled. Factory furnish and install all glass, louvers and panels prior to shipment.
6. Premachine doors in accordance with templates from the specified hardware manufacturers and approved hardware schedule. Factory install hardware.
7. Furnish FRP doors with Flush Pull SL86, color as selected by Architect.
8. Provide door with adjustable bottom brush insert.

2.5 ALUMINUM FRAMING SYSTEMS

A. Tubular Framing

1. Framing system from the door manufacturer of the size and type shown. .125" minimum wall thickness and type 6063-T5 aluminum alloy .625" high applied stops with screws and weather-stripping. Frame members are to be box type with four (4) enclosed sides. Open back framing will not be acceptable.

2. Caulk joints before assembling frame members. Secure joints with fasteners and provide a hairline butt joint appearance. Prefit doors to frame assembly at factory prior to shipment. Field fabrication of framing using "stick" material is not acceptable.
3. Anchors appropriate for wall conditions to anchor framing to wall materials. A minimum of five anchors up to 7'4" on jamb members, and one additional anchor for each foot over 7'4". Secure head and sill members of transom, sidelites and similar conditions.

2.6 ALUMINUM FINISHES

A. Finish/color:

1. FRP Door: To be selected from manufacturer's standard colors by Architect.
2. Aluminum Frame: Anodized Aluminum

3. EXECUTION

3.1. Installation

- A. Comply with manufacturer's recommendations (maintain 3/16" gap between leafs of pairs of doors) and specifications for the installation of the doors and frames. Factory install hardware, louvers in doors. Factory assemble sidelites and transoms to the greatest extent possible.
- B. Set units plumb, level and true to line, without warp or rack of doors or frames. Anchor securely in place. Separate aluminum and other metal surfaces with bituminous coatings or other means as approved by architect.
- C. Set thresholds in a bed of mastic and backseal.
- D. Clean surfaces promptly after installation of doors and frames, exercising care to avoid damage to the protective coatings.
- E. Ensure that the doors and frames will be without damage or deterioration (other than normal weathering) at the time of acceptance.

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- F. Provide Owner with all adjustment tools and instruction sheets. Arrange an in-service session to Owner at Owner's convenience. Any workmanship which is defective or deficient shall be corrected to the Owner's satisfaction and at no additional cost to the Owner per Paragraph 1.8 Project Warranty of this specification.

END OF SECTION 08410

SECTION 08710 - DOOR HARDWARE

PART 1 - GENERAL

1.1 Refer to "General and Special Conditions", and "Instructions to Bidders", Division 1 of Specifications. Requirements of these Sections and the project drawings shall govern work in this section.

1.2 Work Included:

A. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.

B. Related work:

1. Division 0 - Bidding and Contract Requirements
2. Division 1 - General Requirements
3. Section 06100 - Carpentry
4. Section 08112 - Hollow Metal Work
5. Section 08410 - FRP Entrance Doors-Aluminum Framing Systems

1.3 Quality Assurance

A. Requirements of Regulatory Agencies:

1. Furnish finish hardware to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
2. Furnish finish hardware to comply with the requirements of the regulations for public building accommodations for physically handicapped persons of the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.
3. Provide hardware for fire-rated openings in compliance with NFPA 80 and state and local building code requirements. Provide only hardware that has been tested and listed by UL for types and sizes of doors required and complies with requirements of door and door frame labels.

B. Hardware Supplier:

1. Shall be an established firm dealing in contract builders' hardware. He must have adequate inventory, qualified personnel on staff and be located within 100 miles of the project. The distributor must be a factory-authorized dealer for all materials required. The supplier shall be or have in employment an Architectural Hardware Consultant (AHC).

C. Electrified Door Hardware Supplier:

1. Shall be an experienced door hardware supplier who has completed projects with electrified door hardware 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, and who is acceptable to manufacturer of primary materials.
2. Shall prepare data for electrified door hardware, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this project.
3. Shall have experience in providing consulting services for electrified door hardware installations.

D. Pre-installation Meeting:

1. Before hardware installation, General Contractor will request a hardware installation meeting be conducted on the installation of hardware; specifically that of locksets, closers, exit devices, overhead stops and coordinators. Manufacturer's representatives of the above products, in conjunction with the hardware supplier for the project, shall conduct the meeting. Meeting to be held at job site and attended by installers of hardware for aluminum, hollow metal and wood doors. Meeting to address proper coordination and installation of hardware, per finish hardware schedule for this specific project, by using installation manuals, hardware schedule, templates, physical product samples and installation videos.

2. When any electrical or pneumatic hardware is specified this meeting shall also include the following trades/installers: Electrical, Security, Alarm systems and Architect.
3. Convene one week or more prior to commencing work of this Section.
4. The Hardware Supplier shall include the cost of this meeting in his proposal.

E. Manufacturer:

1. Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
2. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

1.4 Submittals:

A. Hardware Schedule

1. Submit Hardware Schedule as directed in Division 1.
2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.
3. Schedule will include the following:
 - a. Door Index including opening numbers and the assigned Finish Hardware set.
 - b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

CATEGORY	SPECIFIED	SCHEDULED
Hinges	Manufacturer A	Manufacturer B
Lock sets	Manufacturer X	Manufacturer X
Kick Plates	Open	Manufacturer Z

- c. Hardware Locations: Refer to Article 3.1 B.2 Locations.
- d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
- e. Hardware Description: Quantity, category, product number, fasteners, and finish.
- f. Headings that refer to the specified Hardware Set Numbers.
- g. Scheduling Sequence shown in Hardware Sets.
- h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
- i. Electrified Hardware system operation description.
- j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
- k. Typed Copy.
- l. Double-Spacing.
- m. 8-1/2 x 11 inch sheets
- n. U.S. Standard Finish symbols or BHMA Finish symbols.

B. Product Data:

- 1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
- 2. Submit product data with hardware schedule.

C. Samples:

- 1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
- 2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

D. Key Schedule:

1. Submit detailed schedule indicating clearly how the Owner's final keying instructions have been followed.
2. Submit as a separate schedule.

E. Electrified Hardware Drawings:

1. Submit elevation drawings showing relationship of all electrical hardware components to door and frame. Indicate number and gage of wires required.
 - a. Include wiring drawing showing point to point wire hook up for all components.
 - b. Include system operations descriptions for each type of opening; describe each possible condition.

F. Submit to General Contractor, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a particular hardware item. General Contractor shall keep these order acknowledgement numbers on file in the construction trailer.

1.5 Product Delivery, Storage, and Handling:

- A. Label each item of hardware with the appropriate door number and Hardware Schedule heading number, and deliver to the installer so designated by the contractor.

1.6 Existing Conditions:

- A. Where existing doors, frames and/or hardware are to remain, conditions, preparations and functions shall be field verified to confirm compatibility with specified hardware. Where any incompatibility is discovered, notify the General Contractor immediately and provide a suggested solution based on industry standard business practices.**

1.7 Warranties:

A. Refer to Division 1 for warranty requirements.

B. Special Warranty Periods:

1. Locksets shall carry manufacturer's 3-year warranty against manufacturing defects and workmanship.
2. Exit Devices shall carry manufacturer's 3-year warranty against manufacturing defects and workmanship.
3. Balance of items shall carry a manufacturer's 1-year warranty against manufacturing defects and workmanship.

C. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work.

PART 2 - PRODUCT

2.1 Furnish each category with the products of only one manufacturer unless specified otherwise; this requirement is mandatory whether various manufacturers are listed or not.

2.2 Provide the products of manufacturer designated or if more than one manufacturer is listed, the comparable product of one of the other manufacturers listed. Where only one manufacturer or product is listed, it is understood that this is the owner's Building Standard and "no substitution" is allowed.

A. Locksets and Latchsets - Mortise Type:

1. Locksets shall be manufactured from heavy gauge steel, minimum lockcase thickness 1/8", containing components of steel with a zinc dichromate plating for corrosion resistance.
2. Locks are to have a standard 2 3/4" backset with a full 3/4" throw two-piece stainless steel mechanical anti-friction latchbolt. Deadbolt shall be a full 1" throw, constructed of stainless steel.

3. Lockcase shall be easily handed without chassis disassembly by removing handing screw on lockcase and installing in opposite location on reverse side. Changing of door hand bevel from standard to reverse hand shall be done by removing the lockcase scalp plate, and pulling and rotating the latchbolt 180 degrees.
4. Lock trim shall be through-bolted to the door to assure correct alignment and proper operation. Lever trim shall have external spring cage mechanism to assist in support of the lever weight. Thumb turns shall have "EZ" thumbturn equal to Schlage L583-363.
5. Function numbers are Schlage.
 - a. Schlage L9000
6. Lockset Trim:
 - a. Schlage 03A
7. Provide strikes with extended lips where required to protect trim from being marred by latch bolt. Provide strike lips that do not project more than 1/8" beyond door frame trim at single doors and have 7/8" lip to center at pairs of 1-3/4" doors.

B. Miscellaneous:

1. Furnish items not categorized in the above descriptions but specified by manufacturer's names in Hardware Sets.

C. Fasteners:

1. Furnish fasteners of the proper type, size, quantity and finish. Use machine screws and expansion shields for attaching hardware to concrete or masonry, and wall grip inserts at hollow wall construction. Furnish machine screws for attachment to reinforced hollow metal doors and frames and reinforced aluminum doors and frames. "TEK" type screws are not acceptable.
2. **Sex bolts will not be permitted on reinforced metal doors where blocking is specified.**

2.3 Finishes:

- A. Generally, Dull Chrome, US26D / BHMA 626. Provide finish for each item as indicated in sets.

2.4 Templates and Hardware Location:

- A. Furnish hardware made to template. Supply required templates and hardware locations to the door and frame manufacturers.
- B. Refer to Article 3.1 B.2, Locations, and coordinate with templates.

2.5 Cylinders and Keying:

- A. All cylinders for this project will be supplied by one supplier regardless of door type and location.
- B. The Finish Hardware supplier will meet with Owner's Rep and/or Owner to finalize keying requirements and obtain keying instructions in writing.
 - 1. Supplier shall include the cost of this service in his proposal.
- C. Provide a cylinder for all hardware components capable of being locked.
- D. Provide cylinders master and grand master keyed to an existing Schlage Primus FSIC (Full Size Interchangeable Core) system according to Owner's instructions. Provide change keys, master keys and grand master keys as required by Owner.

PART 3 - EXECUTION

3.1 Installation

A. General:

1. Install hardware according to manufacturer's installations and template dimensions. Attach all items of finish hardware to doors, frames, walls, etc. with fasteners furnished and required by the manufacture of the item.
2. Reinforced hollow metal doors and frames will be drilled and tapped for machine screws.

B. Field Quality Inspection:

1. Inspect material furnished, its installation and adjustment, and instruct the Owner's personnel in adjustment, care and maintenance of hardware.
2. Locksets and exit devices shall be inspected after installation and after the HVAC system is in operation and balanced, to insure correct installation and proper operation.
3. Closers shall be inspected and adjusted after the HVAC system is in operation and balanced, to insure correct installation and proper operation.
4. A written report stating compliance, and also locations and kinds of noncompliance shall be forwarded to the Architect with copies to the Contractor, hardware distributor, hardware installer and building owner.

C. Technical and Warranty Information:

1. At the completion of the project, the technical and warranty information coalesced and kept on file by the General Contractor shall be given to the Owner or Owner's Agent. In addition to both the technical and warranty information, all factory order acknowledgement numbers supplied to the General Contractor during the construction period shall be given to the Owner or Owner's Agent. The warranty information and factory order acknowledgement numbers

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shall serve to both expedite and properly execute any warranty work that may be required on the various hardware items supplied on the project.

2. Submit to General Contractor, two copies each of parts and service manuals and two each of any special installation or adjustment tools. Include for locksets, exit devices, door closers and any electrical products.








3.2 Hardware Sets:

Hardware Group No. 01

For use on Door #(s):

A100 A102

Provide each SGL door(s) with the following:








QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080L 03A		626	SCH
1	EA	MORTISE CYLINDER/CORE	(ORDERED TO MATCH EXISTING SYSTEM)		626	SCH
1	EA	SURFACE CLOSER	4011 MC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

Hardware Group No. 02

For use on Door #(s):

A103

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINIS H	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080L 03A		626	SCH
1	EA	MORTISE CYLINDER/CORE	(ORDERED TO MATCH EXISTING SYSTEM)		626	SCH
1	EA	SURFACE CLOSER	4011 MC		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS33/WS33X		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

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Hardware Group No. 03

For use on Door #(s):

A101

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINIS	MFR
					H	
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050L 03A 09-544		626	SCH
1	EA	MORTISE CYLINDER/CORE	(ORDERED TO MATCH EXISTING SYSTEM)		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64/SR65		GRY	IVE

Hardware Group No. 04

For use on Door #(s):

A104

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	224XY		628	IVE
1	SET	CONST LATCHING BOLT	FB51P/FB61P (AS REQ'D)		630	IVE
1	EA	DUST PROOF STRIKE	DP1		626	IVE
1	EA	STOREROOM LOCK	L9080L 03A		626	SCH
1	EA	MORTISE CYLINDER/CORE	(ORDERED TO MATCH EXISTING SYSTEM)		626	SCH
1	EA	COORDINATOR	COR X FL		628	IVE
2	EA	MOUNTING BRACKET	MB (AS REQ'D)		689	IVE
2	EA	SURFACE CLOSER	4111 SHCUSH MC ST-1586		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	429AA		AA	ZER
1	EA	OVERLAPPING ASTRAGAL	BY DOOR/FRAME MANUFACTURER		PRI	B/O
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	654A-V3-223		A	ZER
2	EA	DOOR CONTACT	679-05 (AS REQ'D)		BLK	SCE

END OF SECTION

SECTION 08800 - GLASS AND GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of glass and glazing work is shown on the drawings.
- B. The required applications of glass and glazing include (but are not necessarily limited to) the following:
 - 1. Glazing interior doors.(Non-rated)
- C. Related Work Specified Elsewhere:
 - 1. Fire Rated Glass: Section 08810

1.03 QUALITY ASSURANCE:

- A. Prime Glass Standard: Comply with FS DD-G-451.
- B. Heat-Treated Glass Standard: Comply with the following as applicable.
 - 1. Consumer Product Safety Commission 16 CFR 1201.
 - 2. Industry Standards ANSI Z97.1.
- C. Insulating Glass Seal Standard: Comply with proposed standard ASTM E6-P-3, Test Methods P1 and P2.
- D. Manufacturers: Provide each type of glass and primary sealant/gasket from a single manufacturer with not less than 5 years of successful experience in the production of materials similar to those required.
- E. Installer (Glazier): Firm with not less than five (5) years of successful experience in glazing work similar to required work.

1.04 SUBMITTALS:

A. Product Data:

1. Submit manufacturer's product specifications, including documentation to compliance with requirements and instructions for handling, storing, installing, cleaning and protecting each type of glass and glazing materials.

B. Samples:

1. Submit two (2) samples of each type of glass and glazing material required, except for single-pane clear glass (including annealed and tempered). Submit 12" square glass samples and 12" lengths of installed (mocked-up) glazing materials.
 - a. Submit insulating glass samples with completed edge-seal construction, but hermetic seal need not be maintained.

C. Warranties:

1. Warranty on Insulating Glass Units: Provide written warranty signed by fabricator (manufacturer) and countersigned by Contractor/Installer agreeing to within 10 years from date of substantial completion replace glass units with defective hermetic seal of air spaces (but not including that due to glass breakage); defined to include intrusion of dirt or moisture, internal condensation or fogging at temperature above - 20 degrees F., deterioration of protected internal glass coatings resulting from seal failure, and other visual evidence of seal failure or performance; provide the manufacturer's printed and submitted instructions for handling, protecting, and maintaining units that have been adhered to during the warranty period.
2. Warranty on Laminated Glass: Provide written warranty signed by laminator (manufacturer) and countersigned by Contractor/Installer agreeing to within five (5) years after date of acceptance, replace glass units with defective lamination, defined to include evidence of delamination, changes in required strengths, transmittances, color, transparency, and other required performance.

1.05 PRODUCT HANDLING:

- A. Comply with manufacturer's instructions for shipping, handling, storing, and protecting glass and glazing materials. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coatings on glass.

1.06 JOB CONDITIONS:

- A. Pre-Installation Meeting: Comply with General Requirements for pre-installation meeting of Glazier and other trades affected by glass installation.
- B. Weather: Do not proceed with glazing under adverse weather conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommended by manufacturer.

PART 2 - PRODUCTS

2.01 GLASS

A. Non-processed Glass:

- 1. Clear Float/Plate: Type I, Class 1, Quality q3.
- 2. Laminating Film: Except as otherwise indicated, provide clear transparent permanent film of polyvinyl butyryl (PVB), not less than 30 mils thick, as adhesive plastic interlayer for laminating sheets of glass of a composition which has successfully withstood a minimum of 20 years exposure to sunlight and severe weather/temperature changes.

B. Processed Glass:

- 1. Tempered Glass: Heat treat to strengthen glass in bending to not less than 4.5 times annealed strength.
- 2. Tong Marks: Wherever the glazing system shown for the installation of tempered glass will not conceal the tong marks inherent from normal tempering processes, provide tempered glass produced by special process which eliminates tong marks.

C. Fabricated Products:

1. Laminated Glass:

- a. Laminate units at the factory using manufacturer's standard pressure-plus-heat process to produce units of the required sizes, thicknesses, and component make-up to comply with the details and performance requirements shown and specified herein. Exercise extreme precautions and plant control in the laminating process to exclude dirt and other foreign matter from the lamination, and to eliminate voids and achieve complete lamination at each glass surface.
- b. Fabricate units to proper size and shape at the factory so that no cutting, seaming, or nipping will be required for installation at the project site.
- c. Provide the following type:
 - (1) $\frac{1}{4}$ " clear:
Exterior Glass: $\frac{1}{8}$ " clear plate tempered glass
Laminating Film: 30 mils thick
Interior Glass: $\frac{1}{8}$ " clear plate temp. glass

D. Design Thickness:

1. Verify all glass thicknesses will comply with performance requirements.

E. Manufacturer of Glass: One of the following:

1. Old Castle Building Envelope
2. Saint-Gobain North America
3. Pilkington North America, Inc.
4. PPG Industries, Inc. (Basis of Design)
5. Guardian Industries, North America
6. Viracon, Inc., Owatonna, MN

F. Edges:

1. Polish edges wherever exposed to view.

2.02 GLAZING SEALANTS, COMPOUNDS AND GASKETS:

- A. Colors: Provide black or other natural color where no other color is available. Where material is not exposed to view, provide manufacturer's standard color which has the best overall performance characteristics for application shown.
- B. Hardnesses shown and specified are intended to indicate general range necessary for overall performance. Consult manufacturer's technical representative to determine actual hardness recommended for conditions of installation and use. Architect will furnish information concerning anticipated glass movement related to actual glazing channel width and installation temperature upon request. Except as otherwise indicated or recommended, provide glazing materials within the following ranges of hardness (Shore A, fully cured, at 75 degrees F.):
1. 15 to 35 for elastomeric compounds and tapes used with rigid stops and frames for large glass sizes (in excess of 100 united inches). Provide material sufficiently hard to withstand exposure (if any) to abrasion and vandalism.
 2. 25 to 50 for rubber-like curing compounds used with rigid stops and frames for medium and small glass sizes (less than 100 united inches). Provide materials sufficiently hard to withstand impact where used on moving sash and doors.
 3. 35 to 60 for molded gaskets used with rigid stops and frames, depending upon strength needed for applications or insertion of units and open profile of gasket.
 4. 70 to 80 for structural gaskets (not supported by stops).
 5. Non-Elastomeric Compounds: (Shore A not applicable) 2 to 12 mm penetration for 5.0 seconds of penetrometer needle on nominally cured compound (ASTM D 2451).
- C. Compatibility: Before purchase of specified glazing materials, investigate compatibility with channel surfaces, joint fillers, and other materials in glazing channel. Provide only materials (manufacturer's recommended variation of specified materials) which are known to be fully compatible with actual installation condition, as shown by manufacturer's published data or certification.

D. Provide size and shape of gaskets and preformed glazing units as shown, or if not shown, as recommended by manufacturer, either in published data or upon consultation with technical representative.

E. Nonporous Bond Silicone Rubber Glazing Sealant"

1. One-part acid-type silicone rubber elastomeric sealant, complying with FS TT-S-001543, Class A, non-sag, recommended by manufacturer for non-porous exterior joint surfaces and for glazing.

2. Products/Manufacturers: Provide one of the following:

a. 781 Building Sealant; Dow Corning Corporation

b. Silicone Construction 1200 Sealant; General Electric Company

c. Rhodorsil Sealant 3B; Rhodia Inc. Chemical Division

F. Preformed Butyl Rubber Glazing Sealant:

1. Preformed ribbon or tape (coiled with release paper) of polymerized butyl (or mixture of butyl and polyisobutylene) with inert fillers (pigments), solvent-based with minimum 95% solids, non-sag consistency, tack-free time of 24 hours or less, paintable, non-staining, pre-shimming to prevent stretch (as required by Glazier to facilitate proper application and glass installation).

2. Product/Manufacturer:

a. Polyshim Tape: Tremco, Inc.

3. Use in all interior glazing.

2.03 MISCELLANEOUS GLAZING MATERIALS:

A. Channel Cleaner: Use type compound recommended by sealant manufacturer for channel surfaces to be cleaned.

B. Channel Primer/Sealer: Provide type of primer or sealer recommended by sealant manufacturer for application of sealant to channel surfaces.

C. Setting Blocks: Neoprene or other resilient blocks of 70 to 90 Shore A durometer hardness, tested for compatibility with specified glazing sealants.

- D. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesively backed on one face only, tested for compatibility with specified glazing sealants.
- E. Compressible Filler Rod: Closed-cell or waterproof-jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane, or vinyl tested for compatibility with specified glazing sealants of 5 to 10 psi compression strength (25% deflection) as recommended by sealant manufacturers for use in glazing channel to prevent sealant exudation from channel.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Glazier must examine framing and substrate work to receive glass and glazing materials and conditions under which glass is to be installed, and notify the General Contractor, in writing, of conditions detrimental to proper completion of the work. Do not proceed with glazing until unsatisfactory conditions have been corrected in a manner acceptable to Glazier.

3.02 PERFORMANCE REQUIREMENTS:

- A. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes wind loading, and impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.
- B. Protect glass from edge damage during handling, installation and operation of building systems/equipment. Glass breakage during warranty period is a form of faulty material or workmanship (resulting from edge damage) unless known to result from vandalism or other causes not related to materials and workmanship.
- C. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on glass, minimum edge clearance, and adequate sealant thickness with reasonable tolerances. Glazier is responsible for correct glass size for each opening within tolerances and necessary dimensions established.

3.03 INSTALLATION

A. General and Standards:

1. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturers' technical representatives direct otherwise.
2. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, drawn, and bow oriented in the same direction as other pieces.
3. Inspect each piece of glass immediately before installation and eliminate pieces which have observable edge damage or face imperfections.
4. Do not attempt to cut, seam, nip or abrade glass which is tempered, heat strengthened, or coated.
5. Comply with applicable publications by Flat Glass Marketing Association, except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.

B. Preparation of Substrate:

1. Clean the glazing channel or other framing member to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces where elastomeric sealants are used.
2. Apply primer or sealer to joint surfaces where recommended by sealant manufacturer.

C. Sealant/Compound Glazing:

1. Install setting blocks of proper size in sill rabbet, locate at one-fourth of glass width measured from each jamb. Set blocks in thin course of the heel bead compound if heel bead is to be installed.

2. Provide spacers inside and out, and of proper size and spacing for glass sizes larger than 50 united inches, except where pre-shimmed tape or gaskets are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with butyl rubber sealant tape use thickness 1/32" less than final compressed thickness of tape.
3. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in channels at heel of jambs and heads (do not leave voids in sill channels), except as otherwise indicated. In general, voids or filler rods are required for insulating glass and for laminated glass larger than 75 united inches, and for other glass more than 9/32" thick or larger than 120 united inches.
4. Force sealants into channel to eliminate air pockets and voids (other than expansion voids), and to ensure complete "wetting" and bond of sealant to glass and channel surfaces.
5. Tool exposed surfaces of glazing sealants and compounds to provide a substantial "wash" away from glass.
6. When installing processed glass, exercise extraordinary care to avoid contact of glazing materials with processed surfaces, except where concealed in glazing channel. Use masking tape to ensure limitation of compounds to channel area.
7. Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.

D. Gaskets and Tapes:

1. Miter cut and bond ends together at corners where gaskets are used for channel glazing so that gaskets will not pull away from corners and result in voids or leaks in glazing system.
2. Install pressurized tapes and gaskets to protrude slightly out of channel so as to eliminate dirt and moisture pockets. Trim to straight line as required.

3.04 CURE AND PROTECTION:

- A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.
- B. Glazier shall advise the General Contractor of procedures required for protection of glass and glazing sealants and compounds during construction period so that they will be without deterioration or damage (other than normal weathering) at time of Owner's acceptance.
 - 1. Furnish specific instruction to the General Contractor on precautions and provisions required to prevent glass damage resulting from the alkaline wash from green concrete surfaces and similar sources of possible damage.
 - 2. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including pieces damaged through natural causes, accidents and vandalism.

3.05 CLEANING GLASS:

- A. Maintain glass in a reasonably clean condition during construction so that it will not be damaged by corrosive or erosive action and will not contribute (by wash-off) to deterioration of glazing materials and other work.
 - 1. Clean glass in accordance with manufacturer's recommendations. Do not use abrasive materials. On glass, do not use broken razor blades for cleaning.
- B. Wash and polish glass on both faces not more than 4 days prior to Owner's acceptance of the work in each area. Comply with glass manufacturer's recommendations.

END OF SECTION 08800

SECTION 08810 - FIRE-RATED GLASS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-rated glazing (FireLite Plus, Pyran Platinum F, Pyran Star F) materials installed as vision lights in fire-rated doors.

B. Related Sections include the following:

1. Section 08210 - Wood Doors.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
2. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

B. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

C. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.

D. Glass Association of North America (GANA):

1. GANA - Glazing Manual.
2. FGMA - Sealant Manual.

E. National Fire Protection Association (NFPA):

1. NFPA 80: Fire Doors and Windows.
2. NFPA 252: Fire Tests of Door Assemblies.

- F. Underwriters Laboratories, Inc. (UL):
 - 1. UL 10N: Fire tests of Door Assemblies.
 - 2. UL10C: Positive Pressure Fire Tests of Door Assemblies.

- G. 2015 Michigan Building Code.

1.3 PERFORMANCE REQUIREMENTS

- A. FireLite Plus, Pyran Platinum F, Pyran Star F
 - 1. Fire-rated glass ceramic laminated, clear and wireless glazing material for use in impact safety rated locations such as doors with fire rating requirements ranging from 20 minutes to 3 hours with required hose stream test.

1.4 SUBMITTALS

- A. Comply with requirements of Section 01340 "Shop Drawings, Product Data & Samples".

- B. Product data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.

- B. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

- C. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.

- D. Samples: Submit, for verification purposes, approx. 8-inch by 10-inch sample for each type of glass indicated.

1.5 QUALITY ASSURANCE

- A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.
- B. Fire Resistance Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire resistive assemblies.
- C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E-2074-00 and UL10B, labeled and listed by UL.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle materials under provisions of Division 1.
- B. Deliver materials to specified destination in manufacturer or distributor's packaging, undamaged, complete with installation instructions.
- C. Store off ground, under cover, protected from weather and construction activities.
- D. Do not expose Pilkington Pyrostop™ or equal to temperatures greater than 120 degrees or less than minimum 40 degrees F during storage and transportation.
 - 1. Do not expose the non-PVB side of glass to UV light.
 - 2. Store sheets of glass vertically. DO NOT lean.

1.7 WARRANTY

- A. Provide manufacturer's limited warranty under provision of Division 1.
- B. Warranty period: Five years from date of substantial completion.

PART 2 - PRODUCTS

2.1 FIRE-RATED GLAZING MATERIALS

- A. FireLite Plus: as manufactured by the Nippon Electric Glass Company, LTD and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065, voice 1-800-426-0279, fax 1-800-451-9857, e-mail sales@fireglass.com, Web site www.fireglass.com.
1. Properties:
 - a. Thickness: 5/16".
 - b. Weight: 4 lbs. /s.f.
 - c. Approximate Visible Transmission: 85% +/-.
 - d. Fire-rating: Provide ratings as indicated on drawings.
 - e. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
 - f. STC Rating: 35 dB +/-.
 2. Maximum sheet sizes based on surface finish:
 - a. Premium: 48 inches by 96 inches.
 3. Permanently label each piece of FireLite Plus FireLite Logo, UL Logo and Fire rating in sizes up to 3,325 square inches and with the FireLite label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).
 4. Fire Rating - Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00, NFPA 252, UL 10B and UL10C.
 5. Substitutions: Equal products by the following manufacturers will be considered:
 - a. Pyran Platinum F by Safti as manufactured by O'Keefee's, Inc. Voice 1.888.653.3333, Web site <http://www.safti.com>.
 - b. Pyran Star F by Interedge Technologies, Web site <http://www.firesafe-glass.com>.

2.2 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

- A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, FireLite Plus glass panels that exceed 1,393 square inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by the manufacturer.
- B. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:
 - 1. Dow Corning 795 - Dow Corning Corp.
 - 2. Silglaze-II 2800 - General Electric Co.
 - 3. Spectrem 2 - Tremco Inc.
- C. Setting Blocks:
 - 1. FireLite Plus:
 - a. Neoprene, EPDM or Silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.
- D. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.3 FABRICATION

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Minimum required face or edge clearances.
 - 3. Observable edge damage or face imperfections.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.
- C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.2 INSTALLATION (GLAZING)

- A. FireLite Plus
 - 1. Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
 - 2. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
 - 3. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
 - 4. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
 - 5. Place setting blocks located at quarter points of glass with edge block no more than 6-inches from corners.

6. Glaze vertically into labeled fire-rated metal frames or partition walls with the same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
7. Place glazing tape on free perimeter of glazing in same manner described above.
8. Install removable stop and secure without displacement of tape.
9. Install in vision panels in fire-rated doors to requirements of NFPA 80.
10. Install so that appropriate UL and FireLite Plus markings remain permanently visible.

3.3 PROTECTION AND CLEANING

- A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.
- B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

END OF SECTION 08810

SECTION 09250 - GYPSUM DRYWALL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

- A. Extent of each type of gypsum drywall construction required is indicated on Drawings.
- B. This Section includes the following types of gypsum board construction:
 - 1. Steel framing members to receive gypsum board.
 - 2. Gypsum board screw-attached to steel framing and furring members.

1.3 DEFINITIONS:

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA 505 for definitions of terms for gypsum board construction not otherwise defined in this section or other referenced standards.

1.4 SUBMITTALS:

- A. Product data from manufacturers for each type of product specified.

1.5 QUALITY ASSURANCE:

- A. Fire-Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies whose fire resistance rating has been determined per ASTM E 119 by a testing and inspecting organization acceptable to authorities having jurisdiction.
 - 1. Provide fire-resistance-rated assemblies identical to those indicated by reference to GA File No's. in GA-600 "Fire Resistance Design Manual" or to design designations in U.L. "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction.

- B. Single Source Responsibility: Obtain each type of gypsum board and related joint treatment materials from a single manufacturer.
- C. All gypsum board drywall and associated materials shall be manufactured domestically in the United States, by a United States Company and shall conform to ASTM Standards listed herein. Gypsum board drywall and associated materials shall not be imported, rebranded or distributed from another country.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.7 PROJECT CONDITIONS:

- A. Environmental Conditions, General: Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.
- B. Minimum Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously thereafter until drying is complete.
- C. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Steel Framing and Furring:
 - a. Clark Dietrich Framing.
 - b. Jaimes Industries, Inc.
 - c. Marino/Ware, Division of Ware Industries
 - 2. Gypsum Boards and Related Products:
 - a. Gold Bond Building Products Div., National Gypsum Co.
 - b. Georgia Pacific
 - c. Certainteed
 - d. United States Gypsum

2.2 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS:

- A. General: Provide components which comply with ASTM C 754 for materials and sizes, unless otherwise indicated.
- B. Concrete Inserts: Inserts designed for attachment to concrete forms and for embedment in concrete, fabricated from corrosion-resistant materials, with holes or loops for attachment of hanger wires and capability to sustain, without failure, a load equal to 3 times that imposed by ceiling construction, as determined from testing per ASTM E 488, conducted by an independent testing laboratory.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
- D. Channels: Cold-rolled steel, 0.0598 inch minimum thickness of base (uncoated) metal and 7/16 inch wide flanges, protected with rust-inhibitive paint, and as follows:
 - 1. Carrying Channels: 1-1/2 inch deep, 475 lbs per 1000 ft., unless otherwise indicated.
 - 2. Furring Channels: 3/4 inch deep, 300 lbs per 1000 ft., unless otherwise indicated.
- E. Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90 deg and doubled over to form 3/16 inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:

1. Thickness: 0.0329 inch, unless otherwise indicated.
 2. Depth: 3-5/8 inches, unless otherwise indicated.
- F. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 1-1/2 inches, and minimum thickness of base (uncoated) metal as follows:
1. Thickness: 0.0329 inch, unless otherwise indicated.
- G. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C 645 for material, finish and widths of face and fastening flange, fabricated to form 1/2 inch deep channel of the following configuration:
1. Single-Leg Configuration: Assymetric-shaped channel with face connected to a single flange by a single slotted leg (web).
- H. Grid Suspension System: ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.

2.3 STEEL FRAMING FOR WALLS AND PARTITIONS:

- A. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16" minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
1. Thickness: 0.0329 inch where indicated.
 2. Depth: 3-5/8 inches, unless otherwise indicated.
- B. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:
1. Depth: 1-1/2 inches. (7/8" where noted)
 2. Thickness: 0.0329 inch, unless otherwise indicated.
- C. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, minimum thickness of base (uncoated) metal of 0.0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

D. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C 645 for base metal, finish and widths of face and fastening flange, fabricated to form 1/2 inch deep channel of the following configuration:

1. Single-Leg Configuration: Assymetric-shaped channel with face connected to a single flange by a single slotted leg (web).

E. Fasteners: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum drywall manufacturers for applications indicated.

2.4 GYPSUM BOARD:

A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end joints.

1. Thickness: Provide gypsum board in thicknesses indicated, or if not otherwise indicated, in either 1/2 inch or 5/8 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.

B. Gypsum Wallboard: ASTM C1396, and as follows:

1. Type: Regular, unless otherwise indicated.

2. Type: Foil-backed where indicated.

3. Type: Type X for fire-resistance-rated assemblies.

4. Edges: Tapered.

5. Thickness: 5/8 inch.

6. Products: Subject to compliance with requirements, provide one of the following products where Type X gypsum wallboard is indicated:

a. "Fire-Shield G"; Gold Bond Building Products Div., National Gypsum Co.

b. "SHEETROCK Brand FIRECODE 'C' Gypsum Panels"; United States Gypsum Co.

c. Type X gypsum board - Certainteed

d. Tough Rock Fireguard X gypsum board - Georgia Pacific

2.5 TRIM ACCESSORIES:

- A. Cornerbead and Edge Trim for Interior Installation: Provide corner beads, edge trim and control joints which comply with ASTM C 1047 and requirements indicated below:
 - 1. Material: Formed metal, plastic or metal combined with paper, with metal complying with the following requirement:
 - b. Sheet steel zinc-coated by hot-dip process.
 - 2. Edge trim shapes indicated below by reference to designations of Fig. 1 in ASTM C 1047:
 - a. "LC" Bead, unless otherwise indicated.
 - b. "L" Bead where indicated.
 - c. "U" Bead where indicated.
 - 3. One-Piece Control Joint: Formed with vee-shaped slot per Fig. 1 in ASTM C 1047, with slot opening covered with removable strip.
- C. All exterior gypsum corners, shall have a cover guard. Provide surface mount stainless steel corner guard 3-1/2" x 3-1/2" x 8'-0" (Clemens Center), 90 degrees in type 304 satin finish, 16 gauge, cement on, as manufactured by Inpro 1-800-222-5556.

2.6 GYPSUM BOARD JOINT TREATMENT MATERIALS:

- A. General: Provide materials complying with ASTM C 475, ASTM C 840, and recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.
- B. Joint Tape: Paper reinforcing tape, unless otherwise indicated.
 - 1. Use pressure sensitive or staple-attached open-weave glass fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.
- C. Setting-Type Joint Compounds: Factory-prepackaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

1. Where setting-type joint compounds are indicated for use as taping and topping compounds, use formulation for each which develops greatest bond strength and crack resistance and is compatible with other joint compounds applied over it.
 2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
 3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer for this purpose.
- D. Drying-Type Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements for formulation and intended use.
1. Ready-Mix Formulation: Factory-premixed product.
 2. All-purpose compound formulated for use as both taping and topping compound.

2.7 MISCELLANEOUS MATERIALS:

- A. General: Provide auxiliary materials for gypsum drywall construction which comply with referenced standards and the recommendations of the manufacturer of the gypsum board.
- B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum boards.
- C. Spot Grout: ASTM C 475, setting-type joint compound of type recommended for spot grouting hollow metal door frames.
- D. Fastening Adhesive for Wood: ASTM C 557.
- E. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum boards to steel framing.
- F. Gypsum Board Screws: ASTM C 1002.
- G. Gypsum Board Nails: ASTM C 514.
- H. Concealed Acoustical Sealant: Nondrying, nonhardening, nonskinning, nonstaining, nonbleeding, gunnable sealant complying with requirement specified in Division-7 section "Joint Sealers."

- I. Sound Attenuation Blankets: Unfaced mineral fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C665 for Type I with class 0 flame spread and smoke developed per ASTM E84 and as follows:
 1. Mineral Fiber Type: Fibers manufactured from glass.
 2. Use in all partitions (whether or not indicated on drawings).
 3. Equal to Owens Corning thermafiber sound attenuation fire blankets (SAFB) - 2.5 lbs/cu. ft.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine substrates to which drywall construction attaches or abuts, preset hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of drywall construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF STEEL FRAMING, GENERAL:

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.
- C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below to comply with details shown on Drawings:
 1. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.
 2. Where partition and wall framing abuts overhead structure.

- c. Provide slip or cushioned type joints as detailed to attain lateral support and avoid axial loading.
- D. Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members or as indicated.

3.3 INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS:

- A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other construction.
 - 1. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surface do not vary more than 1/8 inch from plane of faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
- D. Terminate partition framing at suspended ceilings only where specifically indicated.
- E. Install steel studs and furring in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.
 - 1. For single layer construction: 16 inches on center.
- F. Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction opposite to that of the flange.
- G. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- H. Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

3.4 APPLICATION AND FINISHING OF GYPSUM BOARD, GENERAL:

- A. Install abuse resistant gypsum board (VH1) typical where indicated on drawings.
- B. Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C 840.
- C. Install sound attenuation blankets prior to gypsum board unless readily installed after board has been installed.
- D. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.
- E. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.
- F. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
- G. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.
- H. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

- I. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.
- J. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
- K. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide. Apply spot grout at each jamb anchor clip just before inserting board into frame.
- L. Form control joints and expansion joints at locations indicated, with space between edges of boards, prepared to receive trim accessories.
- M. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are braced internally.
 - 1. Except where concealed application is indicated or required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, and may be limited to not less than 75 percent of full coverage.
 - 2. Fit gypsum board around ducts, pipes, and conduits.
- N. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch to 1/2 inch space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant.
- O. At all drywall partitions, seal construction at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim, and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.
- P. Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.5 METHODS OF GYPSUM BOARD APPLICATION:

- A. Single-Layer Application: Install gypsum wallboard as follows:
 - 1. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths which will minimize end joints.
 - 2. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular to framing); use maximum length sheets possible to minimize end joints.
- B. Double-Layer Application: Install gypsum backing board for base layer and gypsum wallboard for face layer.
 - 1. On partitions/walls apply base layer and face layers vertically (parallel to framing) with joints of base layer over supports and face layer joints offset at least 10 inches with base layer joints.
- C. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:
 - 1. Fasten with screws.
- D. Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:
 - 1. Fasten both base layers and face layers separately to supports with screws.
- E. Direct-Bonding to Substrate: Where gypsum board is indicated to be directly adhered to a substrate (other than studs, joists, furring members or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum board until fastening adhesive has set.

3.6 INSTALLATION OF DRYWALL TRIM ACCESSORIES:

- A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.
- B. Install corner beads at external corners.

- C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where "U" bead (semi-finishing type) is indicated.
 - 1. Install "LC" bead where drywall construction is tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 - 2. Install "L" bead where edge trim can only be installed after gypsum board is installed.
 - 3. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).
- D. Install plastic edge trim where indicated on wall panels at juncture with ceilings.
- E. Install control joints at locations indicated, or if not indicated, at spacings and locations required by referenced gypsum board application and finish standard, and approved by the Architect for visual effect.

3.7 FINISHING OF DRYWALL:

- A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.
- B. Prefill open joints and rounded or beveled edges, if any, using setting-type joint compound.
- C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.
- D. Finish interior gypsum wallboard to level indicated below and according to ASTM C840 by applying the following joint compounds in 3 coats (not including prefill of openings in base), and sand between coats and after last coat:
 - 1. Provide a Level 5 gypsum board finish at all gypsum board locations, unless noted otherwise.

- E. Partial Finishing: Omit third coat and sanding on concealed drywall construction which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

3.8 PROTECTION:

- A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction being without damage or deterioration at time of Substantial Completion.

END OF SECTION 09250

SECTION 09510 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of acoustical panel ceiling is shown on the drawings and in schedules.

1.03 QUALITY ASSURANCE:

- A. The installation of acoustical panel ceilings is to be by an experienced installation firm which is acceptable to the manufacturer of the acoustical units, as shown by current written statement from the manufacturer.
- B. Standard for Terminology and Performance: Applicable publications by the Acoustical and Insulating Materials Association (AIMA), including "Performance Data, Architectural Acoustical Materials."
- C. Fire Hazard Classification: UL tested, listed and labeled as Class 0.25.

1.04 SUBMITTALS:

- A. Product Data:
 - 1. For information only, submit PDF copy of manufacturer's product specifications and installation instructions for each acoustical panel ceiling material required, and for suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications. Distribute one additional copy of each installation instruction to the Installer.
 - a. Include manufacturer's recommendations for cleaning and refinishing acoustical panel, including precautions against materials and methods which may be detrimental to finishes and acoustical performance.

1.05 SAMPLES

1. Submit (3) three sets of 12" square Samples for each acoustical panel required. In each set of samples show the full range of exposed color and texture to be expected in the completed work. Sample submittal and Architect's review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of the Installer.
2. Submit (3) three, 12" long samples of exposed runner and molding. Architect's review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of the Installer.

C. Maintenance Stock:

1. At the time of completing the installation, deliver stock of maintenance materials to the Owner. Furnish full size units matching the units installed, packaged with protective covering for storage and identified with appropriate labels. Furnish an amount equal to 5.0% of the amount installed.

1.06 JOB CONDITIONS:

- A. Space Enclosures: Do not install until interior acoustical panel ceilings unit space has been enclosed and is weather-tight, and until wet work in the space has been completed and is nominally dry and until work above ceilings has been completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.01 CEILING UNITS:

- A. Acoustical Panels: Clemens Center
 1. Provide 2 x 4 fiberglass units with a scrubbable vinyl film facing (UV protected), not less than 5/8" thick. NRC min. 0.70, CAC n/a, light reflectance min. 0.71.

2. Acceptable Products:
 - a. Armstrong Item No. 2910 perforated "Random Fissured".
 - b. CertainTeed: Item No. 1530-VINP-1 "Versatone White Vintage Perforated".
 - c. USG: Item No. 7055G "Premier Hi-lite ClimaPlus"- "Kapok".
3. Install in 15/16" exposed tee grid.

2.03 CEILING SUSPENSION MATERIALS:

- A. General: Comply with ASTM C 635, as applicable to an intermediate duty suspension system. Coordinate with other work supported by or penetrating through the ceilings, including light fixtures and HVAC equipment.
- B. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung.
 1. Hanger Wires: Galvanized carbon steel, ASTM A 641, soft temper, prestretched, yield-stress load of at least 3 times design load but not less than 12 USWG.
- C. Exposed Suspension System: Exposed systems compatible with tiles specified and as follows:
 1. 15/16" Systems
 - a. Armstrong - 15/16" Prelude XL exposed tee grid.
 - b. CertainTeed - 15/16" Classic Aluminum Capped Stab System.
 - c. Donn - DX24 System; USG Interiors
 - d. Chicago Metallic Corp: 1200 System.
- D. Edge Moldings: Manufacturer's standard channel molding for grid type used for edges and penetrations of ceiling, with a single flange of molding exposed, finish to match grid.

2.04 MISCELLANEOUS MATERIALS:

- A. Acoustical Sealant: A heavy-bodied, non-shrinking, non-drying, non-sag grade mastic compound intended for interior sealing of concealed construction joints.
- B. Tile Cement: As recommended by tile manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION WORK:

- A. Installer must examine the conditions under which the acoustical ceiling work is to be performed and notify the General Contractor, in writing, of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid the use of less-than-half widths units at borders, and comply with reflected ceiling plans wherever possible.

3.02 INSTALLATION:

- A. General: Install material in accordance with manufacturer's printed instructions and comply with governing regulations as indicated, and industry standards applicable to the work.
- B. Install suspension systems to comply with ASTM C 636 with hangers supported only from building structural members as indicated. Locate hangers near each end and spaced 4' - 0' along direct-hung runners, unless otherwise indicated.
 - 1. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for the substrate, and which will not deteriorate or fail with age or elevated temperatures.
- C. Install edge moldings at edges of each acoustical ceiling area and at locations where edge of units would otherwise be exposed after completion of the work, except where adhesively applied.
 - 1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed pm back of vertical leg before fastening to vertical surface.
 - 2. Secure moldings to building construction by fastening with screw-anchors into the substrate through holes drilled in not more than 16" o.c. along each molding.

3. Level moldings with ceiling suspension system to level tolerance of 1/8" in 12' - 0".
 4. Miter corners of moldings accurately to provide hair-line joints, securely connected to prevent dislocation.
- D. Cope exposed flanges of intersection suspension system members so that flange faces will be flush (cope flange of member supported by other member) except as otherwise indicated.
- E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at penetrations.
- F. Install edge trim moldings where indicated and elsewhere as needed to conceal edges of acoustical units which would otherwise be exposed to view after completion of the work. Anchor with fasteners, or if not possible, secure in place with permanent adhesive.

3.03 CLEANING AND PROTECTION:

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and required to permanently eliminate evidence of damage.
- B. The Installer shall advise the General Contractor of required protection for the acoustical panel ceilings, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 09510

SECTION 09650 - RESILIENT FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of resilient flooring and accessories is shown on the drawings and in schedule indicated as "LVT" for "Luxury Vinyl Tile Floor".

1.03 QUALITY ASSURANCE:

- A. Wherever possible, provide resilient flooring and accessories produced by a single manufacturer.
- B. Fire Test Performance: Provide resilient flooring which complies with the following fire test performance criteria as determined by an independent testing laboratory acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux (CRF): Not less than 0.45 watts per sq. cm. per ASTM E 648.
 - 2. Flame Spread: Not more than 75 per ASTM E 84.
 - 3. Smoke Developed: Not more than 450 per ASTM E 84.
 - 4. Smoke Density: Not more than 450 per ASTM E 662.

1.04 SUBMITTALS:

- A. Product Data:
 - 1. For information only, submit PDF copy of manufacturer's technical data and installation instructions for each type of resilient flooring and accessory. Transmit a copy of each installation instruction to the Installer.

B. Samples:

1. Submit (3) three sets of samples of each type, color and finish of resilient flooring and accessory required. Provide full-size tile units and 6" long sample of accessory. Include full range of flooring color and pattern variation. Sample submittals will be reviewed for color, texture and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Maintenance:

1. Submit PDF copy of manufacturer's written instructions for recommended maintenance practices for each type of resilient flooring and accessories.

1.05 JOB CONDITIONS:

- A. Continuously heat areas to receive flooring to 70 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required. Maintain 70 degrees F. temperature continuously during and after installation, as recommended by flooring manufacturer, but for not less than 48 hours.

1.06 EXTRA STOCK

- A. Deliver to the Owner, for use in future modifications, an extra stock of approximately 10% (min. one carton) of each color and pattern in each material installed under this Section, packaging each type of material separately, distinctly marked, and adequately protected against deterioration.

PART 2 - PRODUCTS

2.01 TILE FLOORING: (LVT Flooring)

- A. Mannington Commercial Amtico Signature Collection/Wood:
(Basis of Design)
 1. Sizes: 6" x 36"
 2. Thickness: 0.098"
 3. Finish: Non-ortho phthalate
 4. Edge Treatment: Micro bevel or unbeveled
 5. Static Load: ASTM F970-passes, 2000 psi, residual indent \leq 0.005"
 6. Slip Resistance: ASTM C1028: passes \geq 0.5 leather, 0.6 rubber

7. 25 year limited commercial wear warranty
8. Recyclability: Contains 3% rapidly renewable resource content
9. Wear Layer: 40 mil (quantum guard elite)
10. Contact: Aaron Brown 734-853-7390
11. ASTM F1700 Class III, Type 'B'.
12. Size: Lay 6" x 36" planks in a staggered patten with arrows in same direction.
13. Color: To be selected by Architect.
14. Adhesive: Antico RP-18 full spread, one component.

2.02 ACCESSORIES:

A. Resilient Base:

1. Provide vinyl base (Johnsonite vinyl wall base CB) complying with ASTM F-1861, Type TV, Group 1 (solid) in all areas except Admin. Areas and Media Center unless noted otherwise, as follows:
 - a. Height: 4" - refer to drawings for locations.
 - b. Thickness: 1/8"
 - c. Style: Standard top-set cove or straight type as indicated.
 - d. Provide with preformed inside and outside colors.
 - e. Provide with quarter round .5" high x .5" wide QTR-XX-A by Johnsonite at all interior door frames.
 - f. Install per manufacturers specs to maintain warranty.
 - g. Color: As selected by Architect.

B. Resilient Moulding/Reducer/Floor Finishing Accessories:

1. Provide vinyl nosings for resilient floor covering reducer strip for resilient floor covering, joiner for tile and carpet, or at junction between two dissimilar materials (new/new or new/existing), where shown on drawings and/or required.
 - a. Provide accessories as manufactured by Johnsonite, as follows:
 1. Carpet to LVT: CTA-XX-D
 2. Painted or sealed concrete to LVT: EG-XXJ 3/16" to floor
 - b. Color to be determined by Architect from manufacturer's standard colors.
 - c. Install per manufacturer's standard specifications to maintain warranty.

- C. Adhesives (cements): As recommended by flooring contractor to suit material and substrate conditions.
- D. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the areas and conditions under which resilient flooring and accessories are to be installed and notify the General Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION:

- A. Prior to laying flooring, broom clean or vacuum surfaces to be covered and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.
 - 1. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.
 - 2. Perform moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured and ready to receive flooring.
 - 3. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.03 INSTALLATION:

- A. General:
 - 1. Install flooring after finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature, and relative humidity must be within limits recommended by flooring manufacturer.

2. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces, thresholds, nosing and edgings. Scribe around obstructions and produce neat joints, laid tight, even and straight. Extend flooring into toe spaces, door reveals and into closets and similar openings.
3. Maintain reference markers, holes or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.
4. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. Tightly cement edges to perimeter of floor around covers and to covers.
5. Tightly cement flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks or other surface imperfections.

B. Tile Floors:

1. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.
2. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly to around all fixtures. Broken, cracked, chipped or deformed tile are not acceptable.

C. Accessories:

1. Apply resilient base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in as long lengths as practicable, with preformed corner units or fabricated from base materials with mitered or coped inside corners. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.
 - a. On masonry surfaces or other similar irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

2. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at all unprotected edges of flooring, unless otherwise shown.
3. Apply resilient accessories as indicated and in strict conformance to manufacturer's installation instructions.

3.04 CLEANING AND PROTECTION:

- A. Remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by flooring manufacturer. Protect installed flooring from damage by covering.
- B. Finishing: After completion of project and just prior to final inspection of work, thoroughly clean floors and accessories.
- C. Apply sealer/polish as recommended by LVT manufacturer. Apply per manufacturers specifications (min. 3-4 coats of floor finish).

END OF SECTION 09650

SECTION 09680 - CARPETING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Carpet Squares (Modular carpet)

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.02 SUBMITTALS

- A. Shop Drawings showing the extent of carpet, installation pattern of carpet, and accessories shall be submitted to Architect for approval prior to installation. Check pattern match, if any, for matching during installation and possible waste factors in ordering required amounts. Should also indicate columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet. Copy of approved shop drawings to be available on job site during installation.
- B. Carpet schedule using same room designations indicated on drawings.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics, sizes, patterns, colors available, and method of installation.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial color selection.
- E. Verification Samples: Submit two 18" x 18" samples illustrating color and pattern for each carpet material specified.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

- G. Maintenance Data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.
- H. Manufacturer's Carpet Warranty.
- I. Certification of Recycled Content and verification of reclamation and recycling program.
- J. Certifications: Manufacturer to submit copies of the following independent laboratory reports showing compliance with requirements per these methods outlined in Part 2 of this document. Submitted results shall represent average results for production goods of the specified style.
 - 1. ASTM E-648 Flooring Radiant Panel- Class 1 (mean avg CRF: 0.45w/sq cm or higher
 - 2. ASTM E-662: Smoke Density
 - 3. AATCC 134: Electrostatic Propensity - 3.0 kv or lower-permanent conductive fiber
 - 4. CRI TM-102: Fluorine Analysis - min 500 ppm after two AATCC 171: min. 400 ppm
 - 5. ASTM D-3936: Delamination

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications
 - 1. Company specializing in manufacturing specified carpet with minimum 10 years documented experience.
 - 2. Upon request, manufacturer to provide representative to assist in project start-up and to inspect installation while in process and upon completion. Representative will notify designated contact if any installation instructions are not followed.
 - 3. Single Source Responsibility: Obtain each type of carpet from one source and by a single manufacturer.
- B. Installer Qualifications
 - 1. Flooring contractor must be certified by the carpet manufacturer prior to bid.

2. Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of these types of materials.
3. Flooring contractor possessing Contract for the carpet installation shall not sub-contract the labor without written approval of the Project Manager.
4. Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the carpet manufacturer and JOB CONDITIONS herein.
5. Flooring contractor to provide Owner a written installation warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of one year after job completion.

1.04 DELIVERY, STORAGE, & HANDLING

- A. Deliver materials to the site in manufacturer's original packaging listing manufacturer's name, product name, identification number, and related information.
- B. Store in a dry location, between 60 degrees F and 80 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet rolls horizontally on a flat surface, stacked no higher than two rolls.
- C. Make stored materials available for inspection by the Owner's representative.
- D. Store materials in area of installation for minimum period of 48 hours prior to installation.

1.05 PROJECT CONDITIONS

- A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer's installation instructions.

- B. The maximum amount of moisture evacuation from the floor is 5.0 pounds per 1,000 square feet in 24 hours per ASTM F-1869.04. The acceptable pH level of the substrate is 9.0 or less as tested per ASTM F-710.05.. Flooring contractor is responsible for floor testing. Contractor shall perform min. (1) MVER and 2 RH be performed on the initial 1,000 s.f. for each project and one test between MVER & RH for each 1,000 s.f. for balance of project at each location/floor.
- C. All material used in sub-floor preparation and repair shall be recommended by the carpet manufacturer and shall be chemically and physically compatible with the carpet system being bid.
- D. Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.
- E. Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.06 EXTRA MATERIALS

- A. Provide additional 5% of each product per building/floor for attic stock.

PART 2 - PRODUCTS

2.01 PRODUCT RECYCLABILITY

- A. Product must meet FTC guides for recyclability and must be one hundred percent (100%) closed-loop recyclable back into carpet. Products containing both recyclable and non-recyclable components, manufacturer must adequately report which portions of the product are recyclable per FTC guides 16 CFR section 260.7(d). Note: A manufacturer cannot claim that a product or any portion of a product that is incinerated is recyclable, even if incineration is used to produce heat and power (i.e. waste-to-energy) per FTC guides 16 CFR section 260.7 (d) example 3.

- B. Recyclability of product installed must be the same as that claimed by manufacturer and required by Project requirements.

2.02 RECYCLING PROGRAM

- A. Manufacturer must have a collection and recovery system for product and a fully established, currently operational recycling program at time of bid per FTC guides Section 260.7 (d).
- B. Manufacturer must be able to reclaim and recycle 100% of existing carpet of similar composition back into carpet at time of bid.
- C. Manufacturer must have product a take back program and be able to reclaim and recycle 100% of installed product back into carpet at the end of its service life at time of bid. Claiming a product is recyclable based on future expectation of technology, equipment, process or availability of that product as feed stock is not acceptable. Recycling process must be available for viewing.
- D. Collection and recycling program must be verified by an independent, neutral third-party organization, such as Scientific Certification Systems.
- E. Manufacturer must have written guarantee that 100% of the recovered product will be recycled and that no portion of the product will be landfilled or incinerated (including waste-to-energy).

2.03 MANUFACTURER'S ENVIRONMENTAL COMMITMENT

- A. A manufacturer's environmental commitment will be reflected by its corporate culture and measured by the goals, policies and programs that have been instituted to improve the environmental performance of its operations. Evidence of this commitment must include:
 - 1. All products produced by the manufacturer must meet FTC guides for recyclability and be 100% recyclable in a fully established, currently operational recycling program 16 CFR section 260.7 (d).
 - 2. All products produced by the manufacturer, including recycled content products, must be 100% closed-loop recyclable back into carpet.

3. Manufacturer must show evidence of a positive and continuing improvement in source reduction and the reduction of energy, water, waste and air emissions.
4. Manufacturer must fully comply with FTC Part 260 "Guides for the Use of Environmental Marketing Claims," with respect to advertising, labeling, product inserts, catalogs and sales presentations of all its carpet products submitted and sold. Certification signed by an officer of the manufacturer stating the manufacturer complies with these guides maybe required for submittal upon request.

2.04 INDOOR AIR QUALITY

A. Product must have low VOC, factory applied, "dry" adhesive.

B. Product, inclusive of floor covering adhesive, must meet CRI's IAQ requirements for carpet only. Environmental chamber testing per ASTM D-5116. Emission Rates determined at 24 hours. Product, inclusive of pre-applied adhesive must off gas less than:

0.5 mg/sq. meter per hour of Total Volatile Organic Compound (TVOC);
0.05 mg/sq. meter per hour of formaldehyde;
0.4 mg/sq. meter per hour of styrene; and
0.05 mg/sq. meter per hour of 4-Phenyl Cyclohexene (4-PC)

1. Submit Indoor Air Quality report showing CRI Green label Certification Number for carpet (inclusive of adhesive). [If results for carpet testing are not inclusive of adhesive, submit separate IAQ test reports for carpet and adhesive].
2. Indoor air quality results of the product installed must be same as those specified by the Project requirements.
3. Additionally, product, inclusive of adhesive, must meet the requirements of the State of Washington Indoor Air Quality Specifications for Carpet at 24 hours. Environmental chamber testing per ASTM D-5116. Product must not require the 30-day air out period that the State of Washington protocol allows.

2.05 CARPET WARRANTY

- A. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.
- B. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.
- C. Chair pads are not required, but are recommended for optimum textural performance. Absent the use of chair pads, more intensive maintenance will be required for areas in direct contact with chair caster traffic, and some degree of appearance change is to be expected.
- D. Warranty shall be for a specifically defined non-prorated period of (25) twenty-five years. Lifetime" warranties are not acceptable. More intensive maintenance will be required for product installed on stairs, and some degree of appearance change is to be expected.
- E. Warranty shall not exclude carpet product installed on stairs provided it is properly installed and maintained.
- F. The non-prorated (25) twenty-five years warranty shall specifically warrant against :
 - 1. Excessive Surface Wear: More than 15% loss of pile fiber weight
 - 2. Excessive Static Electricity: More than 3.0 kV per AATCC 134
 - 3. Resiliency Loss of the Backing: More than 10% loss of backing resiliency
 - 4. Delamination
 - 5. Edge Ravel
 - 6. Zippering
- G. Tuft Bind warranty in lieu of edge ravel and zippering is not acceptable.

2.06 FIBER

- A. Nylon Fiber: Solution Dyed, Bulked Continuous Filament (BCF) Nylon Bulked Continuous Filament (BCF) Nylon in a loop pile construction. Cut pile is not acceptable.

- B. Report fiber type (i.e. EPP Certified Invista Antron, SAVANT, etc,)
- C. Report post consumer and post industrial recycled content of the pile face yarn in product based on weight i.e. [(Recycle Content in Pile Face Yarn) / (Total Weight of Pile Face Yarn) x 100]
- D. Fiber to contain carbon-core filament for permanent static control. Topical treatments are not acceptable.
- E. Durable stain inhibitor should be applied to the fiber during product manufacturing to resist fiber staining and soiling.
 - 1. Initial: Minimum 500 ppm Fluorine per CRI TM-102
 - 2. After two hot water extractions per AATCC 171: Minimum 400 ppm Fluorine per CRI TM-102

2.07 BACKING CHARACTERISTICS

- A. Primary Backing: Synthetic Non-Woven.
- B. Secondary Backing: ER3 100% recycled content
 - 1. Density (ASTM D-1667): Min. 65 lbs/cu ft +/- 5%
 - 2. Standard Size: 24" x 24" (18" x 36" where noted)
 - 3. Recycled content: 100% recycled content secondary backing.
 - 4. Fiberglass reinforced.
 - 5. Face yarn fully fused to secondary backing system that will not delaminate.
 - 6. Delamination: No delamination per ASTM D3936.
 - 7. Product must not contain pesticides (US EPA registered antimicrobials). Installation adhesives are exempt from this section.
- C. Adhesive System: RS
 - 1. Low VOC, factory applied "dry" adhesive applied to backing and cured during manufacturing
 - 2. Product as installed to be securely attached to the floor in compliance with Americans with Disabilities Act (ADA), Section 4.5.3.
 - 3.
- D. Product to provide asbestos enclosure properties.
Enclosure means an airtight, impermeable, permanent barrier around ACBM (Asbestos Containing Building Material) to prevent the release of asbestos fibers into the air.

2.08 PERFORMANCE CHARACTERISTICS

- A. Test reports for the following performance assurance testing to be submitted upon request.
Submitted results shall represent average results for production goods of the referenced style.
Requirements listed below must be met by all products.

1. Flooring Radiant Panel
ASTM E-648 / NFPA 253: Class 1 (CRF: 0.45 watts/sq cm or greater)
2. Federal Flammability
CPSC FF 1-70: Passes
3. Smoke Density
ASTM E-662 / NFPA 258: \leq 450 Flaming Mode
4. Electrostatic Propensity
AATCC 134 (Step & Scuff): 3.0 kV or less
5. Static Coefficient of Friction
ASTM C-1028: Passes ADA Requirements for Accessible Routes (minimum 0.60)
6. Delamination of Secondary Backing of Pile Floor Coverings
ASTM D-3936: No Delamination
7. Lightfastness
AATCC 16E: \geq 4 @ 100 hours
8. TARR
3.0 minimum
9. Dimension Stability
AACHEN/ISO 2551: maximum change =/- 0.149%
10. Other
As specified in 2.06 and 2.07 of this document

2.09 MANUFACTURING SPECIFICATIONS

A. Manufactured by C&A Floorcoverings

1. CPT:1-Clemens Center: Change II (style #03747) 24" x 24" flex aire modular
 - a. Construction: Stratatec patterned loop
 - b. Gauge: 5/64
 - c. Stitches per inch: 9.60/in
 - d. Pile Height Average: 0.187 inch
 - e. Fiber System: Dynex SD nylon with Static Control and Ensure
 - f. Dye Method: 100% solution dyed
 - g. Face Weight: 20 oz/sq yd
 - h. Product installation: 24" x 24" unidirectional modular installation
 - i. Color 10808 silver studio, quarter turn.

2.10 ACCESSORIES

- A. Materials recommended by Manufacturer for patching, priming, seam welding, etc.
- B. Adhesives: Products to be supplied with a low VOC, factory applied, "dry" adhesive for "peel and stick" installation.
- C. Base, Carpet Edge, and Transition Strips: As specified in applicable sections.

PART 3 EXECUTION

3.01 EXAMINATION / PREPARATION

- A. Prepare sub-floor to comply with criteria established in Manufacturer's installation instructions. Use only preparation materials that are acceptable to the Manufacturer.
 1. Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation(i.e. floor wax).
 2. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.

- B. Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.
- C. Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.
- D. Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.
- E. There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

3.02 INSTALLATION - GENERAL

- A. Install product in accordance with Manufacturer's installation instructions.
- B. Verify carpet match before cutting to ensure minimal variation between dye lots.
- C. Layout carpet in accordance with shop drawings.
- D. Install carpet tight and flat on sub-floor, well-fastened at edges, with a uniform appearance.
- E. Roll with appropriate roller for complete contact of carpet with mill-applied adhesive to sub-floor.
- F. Trim carpet neatly at walls and around interruptions.
- G. Completed carpet is to be smooth and free of bubbles, puckers, and other defects.

3.03 PROTECTION & CLEANING

- A. Remove excess adhesive and from floor and wall surfaces without damage.
- B. All rubbish, wrappings, debris, trimmings, etc. to be removed from site and recycled or disposed of properly.

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C. Clean and vacuum carpet surfaces using a beater brush/bar commercial vacuum.

D. After each area of carpet is installed, protect from soiling and damage by other trades.

END OF SECTION 09680

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.2 DESCRIPTION OF WORK:

- A. The extent of painting work is shown on the drawings and schedules, and as herein specified. (Note: Multiple colors, both field & accent colors will be used at each area or space)
 - 1. For painting of Clemens Center: Concrete floors, exterior steel. Both Projects: Exterior & interior HM frames & doors, refer to Spec Section 09970 "High Performance Coating".
- B. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise indicated.
- C. The work includes field painting of exposed bare and covered pipe and ducts (excluding color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise indicated.
- D. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
- E. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers and other applied materials, whether used as prime, intermediate or finish coats.

- F. Paint all exposed surfaces in areas designated "paint" in "schedules," except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint them the same as adjacent similar materials or areas.

1.3 PAINTING NOT INCLUDED:

- A. The following categories of work are not included as part of the field-applied finish work, or are included in other sections of these specifications:
1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal, hollow metal work, and similar items.
 2. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) metal toilet enclosures, acoustic materials, casework, finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets, but not light or power panels where exposed elevator entrance frames, doors and equipment.
 3. Concealed surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.
 4. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.

5. Operating Parts and Labels:

- a. Moving parts of operating units, mechanical and electrical parts such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting unless otherwise indicated.
- b. Do not paint over any code-required labels, such as Underwriters', Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

1.4 DELIVERY AND STORAGE:

- A. Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Name or title of material.
2. Fed. Spec. Number, if applicable.
3. Manufacturer's stock number and date of manufacturer.
4. Manufacturer's name.
5. Contents by volume, for major pigment and vehicle.
6. Constituents.
7. Thinning instructions.
8. Application instructions.
9. Color name and number.

1.5 JOB CONDITIONS:

- A. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.

- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.
- C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85% or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
 - 1. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 COLORS AND FINISHES:

- A. Prior to beginning work, the Architect will furnish color chips for surfaces to be painted. Colors will vary from wall to ceiling and from room to room. Final selection for gloss level will be by Architect and may not necessarily be the same as scheduled.
 - 1. Use representative colors when preparing samples for review.
 - 2. Final acceptance of colors will be from samples applied on the job.
- B. Color Pigments: Pure, non-fading, applicable types to suite the substrates and service indicated.
- C. Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the Architect in writing of

any anticipated problems using specified coating systems with substrates primed by others.

2.2 PAINT SYSTEMS:

- A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers, MPI #4.
 - 1. **PPG**; SPEEDHIDE® 6-7 Interior/Exterior Masonry Latex Block Filler.
 - 2. **Benjamin Moore**; Moore's IMC Latex Block Filler No. M88.
 - 3. AkzoNobel Paints (**ICI Paints**); Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filer.
 - 4. **Sherwin-Williams**; PrepRite Interior/Exterior Block Filler B25W25.

- B. Interior Masonry Primer Over Previously Painted Concrete Masonry Units: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application, MPI #50.
 - 1. **PPG**; 4-603 PERMA-CRETE Interior/Exterior Alkali Resistant Primer.
 - 2. **Benjamin Moore**; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253.
 - 3. AkzoNobel Paints (**ICI Paints**); 1000-1200 Ultra-Hide PVA Interior Primer-Sealer General Purpose Wall Primer.
 - 4. **Sherwin-Williams**; PrepRite Masonry Primer B28W300.

- C. Gypsum Board finish coat (Flat factory formulated acrylic latex system 1.4 mils DFT/coat) MPI #53
 - 1. **PPG**; SPEEDHIDE® interior wall flat latex 6-70
 - 2. **Benjamin Moore**; Moorcraft super spec latex flat 275
 - 3. **AkzoNobel Paints (ICI Paints)**; Dulux velvet matte flat professional
 - 4. **Sherwin-Williams**; ProMar 200 zero voc interior latex flat

- D. Gypsum Board finish coat (Semi gloss factory formulated acrylic latex system 1.1 mils DFT/coat) MPI #54
1. **PPG; SPEEDHIDE®** 6-500 interior semi-gloss
 2. **Benjamin Moore; Super spec latex semi-gloss**
 3. **AkzoNobel Paints (ICI Paints); Devflex 4216HP**
 4. **Sherwin-Williams; ProMar 200 interior latex semi-gloss B21W251 series**
- E. Gypsum Board finish coat (Factory formulated eggshell acrylic latex interior enamel system 1.5 mils DFT/coat) MPI #43
1. **PPG; SPEEDHIDE®** interior semi-gloss latex 80-510
 2. **Benjamin Moore; Regal interior 100% acrylic pearl finish**
 3. **AkzoNobel Paints (ICI Paints); Ultra hide low luster wall and trim paint 1433**
 4. **Sherwin-Williams; ProMar 200 interior latex semi-gloss**
- F. Interior Dryfall Paint: Factory formulated 100% acrylic latex, flash rust-resistant dryfall paint.
1. **PPG; SPEEDHIDE®** flat 6-713 series dryfall
 2. **Benjamin Moore; Sweep-up spray latex flat M53**
 3. **AkzoNobel Paints (ICI Paints); #1280 spray master pro uni-grip WB aquacrylic dryfall flat**
 4. **Sherwin-Williams; Waterborne acrylic dryfall B42W2-eg-shel**

2.3 WOOD

A. Painted Woodwork:

Two Coats of Interior Semi-Gloss Alkyd Enamel Over an alkyd Undercoater.

1. PPG Paints; 17-956 PPG Seal Grip® Interior Alkyd Enamel Undercoater
2. PPG Paints; 6-1110XI SPEEDHIDE Interior Wall and Trim Semi-Gloss Oil

B. Stained Woodwork:

Two Coats of Semi-Gloss Oil Polyurethane over an Oil based Stain and One Coat of Sanding Sealer.

1. PPG Paints; OLYMPIC 41570 Premium Interior Fast Dry Wood Stain Oil Based
2. PPG Paints; Deft DFT60 Interior Oil Based Sanding Sealer
3. PPG Paints; Deft DFT224 Interior Semi-Gloss Oil Polyurethane

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Applicator must examine the areas and conditions under which painting work is to be applied and notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Applicator.
- B. Starting of painting work will be construed as the Applicator's acceptance of the surfaces and conditions within any particular area.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.2 SURFACE PREPARATION:

- A. General:
 1. Perform preparation and cleaning procedure in strict accordance with the paint manufacturer's instructions and as herein specified for each particular substrate condition.

2. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.

B. Cementitious Materials:

1. Prepare cementitious surfaces to be painted by removing all efflorescence, chalk, dust, grease, oils, and by roughening as required to remove glaze conforming to SSPC13.
2. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where the moisture content exceeds that permitted by the manufacturer's printed directions.

C. Wood:

1. Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before

application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

2. Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling, etc.
3. When transparent finish is required, use spar varnish for backpriming.
4. Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

D. Ferrous Metals:

1. Clean ferrous surfaces, which are not galvanized or shop-coated of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning conforming to SSPC SP-1 and SSPC SP-2, SSPC-SP-3 or SSPC-SP7 NACE-No. 4 (brush off blast cleaning).

E. Galvanized Surfaces:

1. Clean free of oil and surface contaminants with an acceptable non-petroleum based solvent per SSPC SP-1.

3.3 MATERIALS PREPARATION:

- A. Mix and prepare painting materials in accordance with manufacturer's directions.
- B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

- C. Stir materials before application to produce a mixture of uniform density and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

3.4 APPLICATION:

A. General:

1. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the substrate and type of material being applied.
2. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
4. Paint interior surfaces of ducts where visible through registers or grilles with a flat, non-specular black paint.
5. Paint the back sides of access panels and removable or hinged covers to match the exposed surfaces.
6. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated.
7. Sand lightly between each succeeding enamel or varnish coat.

8. Omit the first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting:

1. Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness:

1. Apply each material at not less than the manufacturer's recommended spreading rate to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

D. Mechanical and Electrical Work:

1. Painting of mechanical and electrical work is limited to those items exposed in occupied spaces and includes all exterior exposed work.

E. Prime Coats:

1. Apply a prime coat of material which is required to be painted or finished, and which has not been prime coated by others.

2. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes:

1. Completely cover and provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

G. Transparent (Clear) Finishes:

1. Use multiple coats to produce glass-smooth surface film of each luster. Provide a finish free of laps, cloudiness, color, irregularity, runs, brush marks, orangpeel, nail holes, or other surface imperfections.
2. Provide satin finish for final coats, unless otherwise indicated.

H. Completed Work:

1. Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.5 CLEAN-UP AND PROTECTION:

A. Clean-up:

1. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

2. Upon completion of painting work, clean window glass and other paint- spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care no to scratch or otherwise damage finished surfaces.

B. Protection:

1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing and repainting, as acceptable to the Architect.
2. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
3. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION 09900

SECTION 09970 - HIGH PERFORMANCE COATING SYSTEMS

COATINGS PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Epoxy Coating systems for the Clemens Center: exterior steel, interior steel columns, HM frames. Note: Multiple colors will be used in individual areas.

1.2 REFERENCES

- A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer and Related Products.
- B. SSPC-SP 2 - Hand Tool Cleaning.
- C. SSPC-SP 3 - Power Tool Cleaning.
- D. SSPC-SP 6/NACE 3 - Commercial Blast Cleaning.
- E. SSPC-SP 11 - Power Tool Cleaning to bare metal.
- F. SSPC-SP 13/NACE 6 Surface Preparation of Concrete
- G. ICRI - Concrete Surface Preparation Standards

1.3 DEFINITIONS

- A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).
- C. Concrete Surface Standard (CSP): Standard for roughness of the surface profile of the concrete measured 1-9 with 9 being the roughest measured with a visual mold.

1.4 SUBMITTALS

- A. Comply with Section 01340 - "Shop Drawings, Product Data and Samples".
- B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation and application instructions.
- C. Color Samples: Submit manufacturer's color samples showing full range of standard colors.
- D. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
- E. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:
 - 1. Project name and location.
 - 2. Name of owner.
 - 3. Name of contractor.
 - 4. Name of architect.
 - 5. Name of coating manufacturer.
 - 6. Approximate area of coatings applied.
 - 7. Date of completion.
- F. Warranty: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Specialize in manufacture of coatings with a minimum of (10) years successful experience.
 - 2. Able to demonstrate successful performance on comparable projects.
 - 3. Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator's Qualifications:

1. Experienced in application of specified coatings for a minimum of (5) five years on projects of similar size and complexity to this Work.
2. Applicator's Personnel: Employ persons trained for application of specified coatings.

C. Preapplication Meeting: Convene a pre-application meeting (2) two weeks before start of application of coating systems. Require attendance of Construction Manager, Architect, applicator and manufacturer's representative. Review the following:

1. Environmental requirements.
2. Protection of surfaces not scheduled to be coated.
3. Surface preparation.
4. Application.
5. Repair.
6. Field quality control.
7. Cleaning.
8. Protection of coating systems.
9. One-year inspection.
10. Coordination with other work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Coating or material name.
2. Manufacturer.
3. Color name and number.
4. Batch or lot number.
5. Date of manufacture.
6. Mixing and thinning instructions.

B. Storage:

1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.
3. Do not use materials beyond manufacturer's shelf life limits.

- C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Weather:

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog or mist.
5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.

- B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

C. Dust and Contaminants:

1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. PPG High Performance Coatings, 23361 Telegraph Road, Southfield, MI 48034 Contact: Robert Zaleski, Phone: (734) 564-3105. Web Site: www.ppghpc.com
- B. Tnemec Company Incorporated, 6800 Corporate Drive, Kansas City, Missouri 64120-1372. Toll Free (800) 863-6321. Phone (816) 483-3400. Fax (816) 483-3969. Web Site www.tnemec.com. Contact: Trent McNutt, cell (419)346-8795 office (614) 850-8160

2.2 INTERIOR STEEL (METAL DOORS, HOLLOW METAL FRAMES,
GRILLES, ETC.)

A. Chemical Exposure, Physical Abuse:

1. System Type: Modified aromatic polyurethane/waterborne epoxy-amine adduct/ceramic modified waterborne aliphatic polyurethane.
2. Surface Preparation: SSPC-SP 2/3 hand/power tool cleaning.

PPG

1. Prime Coat: 97-145 PITT-GUARD Direct-to-Rust Epoxy Mastic at 4.0 to 7.0 DFT
2. Intermediate Coat: AQUAPON WB 98E-1 Epoxy at 2.0 to 3.0 mils DFT.
3. Finish Coat: AQUAPON WB 98E-1 Epoxy at 2.0 to 3.0 mils DFT.

Tnemec

1. Prime Coat: Tnemec Series V69 Hi-Build Epoxoline II at 4.0 to 6.0 mils DFT.
2. Finish Coat: Tnemec Series 1095 Endura-Shield at 2.5 to 5.0 mils DFT.

2.3 PAINTED EXTERIOR EXPOSED STEEL

A. Chemical Exposure, Physical Abuse:

1. System Type: Surface Tolerant High Solids Epoxy / Polyester Acrylic Polyurethane System.
2. Surface Preparation: SSPC-SP 2 hand tool cleaning/SSPC-SP-3 power tool cleaning.

PPG - Lockshield System

1. Prime Coat: PPG Amerlock 2 High Solids Epoxy Coating at 4.0 to 8.0 mils DFT.
2. Intermediate Coat: PPG Amerlock 2 High Solids Epoxy Coating at 4.0 to 8.0 mils DFT.
3. Finish Coat: PPG Amershield VOC Polyester Acrylic Polyurethane at 3.0 to 5.0 mils DFT.

Tnemec

1. Prime Coat: Tnemec Series 1 Omnithane at 2.0 to 3.0 mils DFT.
2. Intermediate Coat: Series V69 Hi-Build Epoxoline II at 4.0- 6.0 mils DFT
3. Finish Coat: Tnemec Series 1094 Endura-Shield at 2.0-5.0 mils DFT

2.4 PAINTED EXPOSED INTERIOR STRUCTURAL STEEL

A. Atmospheric, Chemical, or UV Exposure, Physical Abuse:

1. System Type: Zinc-Rich Urethane/Polyamide Epoxy/waterborne aliphatic polyurethane.
2. Surface Preparation: SSPC-SP6 commercial blast cleaning.

PPG

1. Shop Primer: Durethane MCZ-97-699 at 2.0 to 4.0 mils DFT.
2. Field Intermediate Coat: Amercoat 385-multi-purpose epoxy at 4.0 to 6.0 mils DFT.
3. Field Finish Coat: Pitthane Ultra Urethane, 95-8800 at 2.0 to 3.0 mils DFT.

Tnemec

1. Shop Primer: Tnemec Series ~~AK01~~ **AK02** Tnemec Shop Primer at 2.0 to 3.0 mils DFT.
2. Field Intermediate Coat: Tnemec Series ~~48~~ **V69 Hi-Build Epoxoline II** at 4.0 to 6.0 mils DFT.
3. Field Finish Coat: Tnemec Series 1095 Endura Shield at 2.0 to 5.0 mils DFT.

2.5 ACCESSORIES

A. Coating Application Accessories:

1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
2. Products of coating manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- #### A. Examine areas and conditions under which coating systems are to be applied. Notify the General Contractor in writing of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- #### A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.3 SURFACE PREPARATION OF STEEL

- A. Prepare steel surfaces in accordance with manufacturer's instructions.
- B. Fabrication Defects:
 - 1. Correct steel and fabrication defects revealed by surface preparation.
 - 2. Remove weld spatter and slag.
 - 3. Round sharp edges and corners of welds to a smooth contour.
 - 4. Smooth weld undercuts and recesses.
 - 5. Grind down porous welds to pinhole-free metal.
 - 6. Remove weld flux from surface.
- C. Ensure surfaces are dry.
- D. Interior Steel Surfaces, Moderate to Severe Exposure: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter in accordance with SSPC- SP6.
- E. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.
- F. Primer: Prepare field primer to receive field coat in accordance with manufacturer's instructions.

3.4 APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
- C. Keep containers closed when not in use to avoid contamination.

- D. Do not use mixed coatings beyond pot life limits.
- E. Use application equipment, tools, pressure settings and techniques in accordance with manufacturer's instructions.
- F. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- H. Stripe paint with brush critical locations on steel such as welds, corners and edges using specified primer.

3.5 REPAIR

- A. Materials and Surfaces Not Scheduled to Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture or color.
- C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.6 FIELD QUALITY CONTROL

- A. Inspector's Services:
 - 1. Verify coatings and other materials are as specified.
 - 2. Verify surface preparation and application are as specified.
 - 3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.

4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
 - a. Check for holidays on interior steel immersion surfaces using holiday detector.
5. Report:
 - a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
 - b. Report nonconforming work not corrected.
 - c. Submit copies of report to Architect, Owner's Representative and Construction Manager.

- B. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.7 CLEANING

- A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.8 PROTECTION OF COATING SYSTEMS

- A. Protect surfaces of coating systems from damage during construction.

3.9 ONE-YEAR INSPECTION

- A. Owner will set date for one-year inspection of coating systems.
- B. Inspection shall be attended by Owner, Contractor, Engineer/Architect and manufacturer's representative.
- C. Repair deficiencies in coating systems as determined by Architect in accordance with manufacturer's instructions.

END OF SECTION 09970

SECTION 10100 - MARKERBOARDS AND TACKBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of markerboards and tackboards is shown on the drawings.
 - a. Provide (2) two 4 x 4 glass markerboards and (3) three 4 x 4 tackboards at the Clerk Storage area at the Clemens Center.
- B. The types of boards required include the following:
 - 1. Polyester-faced tackboards.
 - 2. Glass magnetic dry markerboards.

1.03 QUALITY ASSURANCE:

- A. Fire Hazard Classification: Provide materials bearing UL label and marking indicating fire hazard classification of marking and tack surfaces, as determined by ASTM E 84, Class A and as follows.
 - 1. Flame spread not more than 25.
 - 2. Fuel contributed not more than 35.
 - 3. Smoke developed not more than 50.
- B. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for all phases of the work, including preparation of substrate, installation of grounds and anchors, and application of materials.
- C. Provide colors of material for marking markerboards and tackboards as selected by the Architect from manufacturer's standard colors.

- D. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

1.04 SUBMITTALS:

A. Product Data:

- 1. For information only, submit a PDF of manufacturer's technical data and installation instructions for each material and component part. Include methods of installation for each type of substrate to receive units. Transmit copy of each instruction to the Installer.

B. Samples:

- 1. Submit (3) sets of samples for each color of markerboard and tackboard, trim, and accessories required. Provide 12" square samples of sheet materials and 12" lengths of trim members. Architect's review of samples will be for color, pattern, and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Shop Drawings:

- 1. Submit shop drawings for glass markerboard and tackboard units. Include full-scale sections of typical trim members and dimensioned elevations. Show anchors, ground reinforcement, accessories, and installation details.

PART 2 - PRODUCTS

2.01 TACKBOARD:

A. Claridge Balanced Laminated Three-ply Construction:

- 1. Polyester Fabric: Guilford of Maine
 - a. Fabric: 16 oz +/- 0.5 oz/lin.40 over manufacturers 7/16" thick fiberboard meeting ASTM C208.
 - b. Colors as selected by Architect. Note: Colors will vary by location.
- 2. Wrap all edges.
- 3. Sizes: Refer to drawings.

B. Manufacturer: Provide tackboard produced by one of the following:

1. Claridge Products and Equipment, Inc. (Series 8)

2.02 MARKERBOARD:

A. Wall mounted magnetic glass markerboard

1. ¼" low iron ultra clear glass.
2. Steel backing-magnetic glass.
3. Edge treatment: Smooth polished edge with eased corners.
4. Surface: Glossy
5. Stand Off Through Mount (Landscape)-Holiday glass approx.. 1" off wall surface.
6. Size: refer to drawings.
7. Color as selected by Owner.

B. Manufacturer:

1. Claridge Products & Equipment, Inc. (wall-mounted-frameless magnetic glass markerboard)

2.03 TRIM AND ACCESSORIES:

A. General: Fabricate frames and trim of not less than 0.062" thick aluminum alloy, size as shown to suit type of installation. Provide straight, single-length units wherever possible and keep joints to a minimum. Miter corners to a neat, hairline closure. Furnish exposed aluminum trim, accessories, and fasteners with satin anodized finish AA-M12C22A31 class II, 0.010 mm or thicker, unless otherwise indicated.

1. Except as otherwise indicated, provide manufacturer's standard "narrow" trim units, approximately 1/2" wide.
2. When structural support accessories are required for tackboards in addition to normal trim, provide such additional support or modify trim as required to provide necessary support.
 - a. Provide snap-on trim with no visible screws or exposed joints.

- B. Access Series: Furnish at each markerboard:
 - 1. Magnetic stadium marker caddy-small-MGM-MCI-S.
 - 2. Magnetic eraser MGM-MEI.
 - 3. Dry erase markers & microfiber eraser cloth: LCS668-4
(2) packs per glass markerboard.

2.04 FABRICATION:

- A. Provide factory-assembled glass markerboards and tackboards.
- B. All boards are to be in sizes indicated on plans. Boards are to be wall mounted in a stationary position.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the areas and conditions under which units are to be installed and notify the General Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

- A. Install new boards in locations and mounting heights as shown on the drawings and in accordance with the manufacturer's instructions. Provide all grounds, clips, backing materials, brackets, and anchors for a complete installation.
- B. Deliver factory-built new glass markerboard and new tackboard units completely assembled in one piece without joints, whenever possible.
- C. Install new units with concealed hangers plumb and level, in accordance with the manufacturer's printed instructions.
- D. Coordinate job-assembled units with grounds, trim, and accessories. Join all parts with neat, precision fit.

END OF SECTION 10100

SECTION 10400 - IDENTIFICATION DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.02 SUMMARY

- A. Provide labor, materials, and equipment necessary for the complete installation of identifying devices as indicated, including:
 - 1. Interior Signage

1.03 SUBMITTALS:

- A. Submit product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Submit Shop Drawings showing fabrication and erection of signs. Include plans, elevations, and large scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
- C. Signage shall have 2 colors, background and letters. Match sample provided by Architect.
- D. Provide samples for verification of color, pattern, and texture selected and compliance with requirements indicated:
 - 1. Cast Acrylic Sheet: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material, color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

1.04 QUALITY ASSURANCE:

- A. Reference Codes and Specifications: Michigan Building Code 2015 Ed.
- B. Signage shall be provided to conform with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

- A. Manufacturers: (Interior Signage) Subject to compliance with requirements, provide signage by one of the following:
 - 1. ASI Sign Systems, Indianapolis, Indiana; Cincinnati, Ohio; Cleveland, Ohio
 - 2. Diskey Sign Corp. Fort Wayne, Indiana
 - 3. Roban, Lakemore, Ohio
 - 4. Best Signs, Montrose, Colorado
 - 5. J.L. Geisler, Inc. Michigan
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product. Requests for Architect's approval must be accompanied by the "Substitution Request Form" and complete technical data for evaluation. All materials for evaluation must be received by the Architect at least (10) ten calendar days prior to bid due date. Additional approved manufacturers will be issued by Addendum.
 - 1. Refer to Division 1 Instructions to Bidders and Substitution Request Form for additional requirements.

2.02 MATERIALS:

- A. Cast Acrylic Sheet: Provide cast (no extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 degrees F and of the following general types:
 - 1. Thickness: 1/8 inch.
 - 2. Colors as selected from manufacturers full range of offerings.

- B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- C. Anchors and Inserts: Use nonferrous metal or hot dipped galvanized anchors and inserts as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete masonry work.
- D. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background color that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.03 INTERIOR SIGNAGE:

A. Signage, General:

- 1. Graphic Process; Raised letters and Braille shall be formed as an integral part of the sign face. Surface applied letters and Braille are not allowed.
- 2. Letters: Letters and numbers shall have width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 and 1:10. Letters and numbers shall be raised 1/32 inch, uppercase, sans serif or simple sans serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be 5/8 inch high minimum and 2 inches high maximum.
- 3. Ease sign edge and radius corners 3/8 inch.
- 4. Material
 - a. Acrylic plastic

B. Interior Room Name and Number Signs

- 1. Layout of room name and number shall be as directed by the Architect.
- 2. Number of signs required:
 - a. Refer to signage schedule on the documents.
- 3. Provide signs with clear acrylic name plate(s) as indicated on Signage Types.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. General: Located sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using the method indicated below:
 - 1. Mount with adhesive as recommended by manufacturer.
 - 2. Mount with nonremovable oval head screws, using plastic plugs where mounted on masonry.

3.02 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 10400

SECTION 10522 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

- A. The extent of fire extinguishers and wall mounted brackets is shown on the drawings.

1.03 QUALITY ASSURANCE:

- A. Manufacturer: Provide fire extinguishers with wall mounted brackets and fire blanket cabinets manufactured by one of the following:

- 1. J. L. Industries
- 2. Larsens Manufacturing Company (basis of design)
- 3. Potter Roemer
- 4. Nystrom

1.04 SUBMITTALS:

- A. Manufacturer's Data:

- 1. For information only, submit PDF copy of manufacturer's technical data and installation instructions for fire extinguisher required. Transmit copy of each instruction to the installer.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS AND CABINETS:

- A. General: Provide fire extinguisher cabinets including standard 10 lb. multi-purpose dry chemical fire extinguishers, as follows: Larsens Model MP10

- 1. Clemens Center
 - a. Semi-recessed 3 ½" rolled edge trim with full panel standard glazed door. Larsens Model #552409-R4 with full panel glazed door.
 - b. Frame trim and door: 304 stainless steel #4 finish.

- B. Construction: One-piece tubular door frames, mitered and welded. One-piece metal trim frame, to suit cabinet style required. Weld all joints and grind smooth. Provide manufacturer's standard steel box with white baked enamel interior finish.
- C. Door Hardware: Continuous type hinge permitting door to open 180 degrees. Provide red "Fire" handle on all cabinets, unless noted otherwise.
- D. Provide fire-rated cabinets where indicated on plan or if not indicated, at all locations installed in a fire-rated wall as shown on the life safety plan.
- E. Provide each fire extinguisher cabinet with a plastic sign: 4" x 18" 3D tent "Fire Extinguisher" PTD-108.

2.02 FIRE EXTINGUISHERS (without cabinets) where indicated:

- A. General: Provide standard 10 lb. multi-purpose dry chemical fire extinguishers, as follows:
 - 1. Surface mounted fire extinguisher - Larsens Model MP10 with bracket 546.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the substrates and conditions under which the fire extinguishers are to be installed, and notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

- A. Install in locations and at mounting height to comply with governing authorities. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

END OF SECTION 10522

SECTION 10561 - METAL STORAGE SHELVING (Four-Post)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Four-post type metal shelving.
- B. Related Work, Not Furnished:
 - 1. Finish floor covering materials and installation.
- C. Related Sections:
 - 1. Sections in Division 9 - Finishes, relating to finish floor and base materials.

1.3 REFERENCES

- A. American National Standards Institute (ANSI) Standards:
Applicable standards for fasteners used for assembly.
- B. American Society for Testing and Materials (ASTM) Standards:
Applicable standards for steel sheet materials used for fabrication.
- C. American Institute Of Steel Construction (AISC) Standards:
Applicable standards for steel materials used for fabrication.

1.4 DESCRIPTION

- A. General: Four-Post Type Metal Shelving.

B. Finishes:

1. Fabricated Metal Components and Assemblies: All components to be painted with an electrostatically applied Powder Coat paint.

C. Sizes:

1. Available in heights of 76.25" to 100.25" as noted on drawings.
2. Available in nominal widths of 30" to 48" as noted on drawings.
3. Available in nominal single-faced or double-faced depths of 24" as noted on drawings.

1.5 PERFORMANCE REQUIREMENTS

A. Design Requirements:

1. Limit overall width to 48".
2. Limit overall depth to that indicated on Drawings.
3. Limit overall height to 100.25".

- B. Seismic Performance: Provide four-post metal shelving capable of withstanding the effects of earthquake movement when required by 2015 Michigan Building Code.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature and installation instructions for each type of four-post shelving required. Include data substantiating that products to be furnished comply with requirements of the contract documents.

- B. Shop Drawings: Show fabrication, assembly, and installation details including descriptions of procedures and diagrams. Show complete extent of four-post shelving installation layout including quantities, locations and types of accessory units required. Include notations and descriptions of all installation items and components.

1. Show installation details at non-standard conditions, if any.

2. Provide layout, dimensions, and identification of each unit corresponding to sequence of installation and erection procedures.
 3. Provide installation schedule and complete erection procedures to ensure proper installation.
- C. Samples: Provide minimum 3 inch (76MM) square example of each color and texture on actual substrate for each component to remain exposed after installation.
- D. Selection Samples: For initial selection of colors and textures, submit manufacturer's color charts consisting of actual product pieces, showing full range of colors and textures available.
- E. Warranty: Submit draft copy of proposed warranty for review by the Architect.
- F. Maintenance Data: Provide in form suitable for inclusion in maintenance manuals for four-post shelving. Data shall include operating and maintenance instructions, parts inventory listing, purchase source listing, emergency instructions, and similar information.
1. Submit manufacturer's instructions for proper maintenance materials and procedures.
 2. Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against using materials and methods, which may be detrimental to finishes and performance.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage an experienced manufacturer who is ISO 9001 certified for the design, production, installation and service of four-post shelving. Furnish certification attesting ISO 9001 quality system registration.

B. **Installer Qualifications:** Engage an experienced installer who is a manufacturer's authorized representative for the specified products for installing four-post shelving.

1. **Minimum Qualifications:** 1-year experience installing four-post shelving of comparable size and complexity to specified project requirements.

1.8 DELIVERY, STORAGE AND HANDLING

A. Follow manufacturer's instructions and recommendations for delivery, storage and handling requirements.

1.9 PROJECT CONDITIONS

A. **Field Measurements:** Verify quantities of four-post shelving units before fabrication. Indicate verified measurements on Shop Drawings. Coordinate fabrication and delivery to ensure no delay in progress of the Work.

B. **Established Dimensions:** Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating four-post shelving units without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.10 SEQUENCING AND SCHEDULING

A. Sequence four-post shelving units (coordinate with Construction Manager with other work on site) to minimize possibility of damage and soiling during remainder of construction period.

B. Schedule installation of specified four-post shelving after finishing operations; including painting have been completed.

C. Provide components, which must be built in at a time, which causes no delays general progress of the Work.

D. **Pre-installation Conference:** Schedule and conduct conference on project site to review methods and procedures for installing four-post shelving units including, but not limited to, the following:

Recommended attendees include:

1. Owner's Representative.
2. General Contractor.
3. The Architect.
4. Manufacturer's representative.
5. Subcontractors or installers whose work may affect, or be affected by, the work of this section.

1.11 WARRANTY

- A. Provide a written warranty, executed by the General Contractor, Installer, and Manufacturer, agreeing to repair or replace units, which fail in materials or workmanship within the established warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have under General Conditions provisions of the Contract Documents.
- B. Limited Lifetime Warranty: Subject to the terms in the written warranty, warrant the original purchaser exclusively that the shelving manufactured by it will be free from defects in materials and workmanship for the lifetime of the shelving.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General: Products are based upon four-post shelving manufactured by Spacesaver Corporation.
 1. Local Spacesaver Representative Bart Spencer, The Casper Corporation 248-388-4065.

2.2 BASIC MATERIALS

- A. General: Provide materials and quality of workmanship, which meets or exceeds established industry standards for products specified. Use furniture grade sheet metal, wood panels, plastic laminate and fasteners for component

fabrication unless indicated otherwise. Material thicknesses/gauges are manufacturer's option unless indicated otherwise.

2.3 MANUFACTURED COMPONENTS

A. Design:

1. Wedge-lock type consisting of uprights, shelves, and shelf supports, designed to be assembled without fasteners or clips. Shelves shall not have any holes on exposed surfaces. Front and back flanges shall be flush with outside faces of posts. Design shall permit individual shelf adjustment and/or removal anywhere along the entire height of uprights.

B. Materials and Workmanship:

1. Fabricate units from Class 1, cold-rolled steel sheet with all bends sharp and true and no exposed "knife" edges.
 - a. All units shall be free of burrs, sharp edges and projecting hardware with smooth, non-abrasive surfaces and edges.
 - b. After fabrication, shelving shall exhibit no dents, "oil canning", buckling or other surface irregularities.

C. Uprights:

1. Formed from steel sheet to a hollow "tee" shape for intermediate supports and formed angles for end supports. Uprights shall have keyhole slots on inner wall only. Provide with sheet steel panels full height and depth of end uprights. Provide intermediate "tee" uprights between adjacent units.

D. Shelves:

1. Form from sheet steel with flanges on all sides and return hem on front and back flanges. Ends shall be formed to clear inside of upright offset panels. Shelves shall be independently adjustable. Provide all shelves with slots for file dividers.

E. Canopy Tops:

1. Same construction as shelf units.

F. Shelf Supports:

1. Form from heavy gauge steel sheet with four solid steel shoulder rivets, two per ear, that interlock with inner wall of uprights.

G. Nominal Shelf Dimensions:

1. Width: 12 inches to 72 inches sections used to meet project requirements.
2. Shelf Edge Vertical Profile: 3/4 inch maximum.
3. Vertical Adjustment Increment: 1-1/2 inches.
4. Width Of Intermediate Uprights: 2 inches.
5. Clearance Between Uprights: Nominal shelf section width minus 2 inches.
6. Levelness of Completed Shelf Units: Maximum 1/8 inch between bottom shelf and canopy top, measured along the edge of any upright in any direction.
7. Number of Vertical Shelf Spaces: As indicated on the drawings.
8. Vertical Shelf-To-Shelf Spacing: As indicated on the drawings.

H. Load Carrying Capabilities:

1. Provide shelf units capable of supporting 40 pounds per lineal foot with maximum deflection of L/140. Shelves shall exhibit no permanent deflection under fully loaded conditions.

I. Accessories:

1. File Dividers: Provide 3 file dividers per shelf. 42" or larger, 2 for 36" or less.
2. Center Stops: Provide manufacturer's standard.
3. Back Stops: Provide manufacturer's standard.
4. Full Backs: Where required provide manufacturer's standard.

5. Bin Dividers: Where required provide manufacturer's standard.
6. Drawers for microfiche and film where required.

2.4 FABRICATION

- A. General: Coordinate fabrication and delivery to ensure no delay in progress of the Work.

2.5 FINISHES

- A. Colors: Selected from manufacturer's standard available colors as selected by Architect.
- B. Paint Finish: Provide factory applied electrostatic powder coat paint. Meet or exceed specifications of the American Library Association.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine shelving units scheduled to receive accessories with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of specified accessory items.
- B. Verify that intended installation locations of sorter unit units will not interfere with or block established required exit paths or similar means of egress once units are installed.
- C. Proceed with accessory installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Follow manufacturer's written instructions for installation of each type of accessory item specified.

3.3 FIELD QUALITY CONTROL

- A. Verify accessory unit alignment and plumb after installation. Correct if required following manufacturer's instructions.
- B. Remove components that are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.4 ADJUSTING

- A. Adjust all accessories to provide smoothly operating, visually acceptable installation.

3.5 CLEANING

- A. Immediately upon completion of installation, clean components and surfaces. Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

3.6 DEMONSTRATION/TRAINING

- A. Schedule and conduct demonstration of installed accessory items and features with Owner's personnel.
- B. Schedule and conduct maintenance training with Owner's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures that end user personnel would normally perform.

3.7 PROTECTION

- A. Protect system against damage during remainder of construction period. Advise Owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

END OF SECTION

**SECTION 10562 - MOTORIZED MOBILE STORAGE SHELVING (SPACESAVER
"ECLIPSE POWERED SYSTEM®")**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Electric, carriage mounted high-density mobile storage units, support rails, fabrication, and installation including leveling of support rails.
- B. Related Work, Not Furnished:
 - 1. Structural floor system capable of supporting live and dead loads required by prevailing building codes, including loads of storage units to be installed.
 - 2. Finish floor covering and edging materials and installation on raised floors and ramps, or when on concrete with recessed rail installation.
 - 3. Power wiring to units from adequate power supply. Final connections to units shall be provided by electrician.
 - 4. Fire suppression system is by others.
- C. Related Sections:
 - 1. Section 03001 - Concrete Work
 - 2. Division 9 - Finishes, relating to finish floor and base materials.
 - 3. Division 26 Specification Sections power wiring devices, conductors and circuit protection.

1.3 REFERENCES

- A. American Library Association (when applicable)
 - 1. Cantilever Bracket Type Metal Library Bookstacks; Library Technology Reports
- B. American National Standards Institute (ANSI) Standards:
 - 1. Applicable standards for fasteners used for assembly.
- C. American Society for Testing and Materials (ASTM) Standards:
 - 1. Applicable standards for steel sheet materials used for fabrication.
- D. American Institute of Steel Construction (AISC) Standards:
 - 1. Applicable standards for steel materials used for fabrication.
- E. Underwriters' Laboratories (UL):
 - 1. Listings for electrical equipment and devices described in this specification.

1.4 SYSTEM DESCRIPTION

- A. General: The system consists of manufactured storage units mounted on manufacturer's track-guided carriages to form a compact storage system. System design permits access to any single aisle by moving units until the desired aisle is opened. The manufacturer's proprietary unit interlock system prevents units from being moved while the open aisle is occupied. The carriage/rail system provides uniform carriage movement along the total length of travel, even with unbalanced loads.
- B. Carriage System Design and Features: The carriage system consists of a formed structural steel frame with hardened steel wheels riding on steel rails recessed to the floor. Rails shall be types selected by the manufacturer to ensure smooth operation and self-centering of mobile storage units during travel without end play or binding. Rail types, quantities and spacing shall be selected by the manufacturer to suit installation conditions and

requirements. All bearings used in the drive mechanism shall be permanently shielded and lubricated.

- C. Movement Controls: Provide a carriage control panel on the accessible (open) end of each moveable carriage, located 44 inches above the base, centered on the face panel. Minimum controls shall include directional control buttons/icons, STOP/RESET push-button/icon and a red reset light/icon.
1. System controls shall start motors on each movable carriage "block" to start all at once and shall provide dynamic braking to provide smooth operation. No additional hardware shall be required to change between "sequential" and "block" movement. Maximum running speed shall be limited to 3.3 inches per second.
 2. Provide solid state controls and indicator lights/icons for a visual indication of safety system operation. Provide each aisle with a programmable distance sensor to ensure proper timing for start/stop operation.
 3. Pushing the directional control button/icon on any moveable carriage adjacent to the desired aisle location in the direction away from the desired aisle location opens the system at the desired aisle. The selected aisle shall open automatically regardless of the position of the carriages. Manual Reset: The carriage control head will display a flashing red reset light/icon at the newly opened aisle indicating that the aisle is locked open and requires resetting before another aisle can be opened. Provide for automatic lockout and manual reset of controls if selected aisle is not moved within a preset period of time.
 4. Controls shall feature safety activated message and direction indicator designating which aisle safety was activated or back lit message indicating which aisle is in use (i.e. "Right Aisle in use" or "Left Aisle in use").

5. Provide Bluetooth control via the TUSC Mobile Control App in replace of or in addition to the standard powered control or touch technology system controls.
- D. Drive System: The system shall be designed with a positive type motorized drive which minimizes end play and that carriages will stop without drifting. All system components shall be selected to ensure a smooth, even movement along the entire carriage length.
1. Each electric carriage shall be provided with a current limited fractional horsepower gear motor, connected to drive wheel assembly with a roller chain.
 2. System shall include a chain sprocket drive system to ensure that carriages move uniformly along the total length of travel, even with unbalanced loads.
 3. A tensioning device shall be provided on each chain drive (when applicable).
 4. All bearings used in the drive mechanism shall be permanently shielded and lubricated.
 5. System shall operate on 115 V.A.C. 50/60 hertz, 20 amp dedicated circuit provided by others, one per module.
 6. Overhead mounted power pantograph distribution system shall conceal all interconnecting wiring.
- E. Safety Features:
1. Visual indicators/icons shall provide verification that carriages are in the locked or unlocked mode.
 2. One safety sweep shall be provided in each aisle. A full-length infrared photoelectric safety sweep shall be provided to stop carriage movement if the sweep contacts an obstruction while in motion. Sweep must be equipped with OSHA approved safety demarcation tape.
 3. Entire system shall be UL system listed.
 4. A handheld rechargeable power pack shall be provided for emergency operations in case of primary power failure.

F. Finishes:

1. Fabricated Metal Components And Assemblies:
Manufacturer's standard powder coat paint finish.
2. End Panels, Accessible Ends: Plastic Laminate,
Manufacturer's standard available textures and
patterns.

1.5 PERFORMANCE REQUIREMENTS

A. Design Requirements:

1. Limit overall height to 84".
2. Limit overall length to 222".

- B. Seismic Performance: Provide mobile storage units capable of withstanding the effects of earthquake movement when required by the 2015 Michigan Building Code.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature and installation instructions for each type of shelving, track and installation accessory required. Include data substantiating that products to be furnished comply with requirements of the contract documents.

- B. Shop Drawings: Show fabrication, assembly, and installation details including descriptions of procedures and diagrams. Show complete extent of installation layout including clearances, spacings, and relation to adjacent construction in plan, elevation, and sections. Indicate clear exit and access aisle widths; access to concealed components; assemblies, connections, attachments, reinforcement, and anchorage; and deck details, edge conditions, and extent of finish flooring within area where units are to be installed.

1. Show installation details at non-standard conditions. Furnish floor layouts, technical and installation manuals for every unit shipment with necessary dimensions for rail layout and system configuration at the project site. Include installed weight, load criteria, furnished specialties, and accessories.

2. Provide layout, dimensions, and identification of each unit corresponding to sequence of installation and erection procedures. Specifically include the following:
 - a. Location, position and configuration of tracks on all floors.
 - b. Plan layouts of positions of carriages, including all required clearances.
 - c. Details of shelving, indicating method and configuration of installation in carriages.
 3. Provide installation schedule and complete erection procedures to ensure proper installation.
 4. Show locations of wiring and disconnects required for operating movable carriage units.
- C. Samples: Provide minimum 3 inch square example of each color and texture on actual substrate for each component to remain exposed after installation.
- D. Selection Samples: For initial selection of colors and textures, submit manufacturer's color charts consisting of actual product pieces, showing full range of colors and textures available.
- E. Warranty: Submit draft copy of proposed warranty for review by the Architect.
- F. Reference List: Provide a list of recently installed mobile storage systems (5 minimum) to be visited by Owner, Architect and Contractor. Intent of list is to aid in verifying the suitability of manufacture's products and comparison with materials and product specified in this section.
- 1.7 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Engage an experienced manufacturer who is ISO 9001 certified for the design, production, installation and service of motorized, carriage mounted high-density mobile storage units and

support rails. Furnish manufacturer's ISO 9001 quality system registration certificate.

- B. Installer Qualifications: Engage an experienced installer who is a manufacturer's authorized representative for the specified products for installing carriages and anchoring shelving units to carriages.
 - 1. Minimum Qualifications: 1-year experience installing systems of comparable size and complexity to specified project requirements.
 - 2. Guaranteed 24 hour minimum response time to service call.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Follow manufacturer's instructions and recommendations for delivery, storage and handling requirements.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions before fabrication. Indicate verified measurements on Shop Drawings. Coordinate fabrication and delivery to ensure no delay in progress of the Work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating mobile storage units without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.10 SEQUENCING AND SCHEDULING

- A. Sequence storage shelving system installation with other work to minimize possibility of damage and soiling during remainder of construction period.
- B. Schedule installation of specified products and accessories after finishing operations, including painting have been completed.

- C. Provide components, which must be built in at a time which causes no delays general progress of the Work.
- D. Pre-installation Conference: Schedule and conduct conference on project site to review methods and procedures for installing mobile storage units including, but not limited to, the following:
 - 1. Review project conditions and levelness of flooring and other preparatory work performed under other contracts.
 - 2. Review and verify structural loading limitations.
 - 3. Recommended attendees include:
 - a. Owner's Representative.
 - b. Prime Contractor or representative.
 - c. The Architect.
 - d. Manufacturer's representative.
 - e. Subcontractors or installers whose work may affect, or be affected by, the work of this section.

1.11 WARRANTY

- A. Provide a written warranty, executed by the General Contractor, Installer, and Manufacturer, agreeing to repair or replace units which fail in materials or workmanship within the established warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have under General Conditions provisions of the Contract Documents.
- B. Warrant the entire movable compact shelving installation against defects in materials and workmanship for a period of (5) five years from date of acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General: Products are based upon mobile shelving system products manufactured by Spacesaver Corporation.
 - 1. Local Michigan Spacesaver Representative Bart Spencer, The Casper Corporation, 248-388-4065.

2.2 BASIC MATERIALS

- A. General: Provide materials and quality of workmanship which meet or exceed established industry standards for products specified. Use furniture grade sheet metal for component fabrication unless indicated otherwise. Material thickness/gauges are manufacturer's option unless indicated otherwise.
- B. Plastic Laminates. NEMA LD-3, GP-28, Vertical Grade.
- C. Electrical Devices and Controls: UL System Listed for type of application and service.

2.3 GROUT

- A. General: Provide non-shrink, non-staining hydraulic cement compound conforming to the following requirements, based on the performance of the test specimens at room temperature and in laboratory air, as stated by the grout manufacturer.
 - 1. Linear Movement: No shrinkage while setting; maximum expansion limited to .002 inches per linear inch.
 - 2. Compressive Strength: Based on two inch cubes made following ASTM standards, tested on a Balding-Southward machine of 60,000 pounds capacity, meet or exceed the following:
 - a. Age: 1 hour ---- 4,500 psi
7 days ---- 8,000 psi

2.4 MANUFACTURED COMPONENTS

- A. Rails: Rail shall be one-piece, cold drawn structural "T" section 1035 steel extrusion 1-1/16" high with a 2-1/8" base flange, a 5/8" top surface and two anti-tip groves. Rail shall disperse the wheel point load to a minimum 4-1/4" square inch area at the base of the rail. All rail joints to be tongue and groove. Rail shall have two leveling screws and two permanently mounted floor anchors maximum 36" o.c.
1. General: Provide manufacturer's proprietary design units with the following properties:
 2. Material: ASTM/AISI Type 1035 or 1045 steel, manufacturer's selection.
 3. Capacity: 1,000 pounds per lineal foot of carriage.
 4. Minimum Contact Surface: 5/8 inch wide.
 5. Provide rail sections in minimum 6 foot lengths.
 6. Rail configuration shall permit attachment to top of structural floor system with provision for leveling rails to compensate for variations in floor surface level.
 7. Provide rail connections designed to provide horizontal and vertical continuity between rail sections, to gradually transfer the concentrated wheel point load to and from adjoining rail sections. Butt joints without connections are not permitted.
 8. Rail Form Covers: Manufacturer shall provide for protection as required to prevent damage to rails during concrete back pours.
 9. Once rails are leveled, they shall be supported the full length with the specified grout.
- B. Carriages:
1. Provide manufacturer's design movable carriages fabricated of welded steel construction. Galvanized structural components and/or riveted carriages are unacceptable. 1,000 pound per foot minimum capacity.

2. Provide fixed carriages of same construction and height as the movable carriages, anchored to rails. Setting fixed shelving directly on floors is not permitted.
3. When required, provide bolted carriage splices designed to maintain proper unit alignment and weight load distribution.
4. Design carriages to allow the shelving uprights to recess and interlock into the carriages a minimum of 3/4 inch (19MM). Top mount carriages are unacceptable.
5. Provide each carriage with two wheels per rail.

C. Drive / Guide System:

1. Design: Provide drive system which prevents carriage whipping, binding and excessive wheel/rail wear under normal operation.
 - a. If line shafts are used, all wheels on one side of carriage shall drive.
 - b. If synchronized drives are used, a minimum of one wheel assembly driving both sides of carriage at center location required. Drive shaft shall exhibit no play or looseness over the entire length of that assembly.
2. Shafts: Solid steel rod or tube.
3. Shaft Connections: Secured couplings.
4. Bearing Surfaces: Provide rotating load bearing members with ball or roller bearings. Provide shafts with pillow block or flanged self-aligning type bearings.

D. Wheels:

1. Materials: Type 1045 solid steel. Minimum load capacity per wheel: 3200 lbs.
2. Size: Minimum [5 inches [3 inches], outside diameter drive wheels.
3. Guides: Determined by manufacturer; minimum 2 locations.

E. Motors:

1. Type: 90VDC

F. Face Panels:

1. Materials: Plastic laminate clad particleboard with plastic edging on vertical edges.
2. Finishes: Selected from manufacturer's standard available colors and patterns as selected by the Architect.
3. End panels must cover the full height and width of shelving.

G. Shelving: Four Post. See Spec Section 10561 "Metal Storage Shelving (four post)

2.5 ACCESSORIES

A. Touch Technology Control: Provide a touchscreen control head on every carriage that has standard system start/stop/reset controls, Infrared Capable Controls and Infrared Remote Controls, and Touch Technology Aisle Access Controls. (as described below) Depending on access rights user can perform the following system controls at each control head: Access aisle left or right of Touchscreen, Toggle stationary locally, Toggle power for the system, Toggle the auxiliary relay output, Tutorials for basic system and safety operation, Administrative functions.

B. Provide Bluetooth control via the TUSC Mobile Control App or Diagnostic in replace of or in addition to the standard powered control or touch technology system controls. Option exists to not allow system movement from local controls while connected to the TUSC Control App. One user at a time can be connected. Connection to system will timeout via set time configuration when the apps are no longer in use.

C. TUSC Control App: Available from iOS and Android smartphone or tablet. Universal remote control to open and close aisles, enter and search for items, and view safety notifications.

- D. TUSC Diagnostic App: Available from Android smartphone or tablet. Updates systems software/firmware, configurations, and reports diagnostics wirelessly. Communicates system status, faults, and last stops real-time. Save and send diagnostic and configuration information file via email. The app requires registration and authentication with Spacesaver with option to periodically validate credentials for security. During connection automove is disabled.
- E. Programmable Aisle: Provide the ability to create more than one aisle per mobile storage module.
- F. System controls shall start motors on each movable carriage "sequentially" (to minimize power demands) and "block" (to start all at once) and shall provide dynamic braking to provide smooth operation. (No additional hardware shall be required to change between "sequential" and "block" movement).
- G. Power Pack Override: Provide two total handheld rechargeable battery pack units to operate modules in case of main power failure.
- H. Include Automatic Aisle Lighting: Provide top-mounted LED Light fixtures.

2.6 FABRICATION

- A. General: Coordinate fabrication and delivery to ensure no delay in progress of the Work.
- B. Wheels: Provide precision ground and balanced units with permanently shielded and lubricated bearings.
- C. Carriages: Fabricate to ensure no more than 1/4 inch (6MM) maximum deviation from a true straight line. Splice and weld to ensure no permanent set or slippage in any spliced or welded joint when exposed to forces encountered in normal operating circumstances.
- D. Shelving, Supports and Accessories: See individual descriptions in "Shelving" paragraphs.

2.7 FINISHES

- A. Colors: Selected from manufacturer's standard available colors selected by Architect.
- B. Paint Finish: Provide factory applied electrostatic powder coat paint. Meet or exceed specifications of the American Library Association.
- C. Laminate Finish: Provide factory applied laminate panels at locations indicated on approved shop drawings.
- D. Edgings: Provide performed edging, color-matched to unit colors selected.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine floor surfaces with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of mobile storage units.
- B. Verify that building structural system is adequate for installing mobile storage units at locations indicated on approved shop drawings.
 - 1. In new construction, ensure that recesses for rails in floors are at proper spacing and depths, with allowance for grouting.
- C. Verify that intended installation locations of mobile storage units will not interfere with, nor block exit paths or similar means of egress once units are installed.
- D. Verify that adequate capacity permanent power sources have been installed at locations indicated on approved shop drawings.

- E. Prepare written report, endorsed by Installer, listing conditions detrimental to proper performance of mobile storage units, once installed.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Rails:

1. Lay out rails using full-length units to the maximum extent possible. Use cut lengths only at ends to attain total length required. Locate and position properly, following dimensions indicated on approved shop drawings. Verify thickness of finished floor materials to be installed (by others) and install level 1/16 inch above finished floor surfaces.
2. Verify level, allowing for a minimum 1/4 inch of grout under high points. Position and support rails so that no movement occurs during grouting.
3. Set rails in full grout bed, completely filling any voids entire length of all rails including rail connectors. Trim up sides flush with rails to ensure proper load transfer from rail to supporting floor. Using shims in lieu of full grouting is not permitted.
4. Installation Tolerances: Do not exceed levelness of installed rails listed below:
 - a. Maximum Variation From True Level Within Any Module: 3/32 inch.
 - b. Maximum Variation Between Adjacent (Parallel) Rails: 1/16 inch, perpendicular to rail direction.
 - c. Maximum Variation In Height: 1/32 inch, measured along any 10 foot rail length.
5. Verify rail position and level; anchor to structural floor system with anchor type and spacings indicated on approved shop drawings.

B. Floors/Ramps:

1. General: Finished elevation shall be 1/16" below top of rails.

C. Shelving Units Installation:

1. General: Follow layout and details shown on approved shop drawings and manufacturer's printed installation instructions. Position units level, plumb; at proper location relative to adjoining units and related work.
2. Carriages:
 - a. Place movable carriages on rails. Ensure that all wheels track properly and centering wheels are properly seated on centering rails. Fasten multiple carriage units together to form single movable base where required.
 - b. Position fixed carriage units to align with movable units; make final leveling adjustments with leveling screws.
3. Shelving Units:
 - a. Permanently fasten shelving units to fixed and movable carriages with vibration-proof fasteners.
 - b. Stabilize shelving units following manufacturer's written instructions. Reinforce shelving units to withstand the stress of movement where required and specified.
4. Wiring:
 - a. Make final control wiring connections between modules under single control.
 - b. Test wiring for continuity and proper connections with regulated field power supply before making final power connections.
 - c. Make final wiring connections to permanent power source. Connection to power source by others.
 - d. Test system operation by cycling all units through complete operations sequences.

3.3 FIELD QUALITY CONTROL

- A. Verify shelving unit alignment and plumb after installation. Correct if required following manufacturer's instructions.
- B. Remove components which are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new, undamaged, matching units.

3.4 ADJUSTING

- A. Adjust components and accessories to provide smoothly operating, visually acceptable installation.

3.5 CLEANING

- A. Immediately upon completion of mobile shelving installation, clear components and surfaces. Remove surplus materials, rubbish and debris resulting from mobile shelving installation upon completion of work and leave areas of installation in neat, clean condition.

3.6 DEMONSTRATION/TRAINING

- A. Schedule and conduct demonstration of installed equipment and features with Owner's personnel.
- B. Schedule and conduct maintenance training with Owner's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures that end user personnel would normally perform.

3.7 PROTECTION

- A. Advise Owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 10800 - TOILET ACCESSORIES

PART I - GENERAL

1.01 RELATED DOCUMENTS:

- A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION:

- A. The extent of each type of toilet accessory is shown on the drawings.

1.03 QUALITY ASSURANCE:

A. Inserts and Anchorages:

- 1. Furnish inserts and anchoring devices which must be built into masonry for the installation of toilet accessories. Coordinate delivery with other work to avoid delay.
- 2. See masonry sections of these specifications for installation of inserts and anchorage devices.

B. Products:

- 1. Provide products of the same manufacturer for units exposed in the same areas, unless otherwise acceptable to the Architect.
- 2. Stamped names or labels on exposed faces of units will not be permitted, except where otherwise indicated.
- 3. Provide locks where indicated, with the same keying for each type of accessory units in the project wherever possible. Furnish two keys for each lock.

- C. The specifications indicated specific products of one manufacturer to communicate design intent.

1.04 SUBMITTALS:

A. Product Data:

- 1. For information only, submit PDF copy of manufacturer's technical data and installation instructions for each toilet accessory. Transmit copies of installation instructions to the Installer.

B. Samples:

1. When requested, submit full-size samples of units to Architect for review of design and operation. Acceptable samples will be returned and may be used in the work. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Setting Drawings:

1. Provide setting drawings, templates, instructions and directions for installation of anchorage devices in other work.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Stainless Steel: AISI, Type 302/304 with polished No. 4 finish, 0.034 inch (22 gauge) minimum thickness.
- B. Brass: Unleaded , flat products, ASTM B19; rods, shapes, forgings, and flat products with finished edges, ASTM B16; castings, ASTM B30.
- C. Sheet Steel: Cold rolled, commercial quality, ASTM A336, 0.04 inch (20 gauge) minimum. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A527, G60.
- E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B456, Type SC2.
- F. Galvanized Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.
- G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.02 STAINLESS STEEL SHELF ((1) one at F & O Storage A100, Clemens Center)

- A. Bobrick B-298 x 24"
- B. Bradley 7210 x 24"
- C. ASI 0692-824

- 2.03 PAPER TOWEL DISPENSER ((1) one at F & O Storage A100, Clemens Center)
A. Bobrick B263
B. Bradley 251-15
C. ASI 0245-SS
- 2.04 UTILITY SHELF W/MOP BROOM HOLDERS & RAG HOOKS ((1) one at F & O Storage A100, Clemens Center)
A. Bobrick B-239 X 34"
B. Bradley 9933 X 34"
C. ASI 1308-3 X 34"
- 2.05 MISCELLANEOUS ACCESSORIES
- A. Fasteners and Anchors
1. Provide mounting kits with stainless steel screws for accessories requiring same.
 2. Mounting kits shall include toggle nuts for hollow walls and expansion shields for solid walls. Provide 2 fasteners at each mounting plate.
 3. Provide 12 gauge, 3 inches wide, steel concealed anchor plates with tapped holes for installation of grab bars on walls constructed with metal studs.
 4. Provide concealed anchors for installation of grab bars on solid walls. Anchor assembly shall consist of tapped 12 gauge anchor plate, 10 gauge back plate, and 3/8 inch diameter thru-wall bolt.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Installer must examine the areas and conditions under which toilet accessories are to be installed and notify the General Contractor in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION:

- A. Use concealed fastenings wherever possible.

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- B. Provide anchors, bolts and other necessary anchorages and attach accessories securely to walls and partitions in locations as shown or directed.
- C. Install concealed mounting devices and fasteners fabricated of the same materials as the accessories, or of galvanized steel, as recommended by manufacturer.
- D. Install exposed mounting devices and fasteners finished to match the accessories.
- E. Provide theft-resistant fasteners for all accessory mountings.
- F. Secure toilet room accessories in accordance with the manufacturer's instructions for each item and each type of substrate construction.

END OF SECTION 10800

SECTION 12300 - PLASTIC LAMINATE CASEWORK

PART 1 - GENERAL

1.01 General Provisions

- A. Attention is directed to Division 0, Bidding and Contract Requirements and to Division 1 General Requirements which are hereby made a part of this Specification. Refer to other sections, divisions, and schedules for work in connection with this section.

1.02 Intent

- A. The intent of this specification is to establish minimum performance and quality criteria consistent with preestablished standards of design and function. Casework not meeting these minimum requirements will be unacceptable.
- B. The casework contractor shall be held in strict compliance with any specific materials, finishes, construction details and hardware that are specified herein. Bids proposing to supply casework not meeting these requirements will be rejected.

1.03 Work Included

- A. Furnish, deliver, and install to Owner's and Architect's satisfaction, all prefabricated plastic laminate casework as shown on drawings, schedules and equipment lists.
- B. Furnish and install all fillers, scribes, finished ends, finished backs, work surfaces/backsplashes, and cutouts required to provide a complete and finished project. Plastic laminate work surfaces shall include backer sheet.
- C. Provide sinks and fittings, electrical outlets and fixtures when specifically stated as being part of this contract.
- D. Provide locks on all cabinets capable of locking unless noted otherwise. All cabinets are to be keyed alike per room. All locks are to be masterkeyable to room doors.
- E. Installer shall coordinate with General Contractor for connections, and testing of all sinks, fittings, electrical fixtures; coordinating all rough-ins: mechanical piping, electrical runs, and connections required for a complete project.

- F. Blocking, framing, and reinforcement in walls, ceilings, and floors for anchoring of cabinets and trim.

1.05 QUALIFICATIONS

- A. Plastic laminate casework shall be as manufactured by Stevens Advantage, Division of Stevens Industries, Inc., Teutopolis, IL. Products and catalog numbers are from Stevens Advantage Catalog and are used as basis for identification, configuration, size and quality.
- B. Other pre-approved manufacturers are as follows:
- TMI Systems Design Corp. Dickinson, North Dakota
 - Case Systems Inc., Midland, Michigan
 - Wood Metal Industries, Selinsgrove, PA
 - Strata Design, Inc., Traverse City, MI
- C. Casework of other manufacturers will be considered for approval providing written request is received at least ten (10) working days prior to announced bid date and approved by addendum. Bidder shall state in writing any deviations from requirements and specifications. The casework shall conform to configuration, arrangement, design, material quality, joinery, panel thickness, and surfacing of that specified and shown on drawings.
- D. Manufacturers requesting approval shall submit samples with Cut-A-Ways showing cabinet construction, joinery, drawer and door construction, hardware, and materials; along with catalogs and specification in order that accurate evaluations can be made. Samples may be impounded for the duration of contract to insure construction specification compliance.

1.06 SUBMITTALS

- A. Shop drawings shall be submitted for approval within thirty (30) days after formal notification of award of contract. Drawings shall consist of floor plans indicating arrangement and relation to electrical, data technology and adjacent work and equipment, and complete elevations of casework. Centerline of service requirements shall be noted for use by other trades. A schedule of all sinks, fittings, and accessories that are part of this contract shall be provided.

- B. Color samples shall be submitted for selection and coordination at time of contract award. Samples of actual material and color shall be available as required.
- C. Additional catalog cuts, details and samples as requested by Architect for evaluation and coordination.
- D. Physical sample must be approved prior to fabrication.

1.07 PRODUCT DELIVERY AND STORAGE

- A. Protect cabinet and countertops during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Store cabinets and countertops at project site installation and storage areas with similar ambient conditions as final installation. Storage areas must be kept dry, heated with low relative humidity and away from construction work such as painting, wet work, grinding and similar operations.

1.08 WARRANTY

- A. Casework manufacturer shall provide lifetime guarantee and limited warranty to the original Owner against defective material and fabrication for as long as they own the product - this is a warranty of replacement and repair only, the manufacturer will correct defects in material and/or fabrication without additional cost.
- B. Accessory equipment (sinks, fittings etc.) shall be warranted by appropriate manufacturer's guarantee.

PART 2 - PRODUCTS

2.01 CORE MATERIAL

- A. Cabinet components having particle board core material shall be of a minimum 45 lb. density, M-2 industrial grade. The particle board used shall have been tested under ANSI A208.1 1993 standards and/or ASTM D 1037-91A.
- B. Medium density fiberboard (MDF) shall be used in high stress areas as drawer members and shall be minimum 48 lb. density MD-21 grade and tested under ANSI A208.2 1994 Standards.

- C. Industrial hardboard shall be pre-finished 1/4" thickness composed of wood fibers, phenolic resin binders and moisture inhibitors that meet or exceed the hardboard product standard ANSI/AHA A135.4 1988.
- D. All countertops located with 3'-0" of any direction of built-in sink and/or bubblers shall be constructed of marine grade "Greenboard" MR moisture/water resistant particle board. The particle board shall be tested under ANSI A208.1 1-1993, M3 standards.

2.02 SURFACE MATERIAL

- A. Exposed exteriors shall be permanently thermofused plastic laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused plastic laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards. (Warranted for life against delamination).
- B. Exposed doors and drawer fronts shall be permanently thermofused plastic laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused plastic laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards, (Warranted for life against delamination).
- C. Exposed interiors shall be permanently thermofused melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused melamine laminate shall meet ALA 1996 specification standards, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards. (Warranted for life against delamination).
- D. Semi-exposed and concealed surfaces shall be permanently thermofused melamine laminate or high pressure decorative plastic laminate cabinet liner, 0.020" thickness for balanced construction. Thermofused melamine laminate shall meet the ALA 1996 specifications standard, as tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards.

2.03 EDGINGS

- A. Exposed exterior cabinet front edges shall be banded with a contrasting or matching rigid PVC extrusion, 0.020" thickness, resistant to chip, crack and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. The 0.020" thick edging shall be applied with waterproof hot melt adhesive.
- B. Door and drawer front edges shall be banded with a contrasting or matching rigid PVC extrusion, 3mm (1/8") thickness, resistant to chip, crack, and high impact. Edging shall have a satin finish with UV cured top coat for additional durability. The 3mm thick edging shall be applied with waterproof hot melt adhesive, and shaped to provide radiused edges and radiused corners.
- C. Adjustable shelves shall be banded with PVC extrusion, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging shall be applied with waterproof hot melt adhesive. Shelves to be 1" thick. 0.020" thick PVC edging shall be applied to four (4) edges of adjustable shelf.
- D. All other interior components, including drawers, shall be banded with a PVC extrusion, 0.020" in thickness, resistant to chip, crack, and high impact. Edging shall have a satin finish with a UV cured top coat for additional durability. Edging to be machine applied with waterproof hot melt adhesive.

2.04 COLOR SELECTIONS

- A. Exposed cabinet exteriors shall be chosen from Thermofused plastic laminate selections as depicted in manufacturer's color selector guide. A minimum of seventy (70) colors and patterns shall be available as standard selection.
- B. Exposed doors and drawer fronts shall be chosen from Thermofused plastic laminate selections as depicted in manufacturer's color selector guide. A minimum of seventy (70) colors and patterns shall be available as standard selection.
- C. Semi-exposed surfaces, including drawer box components, shall be finished in either pearl or grey as selected from casework manufacturer's standard interior color selections.

- D. Exposed interior components, including both faces of shelves and interior face of backs to match exposed cabinet exterior color selection.
- E. Door and drawer front edges shall be chosen from one of twenty-two (22) trim group colors in 3mm thick PVC in contrasting or matching colors as depicted in manufacturer's color guide.
- F. Exposed front edge of cabinet, including exposed interior edges, shall be selected from one of seventy (70) trim group colors in 0.020" thick PVC in contrasting or matching colors as depicted in manufacturer's color guide, or commercial match to selected exposed exterior color based on availability.
- G. Semi-exposed edges of cabinet components including drawers, shall be either pearl or grey in 0.020" thick PVC.
- H. Pulls shall be available in chrome, brass, bent wire and injection molded pulls in either bent wire or contour design, to be available in twenty (20) colors as selected from manufacturer's color selector.
- I. Casework of substitute brands with lesser amounts or more restrictive selection requirements will not be considered equal and shall be rejected.
- J. Finishes to be laminate manufacturer's matte, suede, or equivalent finish as approved by Architect. Samples will be reviewed by Architect for color, texture, and pattern only.

2.05 HARDWARE

A. Hinges

- 1. Concealed hinge shall be commercial grade 120 degree pivot overlay style. Hinges shall be two (2) piece construction with door hinge and cabinet mounting plate. Hinges shall be compact design with "minimal intrusive" mechanism into compartment space. Hinges shall have spring loaded self-close feature. Concealed hinges shall have 3-way (vertical, in-out, horizontal) alignment adjustments. Hinges shall be mounted with 5mm thread fasteners and nylon screw mount inserts.

- a. Two hinges used on all doors less than 47" in height, three hinges used on all doors 47" to 63" in height and four greater than 63" in height. Hinge to accommodate 13/16" (21 mm) door.
- B. Door catches shall be a heavy-duty spring loaded, large diameter (17.5mm - 11/16") roller type catch mounted at bottom edge. All doors over 48" in height shall be provided with roller catch at both top and bottom of door.
- C. Catch strike plate shall be injection molded ABS, with an integrally molded engagement ridge. Strike plate shall also provide a wide face bumper insuring a positive door stop.
- D. Pulls shall be impact resistant injection molded bent wire, 4" length available per color selection in Article 2.04.H.
- E. Drawer and slide out shelves shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral stability is achieved thru a special formed captive profile. Slides shall have 100 lb. load rating, with both in and out drawer stop, 3" self close feature and a side adjustment cam allowing 3mm side to side alignment.
- F. Drawers specifically noted for full extension file use shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral stability is achieved thru a special formed captive profile. Slides shall have 150 lb. load rating, with both in and out drawer stop, and 3" self close feature. File drawer shall include extruded top mounted molded side rails to accept standard hanging file folders.
- G. Knee-space, pencil drawers, and keyboard trays, shall be designed to permit under counter or support frame mounting, with 100 lb. nylon roller epoxy coated steel slides.
- H. Shelf support clips for 1" thick adjustable shelves shall be injection molded clear polycarbonate. Support clips shall incorporate integral molded lock tabs to retain shelf from topping or inadvertently being lifted out. Support clip shall have 5mm dia. double pin engagement into precision bored hole pattern in cabinet vertical members. Clips shall have a molded ridge which provide pressure against edge of shelving to maintain positive pin engagement. Clip shall be designed in such a manner to

provide means for permanent retention to shelf. Static test load must exceed 200lb. per clip.

- I. Dividers that are 1/4" thick shall be fully adjustable and retained with injection molded clear polycarbonate clip.
- J. Locks shall be cylinder type, diecast, with five (5) disc tumbler mechanism. Each lock shall be provided with milled brass key. Master key cabinets to room doors. Cabinets with multiple locks installed shall be keyed alike by room, with each cabinet in that room keyed the same unless otherwise specified. Locks shall be Remov-A-Core to give flexibility for different pass key options. Locks shall be provided on all cabinets capable of locking.

2.06 COMPONENTS

- A. Base and wall cabinet ends shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.A and edged as described in Article 2.03.A.
- D. Base cabinet tops and bottoms shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03.A.
- C. Wall cabinet top and bottom shall be 1" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03.A.
- D. Vertical cabinet members shall be 3/4" thick particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03D.
- E. Cabinet backs shall be 1/4" thick pre-finished industrial hardboard.
- F. Frame rails shall be 3/4" thick x 3 3/4" wide particle board, laminated for balanced construction, surfaced as described in Article 2.02.C, and edged as described in Article 2.03.A.

- G. Sub base shall consist of two (2) toe kick support rails shall be 3/4" thick x 3 3/4" high particle board and be inset from cabinet front and back edge, to give additional load support.
- H. Mounting rails shall be 3/4" thick x 3 3/4" wide particle board. Wall cabinets shall have rails positioned at the top and bottom. Base cabinet shall have rails positioned at the top of unit.
- I. Drawers shall be full box design with a separate front. Drawer sides and ends shall be constructed of 5/8" medium density fiberboard with pearl or grey color thermofused melamine laminate and matching PVC top edges. Bottoms shall be 1/4" thick medium density fiberboard, pearl or grey color thermofused melamine laminate.
- J. Adjustable shelves shall be 1" thick. Edges of shelf shall be banded as described in Article 2.03.C with a high impact, rigid PVC extrusion, pearl or grey in color.
- K. Solid hinged doors, and drawer fronts shall be 3/4" thick material of balanced construction, surfaced as described in Section 2.02.B, edged as described in Article 2.03.B.

2.07 CONSTRUCTION

- A. Cabinet parts shall be accurately machined and precision bored for premium grade quality joinery construction, utilizing automatic machinery to ensure consistent sizing on modular cabinets. Cabinets shall be assembled under controlled case clamp conditions, assuring final cabinet squareness and proper joint compressions.
- B. Cabinet ends shall be bored to receive 8mm, industrial grade hardwood laterally fluted dowels with chamfered ends. Cabinet ends shall be prepared to receive adjustable shelf hardware at 32mm (approximately 1 1/4") centers. Door hinges and drawer slides shall be machined drilled to maintain vertical and horizontal alignment of components. Inset grooving with chamfer shall be machined 3/4" from rear edge to accept the 1/4" back. Base units shall have one piece end panels continuous to floor for added load capabilities.

- C. Tops and bottoms shall be joined to cabinet ends using a minimum of six (6) dowels at each joint for twenty-four (24) inch deep cabinets and a minimum of four (4) dowels at each joint, for twelve (12) inch deep cabinets. All dowels to be industrial grade hardwood, laterally fluted, with chamfered ends and 8mm in diameter. Top of base cabinet will be full depth. Inset grooving with chamfer shall be machined 3/4" from rear edge to accept the 1/4" back.
- D. Vertical dividers shall be bored to receive adjustable shelf hardware at 32 mm (approximately 1 1/4") centers. Dividers shall be joined to tops and bottoms with 8mm diameter hardwood dowels.
- E. Frame rails shall be joined to ends with 8mm diameter hardwood dowels.
- F. Two (2) toe kick supports shall be inset from cabinet front and back edges, and doweled into cabinet ends with 8mm hardwood dowels.
- G. Mounting rails shall be fully concealed behind backs. Rails shall be 3/4" thick and fastened to cabinet ends with 8mm hardwood dowels. Wall cabinets shall incorporate two mounting rails. Wall cabinets shall have rails positioned at top and bottom. Base units shall have rail positioned in the upper back area.
- H. Back panels shall be 1/4" thick and inset 3/4" from rear edge of cabinet. Back shall be glued and continuously trapped in top, bottom and ends of cabinets.
- I. Drawer corner joints shall be interlocking dowel pin design. Hardwood dowel pins, 8mm diameter shall be inserted into drawer fronts and backs to fit into machined hole patterns in drawer sides. Bottoms shall be trapped into grooves on all four sides glued and mechanical fastened. Drawers shall be suspended on slides as described in Article 2.05.E.

2.08 WORK SURFACES

- A. Core material having particle board shall be of a minimum 45 lb. density, M-2 industrial grade. The particle board used shall have been tested under ANSI A208.1 1993 standards and/or ASTM D 1037-91A.

- B. Surface material and backsplash shall be 1/2" or 3/4" solid surface material. Refer to Spec Section 09540 "Special Surfaces".
- C. Exposed edges shall be high 180 degree roll-edge unless noted otherwise on drawings.
- D. Underside of all work surfaces to have BK-20 backer or approved equivalent. This balance sheet shall be thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F. temperature.
- E. Counter Tops (Alternate - Clemens Center-Clerk Storage)
 - 1. Deck shall consist of two layers of 3/4" (19 mm) particle board at the front edge and all other exposed edges providing a total thickness of 1 1/2" (40 mm). Solid patterns or wood grain colors high-pressure plastic laminate may be selected for the surfaces. The method of application of the laminate to the substrate shall be as recommended by the Decorative Plastic Laminate Association.
 - a. Medium density fiberboard (MDF) shall be used in high stress areas as drawer members and shall be minimum 48 lb. density MD-21 grade and tested under ANSI A208.2 1994 Standards.
 - 2. Attached back splashes will have 1/4" (6 mm) of scribe on them to allow for normal field variances. Loose back splashes will not have scribe.
- F. Physical Properties shall meet minimally:
 - 1. Flexural Strength ASTM-Method D-790 16,000/psi
 - 2. Compressive Strength ASTM-Method D-695 36,500/psi
 - 3. Hardness Rockwell M ASTM-Method D-785 110
 - 4. Density Gr./CC. ASTM-Method D-792 123.55 lbs/ft³
 - 5. Water Absorption ASTM-Method D-570 0.0076%
 - 6. Flame Test ASTM-Method D-635 Self-Extinguishing

2.09 COLOR SELECTION

A. Laminate Color Selection:

1. Select from the full range of Wilsonart®, Formica, Laminart, Nevamar Corp. and Arborite-Div. of ITW Canada, stock color charts for cabinet faces, exposed ends, open interiors and countertops.

B. Hinge and Pull Color Selection:

1. Select from full range of stock and custom colors.

C. Miscellaneous Hardware Color Selection (support brackets, table frames, rail):

1. Select from full range of stock and custom colors.

D. 3mm PVC Edge Banding Color Selection:

1. Select from full range of stock and custom colors.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The Installer must examine the job site and the conditions under which the work in this section is to be performed, and notify the General Contractor in writing of any unsatisfactory conditions. Do not proceed with work under this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. Casework, countertops, and related materials to be conditioned to average prevailing humidity condition in installation areas prior to start of work.
- C. Install casework and countertops with factory-trained supervision authorized by manufacturer. Casework shall be installed plumb, level, true and straight with no distortions. (Shim as required). Securely attached to building structure with anchorage devices of appropriate type, size and quantity to meet applicable codes, specifications and safety conditions. Where laminate clad casework and countertops abuts other finished work, scribe and trim to accurate fit.

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- D. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by the manufacturer.
- E. Repair, or remove and replace, defective work as directed upon completion of installation.
- F. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts of units.
- G. Advise Owner's Representative of procedures and precautions for protection of casework and countertops from damage by other trades until acceptance of work by Owner.
- H. Cover casework with 4-mil polyethylene film for protection against soiling and deterioration during remainder of construction period.

END OF SECTION 12300

**SECTION 210500
COMMON WORK RESULTS FOR FIRE SUPPRESSION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.
- B. Incoming fire service backflow preventer.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 09 9123 - Interior Painting: Preparation and painting of interior fire protection piping systems.
- C. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Piping identification.
- E. Section 21 1200 - Fire-Suppression Standpipes: Standpipe design.
- F. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

- A. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- B. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2016.
- F. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard 2017.
- G. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings 2018.
- H. ASME B16.11 - Forged Fittings, Socket-welding and Threaded 2016 (Errata 2017).
- I. ASME B16.25 - Buttwelding Ends 2017.
- J. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- L. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe 2021.
- M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- N. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
- O. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40 2017.
- P. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 2019.

- Q. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR) 2019.
- R. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings 2014.
- S. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).
- T. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2010.
- U. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 2012.
- V. AWWA C606 - Grooved and Shouldered Joints 2015.
- W. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- X. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems 2019.
- Y. UL (DIR) - Online Certifications Directory Current Edition.

1.04 PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13 - Standard for the Installation of Sprinkler Systems
 - 2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems
 - 3. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection
- B. Delegated Design: Engage a qualified Fire Protection professional engineer, as defined in Section 014000 "Quality Requirements," to design project sprinkler systems. Base calculations on results of fire-hydrant flow test. Flow test shall be performed within one year of construction start.
- C. Hydraulic Design Criteria: Sprinkler system design shall be approved by authorities having jurisdiction, Owner's Insurance Underwriter (where applicable) and shall be designed according to the following:
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers, or 10 psi, whichever is greater.
 - 2. Sprinkler Occupancy Hazard Classifications: Refer to Drawings.
 - 3. Minimum Density for Automatic-Sprinkler Piping Design: Refer to Drawings.
 - 4. Maximum Protection Area per Sprinkler: According to the latest NFPA 13 standard, UL listing and as specified on Drawings.
 - 5. Total Combined Hose-Stream Demand Requirement: According to latest NFPA 13 standard unless otherwise indicated on drawings.
 - 6. Water velocity in the piping system shall not exceed the following:
 - a. Underground mains: 16 ft/sec.
 - b. Aboveground mains: 32 ft/sec.
 - c. Sprinkler branch lines: 20 ft/sec.
 - 7. Water supply noted on the drawings. If not, Contractor shall make flow test to ascertain water flow.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Delegated-Design Submittal: For all sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified

professional engineer responsible for their preparation.

1. Shop Drawings and Hydraulic Calculations:
 - a. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals.
 - b. Indicate installation, layout, weights, mounting and support details, and piping connections.
 - c. Layout and name (or number) of each room repeated as shown on the Architect's/Engineer's plans.
 - d. Reflected ceiling plan for each area showing location of partition walls, ceiling grid lines, ceiling light fixtures; proposed location of all fire sprinkler heads; and size and location of all piping. Shop drawings shall clearly identify any areas proposed to be protected with "dry type" systems and "anti-freeze type" systems and shall identify sprinkler heads rated for discharge at temperatures other than 165 degrees F.
 - e. Shop drawings shall be submitted to the Architect/Engineer, AHJ and Owner's Insurance Underwriter (where applicable) for review and approval.
- C. Product Data: For each type of product.
 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department or pump test header connection.
 3. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable Victaulic style number.
- D. Shop Drawings, Product Data and Hydraulic calculations shall be reviewed as one package; review of submittals shall not start until Engineer has all product data, hydraulic calculations and shop drawings.

1.06 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 1. Provide fire protection work per the mandatory code requirements, standards of NFPA, and the requirements of the Owner's Insurance Underwriter, where applicable, except where more stringent requirements are indicated, as modified and supplemented by the Contract Documents. The NFPA requirements include the appendices and supplements.
 2. The provisions and recommendations of the NFPA constitute mandatory minimum requirements for work specified herein. No payment will be made by the Owner for extra charges for work added in order to comply with NFPA Standards and Owner's Insurance Underwriter requirements, where applicable.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified Fire Protection engineer.
- D. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.
- E. Comply with UL (DIR) requirements.

- F. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- G. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
- H. Pipe: Each length of pipe shall be legibly identified at mill by paint, stenciling or raised symbols identifying manufacturer and class type or schedule of pipe. Copper pipe shall be identified at 3 foot intervals.
- I. Fittings: To be identified by manufacturer by permanently attached tags, imprints or other approved means indicating class of wall thickened and material.

1.07 DEVIATIONS FROM BASIS OF DESIGN MANUFACTURER

- A. Should the Division 23 Contractors submit equipment by a Manufacturer other than that indicated as the Basis of Design on the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design (roof openings, curbs, structural support, etc.) and coordination of any differing dimensions and clearances with all other trades.

1.08 FIELD CONDITIONS - RENOVATION PROJECTS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - 1. Notify Architect & Construction Manager no fewer than five days in advance of proposed interruption of sprinkler service.
 - 2. Do not proceed with interruption of sprinkler service without Architect's and Construction Manager's written permission.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

- A. Sprinkler Systems: Comply with NFPA 13.
- B. Standpipe and Hose Systems: Comply with NFPA 14.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 BURIED PIPING

- A. Steel Pipe: ASTM A53/A53M Schedule 40 or ASTM A135/A135M Schedule 10, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
 - 1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASME B16.25, buttweld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
 - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
 - 3. Joints: Welded in accordance with AWS D1.1/D1.1M.

4. Casing: Closed glass cell insulation.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
 1. Fittings: AWWA C110/A21.10, standard thickness.
 2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket.
 3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.03 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A53 Schedule 40 or ASTM A135/A135M Schedule 10, black.
 1. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
 2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
 3. Ductile iron Fittings: ASTM A536, Grade 65-45-12. In applicable sizes, fittings shall be short pattern, with flow equal to standard pattern fittings.
 - a. Basis of Design: Victaulic FireLock.
 4. Mechanical Grooved Couplings: Two ductile iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, ASTM A449 compliant steel bolts, nuts; galvanized for galvanized pipe.
 - a. Rigid Type: Housings cast with offsetting, angle-pattern, bolt pads to provide system rigidity and support and hanging in accordance with NFPA-13, fully installed at visual pad-to-pad offset contact. Couplings that require exact gapping at specific torque ratings are not permitted.
 - 1) Installation-Ready for complete installation without field disassembly.
 - 2) Basis of Design: Victaulic Style 009N and 107N.
 - b. Flexible Type: For use in locations where vibration attenuation and stress relief are required.
 - 1) Basis of Design: Victaulic Installation-Ready Style 177 or Style 77.
 - c. Installation-Ready gaskets are center-leg, with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth.
 5. Installation-Ready fittings for Schedule 40 & 10 grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½ (DN 32 thru DN 65). Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready ends, orange enamel coated, red enamel coated or galvanized. Fittings complete with prelubricated Grade "E" EPDM Type 'A' gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa).
 6. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.
- B. CPVC Pipe (for Residential NFPA 13R applications only): ASTM F442/F442M, SDR 13.5.
 1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.
 2. Joints: Solvent welded, using ASTM F493 cement.

2.04 PIPE SLEEVES

- A. Vertical Piping:
 1. Sleeve Length: 1 inch above finished floor.
 2. Provide sealant for watertight joint.
- B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

- C. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc coated or cast iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
 - 1. Brass pipe.
 - 2. Connect sleeve with floor plate.
- E. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 - 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 - 2. Connect sleeve with floor plate except in mechanical rooms.
- F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
 - 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 - 2. Connect sleeve with floor plate except in mechanical rooms.
- G. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
 - 3. Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.05 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Modular/Mechanical Seal:
 - 1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 - 2. Provide watertight seal between pipe and wall/casing opening.
 - 3. Elastomer element size and material in accordance with manufacturer's recommendations.

2.06 ESCUTCHEONS

- A. Material:
 - 1. Metals and Finish: Comply with ASME A112.18.1.
- B. Construction:
 - 1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
 - 2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.07 PIPE HANGERS AND SUPPORTS

- A. Supporting Elements: provide UL/FM components per NFPA 13, ANSI B 31.1 and MSS SP-58 except that "C" clamps or any modification thereof are unacceptable.
 - 1. "C" clamps: With set screw, locknut and restraining strap are acceptable for piping up to 2-1/2".
- B. Furnish necessary piping and equipment supporting elements including; building structure attachments; supplementary steel; hanger rods, stanchions and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides.
- C. Center Loading Beam Clamps: For attachments to building structure as approved except piping supported from top of steel.

2.08 MECHANICAL COUPLINGS

- A. Manufacturers:
 - 1. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
 - 2. Victaulic Company: www.victaulic.com/#sle.
 - 3. Anvil/Gruvlok: www.anvilintl.com
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Rigid Mechanical Couplings for Grooved Joints:
 - 1. Dimensions and Testing: Comply with AWWA C606.
 - 2. Minimum Working Pressure: 300 psig.
 - 3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
 - 4. Gasket Material: EPDM-HP suitable for operating temperature range from minus 30 degrees F to 250 degrees F.
 - 5. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.
- C. Only use grooved coupling as permitted by NFPA 13 and NFPA 14.

2.09 INCOMING FIRE SERVICE BACKFLOW PREVENTER

- A. A backflow preventer assembly shall be installed on fire protection systems when connected to a drinking water supply. Degree of hazard present and type of incoming service backflow preventer shall be coordinated with the Authority Having Jurisdiction.
- B. Double Check Detector Assembly
 - 1. ASSE 1048, UL 1469, AWWA C510-92: The main valve body shall be manufactured from 300 Series stainless-steel to provide corrosion resistance, 100% lead free* through the waterway. The double check detector assembly consists of two independently operating, spring loaded check valves, two UL, FM, OSY resilient seated gate valves, and bypass assembly. The bypass assembly consists of a meter, a double check including shutoff valves and required test cocks. Each cam-check shall be internally loaded and provide a positive drip tight closure against reverse flow. Cam-check includes a stainless-steel cam arm and spring, rubber faced disc and a replaceable seat. There shall be no brass or bronze parts used within the cam-check valve assembly. The check valve seats shall be of molded thermoplastic construction. The use of seat screws as a retention method is prohibited. All internal parts shall be accessible through a single cover on the valve assembly. The valve cover shall be held in place through the use of a single grooved style two-bolt coupling. The bypass line shall be hydraulically sized to accurately measure low flow. The bypass line shall consist of a meter, a small diameter double check assembly with test cocks and isolation valves. The bypass line double check valve shall have two independently operating modular poppet check valves, and top mounted test cocks.
 - 2. May be installed horizontal or vertical "flow up" position.
 - 3. Basis of Design: Ames Series 3000SS

PART 3 EXECUTION

3.01 FIRE SUPPRESSION PIPING APPLICATIONS

- A. CPVC pipe, Schedule 40 or Schedule 80 CPVC fittings, and solvent-cemented joints may be used for residential occupancies ONLY.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
 - 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

2. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 (DN 65) and larger, shall be one of the following:
 1. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 2. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 3. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 4. Schedule 10, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 5. Schedule 10, black-steel pipe with plain ends; welding fittings; and welded joints.
- D. High-pressure, wet-pipe sprinkler system, shall be one of the following:
 1. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

3.03 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.
- C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- D. Install piping to conserve building space, to not interfere with use of space and other work.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 2. Place hangers within 12 inches of each horizontal elbow.
 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 6. Provide copper plated hangers and supports for copper piping.
- H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of

zinc rich primer to welding.

- J. Structural Considerations:
 - 1. Do not penetrate building structural members unless indicated.
- K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- L. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 - 3. Locate piping in center of sleeve or penetration.
 - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 - 5. Tighten bolting for a water-tight seal.
 - 6. Install in accordance with manufacturer's recommendations.
- M. Escutcheons:
 - 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
 - 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
 - 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- O. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.
- P. Where pipes are in partitions, furred out spaces and chases, obtain information as to their exact location and size and install work so as to be entirely concealed in allotted space. If conflicts arise making this impossible, obtain instructions from Architect before proceeding with work.
- Q. Where there is evidence that parts of fire protection work will interfere with other work, assist in working out space conditions and/or structure, make necessary adjustments to accommodate work.
- R. Fire protection work installed before coordinating with other work so as to cause interference with other work to be changed to correct such condition without additional cost to Owner.
- S. Accessibility:
 - 1. Install fire protection work to permit removal (without damage to other parts) of coils, heat exchangers, pumps, fan shafts and wheels, belt guards, sheaves and drives and other parts requiring periodic replacement or maintenance.

2. Arrange pipes and equipment to permit ready access to valves, cocks, traps, starters, motors, dampers, control components and to clear openings of swinging and overhead doors and of access panels.
- T. When necessary to install "U"-shaped dip in a pipe due to a conflict with duct work or other building components, Contractor shall install a $\frac{3}{4}$ " diameter hose nipple and cap pointing down at lowest point in pipe dip. Contractor shall try to arrange piping layout to avoid such dips; no such dip shall be installed without prior approval of Engineer. All such conditions shall be clearly located and noted on record drawings given to Owner.
- U. When necessary to install inverted "U" in branch piping to rise above an obstruction, Contractor shall install an upright $\frac{3}{4}$ " diameter air vent nipple and cap at high point of inverted "U". Contractor shall try to arrange piping layout to avoid such high points; no such installation shall be made without approval of Engineer. All such conditions shall be clearly located and noted on record drawings given to Owner.
- V. Contractor shall provide Owner with at least 24 hours prior notice before commencing sprinkler installations. Owner shall be responsible for deactivating building alarm system and notifying local fire department or other agencies. Under no circumstances shall Contractor attempt to deactivate building alarm system or circumvent any valve tamper switch. Contractor shall perform all work during normal business hours. By the end of each working day, Contractor shall cap all pipe ends.
- W. Pressure test completed work in progress, repair any leaks and otherwise make the sprinkler system water tight so that fire alarm and sprinkler protection system can be reactivated by Owner during non-business hours.

3.04 SOUND CONTROL

- A. Penetrations shall be maintained airtight to prevent sound transfer.
- B. Piping shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.05 CLEANING

- A. Flush entire piping system of foreign matter in accordance with NFPA 13.
- B. Upon completion of work, clean all parts of the installation.
- C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

3.06 TESTING AND ACCEPTANCE

- A. After completing branch system, Contractor shall test fire sprinkler piping hydrostatically for a period of two hours at not less than 200 psi or at 50 psi in excess of the maximum operating static pressure when the maximum static pressure exceeds 150 psi. Contractor shall check system for leakage of joints and measure hydrostatic pressure at low point of each system or zone being tested.
- B. The Contractor shall repair or replace piping and fittings as required to eliminate leakage (in accordance with NFPA standards for "little or no leakage") and retest as specified to demonstrate compliance.
- C. Upon satisfactory completion and testing of branch piping system, Contractor shall provide Owner with a letter certifying that branch piping system has been completed in accordance with NFPA 13 and is operational, complete and has no defects.
- D. Test shall be witnessed by Architect/Owner and any authorities having jurisdiction who may so require.

**SECTION 210553
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Control Panels: Nameplates.
- B. Pumps: Nameplates.
- C. Valves: Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Laminated three-layer plastic with engraved letters.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

**SECTION 212200
CLEAN-AGENT FIRE-EXTINGUISHING SYSTEM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire suppression system control panel.

1.02 RELATED REQUIREMENTS

- A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Design Data: Submit design calculations stamp of approval from Authority Having Jurisdiction. Include calculated system pressures, nozzle flow rate, orifice code numbers, piping pressure losses, component flow data, and pipe sizes.

PART 3 EXECUTION

2.01 INSTALLATION

- A. Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient. Install piping to conserve building space, and not interfere with use of space and other work.
- B. Identify in accordance with requirements of referenced standard.
- C. In rooms with suspended ceiling tiles, clip or retain tiles within 4 foot (1.2 m) radius of the nozzles to prevent lifting during discharge.
- D. Install wiring in compliance with NFPA 70, see Section 260583.

2.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 014000 - Quality Requirements.
- B. Test distribution piping and valving, prior to nozzle installation, to 50 psi (340 kPa) air pressure test. Inspect joints using soap water solution or halide torch or lamp. Repair leaks and retest. Maintain test pressure for four hours.
- C. Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.
- D. Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, and storage container pressure. Test supervision of each circuit.
- E. Check each ionization detector with a sensitivity meter, adjust. Record sensitivity, and include record in test report.
- F. Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.
- G. Pressure test entire enclosure with test fan, pressurizing protected area both under positive and negative conditions. Confirm that leakage is within system design allowance.

**SECTION 220005
BASIC PLUMBING REQUIREMENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. This section applies to all sections of Division 22.
- B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.
- C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.
- D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under item "A" above.

1.02 APPLICATION

- A. This section applies to all plumbing work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required.
- B. The plumbing contractor is responsible for the installation and operation of the plumbing systems.
- C. The plumbing contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

1.03 INSPECTION OF SITE

- A. Each Contractor shall visit the site prior to bid submission to determine all existing conditions that may affect his work and shall make appropriate allowances for such conditions in his bid. Failure to visit the site shall not be cause for a request for additional compensation later in the project during construction.
- B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.
- C. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- D. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

1.04 ALTERNATES AND SUBSTITUTIONS

- A. Refer to Division 01 - General Requirements for procedures to submit products by a Manufacturer that is not listed as approved equal in the Specifications.

1.05 DEVIATIONS FROM BASIS OF DESIGN MANUFACTURER

- A. Products identified within the schedules and details are used as the basis of design for laying out and coordinating with other trades such as structural, architectural, and electrical. Should Division 22 Contractor submit products by a manufacturer other than that indicated as Basis of Design in the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design and coordination of

any differing dimensions and clearances with all other trades. This evaluation shall be included as part of the proposed product submittal.

1.06 MATERIALS

- A. Plumbing equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.
- B. The Plumbing trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 22 of these specifications, including all wiring devices, transformers, conduit, etc. Any conduits used for control wiring shall meet the specifications as indicated in Division 26.
- C. Power wiring 120 volts and greater shall be by the Electrical Trades.

1.07 CODES, PERMITS AND FEES

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for plumbing work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 22 shall be the latest issue, unless otherwise noted.
- B. Rules of local utility companies and municipalities shall be complied with. Check with the utility company and/or municipality supplying service to the installation and determine all devices including, but not limited to: meters, regulators, valves which will be required and include the cost of all such items in the proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.08 MAINTENANCE

- A. Provide 8 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.
- B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Manuals shall be submitted in electronic format for review. When approved, four (4) bound hard copies and an indexed electronic PDF shall be provided to the owner. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

1.09 WARRANTY AND GUARANTEE

- A. Contractor shall guarantee all work installed by him or his subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

1.10 SUBMITTALS

- A. Shop drawings and samples shall be submitted in compliance with the Conditions of the Contract and Division 1 General Requirements.
- B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (plumbing piping, plumbing fixtures, etc.). Refer to other sections of the electrical specifications for additional requirements.
- C. Shop Drawings: Each piece of equipment shall be identified by the number shown in the schedules and by specification article number pertaining to the item. Shop drawings shall as a minimum be ¼" equals 1' 0" scale, and shall be newly prepared by the Contractor and not reproduced from the Architect's drawings. Layouts shall be made for all floor plans including all ductwork, piping, electrical distribution and other mechanical equipment. Layouts shall show clearances of piping, ducts, etc., above floor.
- D. Contractor shall obtain Engineer's approval on all the work before any equipment is purchased, or any work installed. Contractor shall also secure approval of the Governmental Authorities having jurisdiction on all equipment and on the layout of the complete system.
- E. The Engineer's review and approval of shop drawings is a gratuitous assistance and in no way does it relieve the Contractor from responsibility for errors or omissions which may exist on the shop drawings. Where such errors or omissions are discovered later, they must be made good by the Contractor, without any additional cost to the Owner, irrespective of any approval by the Engineer.
 - 1. The Contractor shall incorporate with his shop drawings, a letter indicating all deviations from the plans and/or specifications. If in the opinion of the Architect, the deviations are not equal, the Contractor will be required to furnish the item as specified and as indicated on the drawings.
 - 2. Record documents shall be submitted in compliance with the requirements of the Specifications.
- F. Engineer WILL NOT REVIEW:
 - 1. Submittals not specified.
 - 2. Submittals not reviewed by Contractor; including Contractor stamp with signature comments.
 - 3. Submittals made after work is delivered to site and/or installed.
 - 4. Submittal resubmissions unless resubmission is required by Architect/Engineer.
- G. Installation of any item that requires submittal approval by the engineer shall be installed at the contractor's risk. The contractor, at his cost, shall remove all work installed prior to approval of the submittal.
- H. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from errors in submittals.
- I. For underground piping, record dimensions and invert elevations of all piping, including all offsets, fittings, cathodic protection and accessories. Locate dimensions from benchmarks that will be preserved after construction is complete.

1.11 RECORD DRAWINGS

- A. Refer to Division 01 - General Requirements for procedures. All literature shall be furnished in accordance with requirements listed in Division 01.
- B. Contractor shall provide the following record drawings as part of the Project closeout document process:

1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.
2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

1.12 QUALITY ASSURANCE

- A. Other referenced standards:
 1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE.

PART 2 PRODUCTS

2.01 SLEEVES AND ESCUTCHEONS

- A. Provide sleeves wherever pipes pass through exterior wall and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleeves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit within the sleeve shall be sealed at each installation with a 3M approved sealant.

2.02 DIELECTRIC UNIONS

- A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.
- B. Dielectric waterway fittings shall be a copper-silicon casting conforming to UNS C87850, and UL classified in accordance with ANSI / NSF-61 for potable water service.

2.03 BUILDING ATTACHMENTS FOR PLUMBING WORK SUPPORTS

- A. General Requirements:
 1. Provide building attachments required for supporting plumbing work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.
 2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.
 3. If specially designed building attachments are required, retain the services of a licensed structural engineer to design such building attachments.
 4. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.
 5. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.
- B. Attachments to Structural Steel:
 1. Support plumbing work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.
 - a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.
 - b. Side beam clamp with retaining clips - for loads up to 120 lb.
- C. Cast in Place Concrete Inserts:
 1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#

- D. Drilled Insert Anchors:
1. Where plumbing work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.

PART 3 EXECUTION

3.01 GENERAL

- A. Existing piping: when encountered during the course of work, protect, brace and support existing piping where required for proper execution of the work.
- B. Interruption of existing active piping: when the course of work makes shut-down of services unavoidable, the plumbing contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference with established operating routine.
- C. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderly fashion.
- D. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

3.02 INTERPRETATION OF CONTRACT DOCUMENTS

- A. Should there be discrepancy or a question of intent, refer matter to Architect/Engineer for decision before ordering any equipment or materials or before starting any related work.
- B. Drawings and Specifications are to be taken together. Work specified and not shown or work shown and not specified shall be performed or furnished as though mentioned in both Specifications and Drawings. If there is discrepancy between Drawings and Specifications as to quantity or quality to be provided, the greater quantity or better quality shall be provided.
- C. Minor items and accessories or devices reasonably inferable as necessary to complete and proper installation and operation of any system shall be provided by Contractor for such system whether or not specifically called for by Specifications or Drawings.
- D. Architect/Engineer may change location of any equipment 5' and any piping, ductwork, conduit, etc. 10' in any direction without extra charge, provided such changes are made before installation.
- E. Locations of items not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and shall be subject to review and approval by Architect/Engineer.
- F. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points.
 1. Where headroom or space conditions appear inadequate, notify Architect or Owner's field representative before proceeding with installation.
 2. Pipe/duct rerouting and size changes shall be made at no additional cost to the Owner.
- G. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, and also furnish information and shop drawings necessary to permit installation of other work without delay.

- H. Where there is evidence that parts of the Work specified in Divisions 21, 22, and 23 will interfere with other work, assist in working out space conditions to make satisfactory adjustments, revise and submit coordinated shop drawings.
- I. After review and without additional cost to the Owner, make minor modifications in the work as required by structural interferences, by interferences with work of other sections or for proper execution of the work.
- J. Work installed before coordinating with other work so as to cause interference with other work shall be changed and corrected without additional cost to the Owner.
- K. Drawings are diagrammatic in nature and are a graphic representation of requirements and shall be followed as closely as actual building construction will permit. All changes from the plans necessary to make the work conform to the building as constructed and to fit the work of other trades or to conform to rules of the Governmental Authorities having jurisdiction, NFPA, OSHA and the Owner's Insurance Underwriters, shall be made by the Contractor without extra cost to the Owner.
- L. The layout of the piping, ductwork, equipment, etc., as shown on the drawings shall be checked and exact locations shall be determined by the dimensions of the equipment approved and the Contractor shall obtain approval for the revised layout before the apparatus is installed. The Contractor shall field measure or consult existing record Architectural and Structural Drawings if available for all dimensions, locations of partitions, locations and sizes of structural supports, foundations, etc.
- M. Omission in the Drawings and/or Specifications of any items necessary for the proper completion or operation of the work outlined in this specification shall not relieve the Contractor from furnishing same without additional cost to the Owner.
- N. The Equipment Shop Drawings should be furnished to the installing Contractor by the purchasing Contractor before roughing in. Contractor shall not install any piping or ductwork for said equipment until he has received approved shop drawings for same.

3.03 ALTERATIONS IN PRESENT BUILDING AND SYSTEMS

- A. Contractor shall take particular note of the revisions and alterations to the existing systems, facilities and equipment due to the new construction as indicated on the Drawings and/or in Specification. Contractor shall remove, reroute or alter all services, ductwork, etc., as required or as indicated on the drawings.
- B. The Contractor shall maintain all services in the existing building. In case, where new service connections are to be made to existing services and service interruptions can in no way be avoided, the service interruptions shall be with the minimum of inconvenience to the Owner and the work shall be done at such time of any day, Saturday and Sunday included, and only as directed by the Owner or the Architect.

3.04 ACCESSIBILITY

- A. Do not locate traps, valves, controls, unions, cleanouts, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in plumbing systems.

3.05 ACCESS PANELS:

- A. Refer to Division 08 - Openings; Provide access doors in locations as required by applicable codes and as indicated below. Coordinate locations with architectural trades.
- B. Submit shop drawings for review before ordering panels. Where fire rating is required, furnish label doors compatible with fire rating of assembly.

- C. Contractor shall confer with other trades with respect to access panel locations, and shall wherever practical group valves, traps, dampers, etc. in such way as to be accessible from single panel and eliminate as many access panels as possible.
- D. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.
- E. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials.

3.06 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Contractor shall furnish and install sheet metal drain pans beneath piping that is routed above electrical equipment and/or above the 3' access space in front of such equipment. Electrical equipment, for the purpose of addressing drain pan requirements, shall be defined as free-standing or wall-mounted switchgear, transformers, distribution boards or motor control centers.
 - 1. Drain pans shall be 20 gauge galvanized sheet metal with a minimum 4" high turned up edge. Bottom of drain pan shall slope to a single drainage point at $\frac{1}{8}$ " per foot. A 1" diameter clear plastic tube shall allow collected fluid to drain to the nearest open site floor drain. Secure plastic tubing to building structure only.
 - 2. Drain pan shall be hung from building structure with angle iron trapeze hangers (no hanger shall penetrate the drain pan). Consider drain pan to be full of water for hanger load calculations.
 - 3. Drain pans shall include liquid detectors with alarms only if noted on the drawings. Liquid detectors shall be specified in Section 22 10 06 Plumbing Piping Specialties.
- B. Contractor shall include provisions to adjust the local lighting layout, at no extra cost to Owner, in order to accommodate any detrimental effect the drain pan has on the illumination of the electrical equipment and access space.

3.07 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

- A. Refer to Division 01 - General Requirements.
- B. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective, responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.
- C. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

3.08 EXCAVATION AND BACKFILLING

- A. Provide all excavation, trenching, tunneling, removal of materials, de-watering and backfilling required for the proper laying of pipes and plumbing work. Coordinate the work with other excavating and backfilling in same area.

3.09 ROUGH-IN FOR CONNECTION TO EQUIPMENT

- A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

3.10 MATERIAL AND EQUIPMENT

- A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

3.11 SEAL PENETRATIONS

- A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

3.12 SOUND CONTROL

- A. Penetrations shall be maintained airtight to prevent sound transfer.
- B. Piping shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.13 FIRESTOPPING

- A. Refer to Division 07 - Thermal and Moisture Protection for more information.
- B. Provide UL classified firestopping system for plumbing penetrations through rated walls and floors to maintain the fire rating.

3.14 CONTROL WIRING

- A. All control wiring for plumbing and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

3.15 CLEANING, FLUSHING, AND INSPECTING

- A. Refer to Division 01 - General Requirements; all plumbing equipment and components shall be cleaned as frequently as necessary through the construction process and again prior to project completion.
- B. Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
- C. Sufficient flushing water shall be introduced into the mains to produce a velocity of not less than 4' per second and this flow rate shall be continued until the discharge is clean and clear and does not show evidences of silt or foreign matter when a sample is visually inspected.
- D. Inspect pressure piping in accordance with procedures of ASME B31.

3.16 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

- A. Refer to Division 01 - General Requirements; all equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.
- B. On-site storage shall be coordinated with Construction Manager/General Contractor and be performed in a manner as to avoid damage, deterioration and loss.
- C. Contractor shall provide temporary protection for installed equipment prior to project completion.

- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. All equipment shall be inspected prior to installation to assure that equipment is free from defect and damage.
- F. Protect plumbing fixtures and piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.17 PIPING TESTS

- A. Test pressure piping in accordance with ASME B31.
- B. General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible and remove control devices before testing. Test each natural section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
 - 1. Test each piping system at 150% of operating pressure, or other pressure as required by Authority Having Jurisdiction, whichever is greater.
 - a. Domestic water systems and equipment vents shall be tested hydrostatically for minimum of four hours at 1½ times design pressure for that system, or 100 psig minimum, whichever is greater, unless otherwise specified.
 - b. Storm, soil, waste and vent piping shall be tested with water for minimum of 24 hours at 10 feet head.
 - c. Acid resistant waste and vent systems shall be tested as per manufacturer's recommendations.
 - 2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics or other temporary repair methods.
- D. Drain test water from piping systems after testing and repair work has been completed.

**SECTION 220505
SELECTIVE DEMOLITION FOR PLUMBING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Demolition and extension of existing plumbing work.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.

1.03 SUMMARY

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of minor electrical demolition as described in this specification.
- B. The demolition documents plans and specification have been prepared from existing non-as built documents and cursory non-invasive field investigation.
- C. It is the contractors obligation to become familiar with the extent of demolition and the existing condition before submitting their bid.
- D. During demolition if the contractor discovers unforeseen significant non-code compliance conditions of the existing installation they shall notify the Architect and Engineer immediately in writing.
- E. The contractor shall become familiar with the drawings and scope of work of other trades as the work scope of those trades relates to mechanical equipment and connection requirements.
- F. During demolition the contractor shall record on site as-builts all plumbing sanitary, waste and domestic hot, cold and hot water recirculation capped branches for reuse in renovated project space.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping to be demolished serve only equipment and facilities within the demolition areas.
- B. Demolition drawings are based on casual field observation and existing record documents.
- C. Report discrepancies to Owner before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Identify locations for capping plumbing piping before any demolition work commences.
- B. Coordinate utility service shut-downs with Utility Companies.
- C. Provide temporary connections to maintain existing systems in service during construction.
- D. Confirm isolation valve locations for domestic water piping. Repair leaking isolation valves or replace inoperable valves before commencing piping demolition.

3.03 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

- A. In general plumbing remodeling work is shown on Drawings but carefully study all drawings for all contracts for "demolition" and "remodeling" work in existing building and field check to verify locations where such work is being done to determine exact extent of work required. No extra will be allowed for additional work required because of demolition or remodeling whether or not work is specifically noted, itemized or shown on Drawings.
- B. Remove existing equipment and materials pertaining to contract as specified or as required, whether shown on Drawings or not, to prepare for new work of all contracts.
- C. Where necessary, reroute piping, ducts, etc. from within walls, floors, ceilings, etc. being removed. Contractor involved with interrupted service shall be responsible for accomplishing required work whether shown on Drawings or not.
- D. Remove, relocate, and extend existing plumbing piping to accommodate new construction.
- E. Remove domestic water piping back to main and provide isolation valve and cap. DEAD LEGS ARE NOT ALLOWED.
- F. Remove sanitary and waste piping to branch connection fitting to negate any dead legs.

3.04 CLEANING AND REPAIR

- A. Refer to Division 01 - General Requirements for procedures.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.

**SECTION 220719
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2013).
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2019.
- E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.

2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
 1. Vapor Barrier Lap Adhesive shall be compatible with the insulation and as recommended by the insulation manufacturer.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- G. Indoor Vapor Barrier Finish:
 1. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.
 2. Armacell LLC: www.armacell.us/#sle.
 3. K-Flex USA LLC: www.kflexusa.com/#sle.
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 220 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETS

- A. PVC Plastic.
 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com/#sle.
 - b. Proto Corporation: www.protocorporation.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
- H. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

- A. Plumbing Systems:
 - 1. Domestic Hot Water Supply & Recirculation:
 - a. Pipe Size Range: 1/2 to 1-1/4 inch
 - 1) Thickness: 1 inch
 - b. Pipe Size Range: 1-1/2 to 8 inch
 - 1) Thickness: 1-1/2 inch
 - 2. Domestic Cold Water: 1 inch thick.
 - 3. Roof Drain Bodies: 1/2 inch thick.
 - 4. Roof Drainage Above Grade: 1/2 inch thick with PVC jacket.
 - 5. Plumbing Vents Within 10 Feet of the Exterior: 1/2 inch thick with PVC jacket.
- B. Cooling Systems:
 - 1. Condensate Drains from Cooling Coils: 1 inch thick.
- C. Other Systems:
 - 1. Piping Exposed to Freezing with Heat Tracing: 1 inch or as recommended by heat tracing manufacturer.

**SECTION 221005
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Flanges, unions, and couplings.
 - 4. Pipe hangers and supports.
 - 5. Valves.
 - 6. Check.

1.02 RELATED REQUIREMENTS

- A. Section 220553 - Identification for Plumbing Piping and Equipment.
- B. Section 220719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- D. ASME B31.9 - Building Services Piping; 2017.
- E. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023.
- F. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- G. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- I. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.
- J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.
- K. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
- M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2018.
- N. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
- O. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.
- P. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
- Q. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

- R. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.
- S. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2021.
- T. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2015.
- U. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.
- V. AWWA C651 - Disinfecting Water Mains; 2014, with Addendum (2020).
- W. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.
- X. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.04 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- B. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.
- C. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.
- D. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- C. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

1.06 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (____) OF BUILDING

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- B. PVC Pipe: ASTM D2729.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
 - 3. Joints: Grooved mechanical couplings.
 - 4. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.

2.05 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions.

2.06 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.
- B. Plumbing Piping - Water:
 - 1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
 - 2. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.07 BALL VALVES

- A. Manufacturers:
 - 1. Tyco flow control: www.tycoflowcontrol.com
 - 2. Nibco, Inc: www.nibco.com
 - 3. Milwaukee Valve Company: www.milwaukeevalve.com
- B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.08 PIPING SPECIALTIES

- A. Flow Controls:
 - 1. Manufacturers:
 - a. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - b. Griswold Controls: www.griswoldcontrols.com/#sle.
 - c. Taco, Inc: www.taco-hvac.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Establish elevations of buried piping outside the building to ensure not less than 4 ft (____ m) of cover.
- G. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- H. Install valves with stems upright or horizontal, not inverted. Refer to Section 220523.
- I. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- J. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- K. Sleeve pipes passing through partitions, walls and floors.
- L. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- M. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Support cast iron drainage piping at every joint.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Install globe valves for throttling, bypass, or manual flow control services.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/8 inch per foot (1:100) slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES

- A. Pipe Hanger Spacing:
 1. Metal Piping:
 - a. Pipe Size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
 - 1) Maximum Hanger Spacing: 6.5 ft (2 m).
 - 2) Hanger Rod Diameter: 3/8 inches (9 mm).

**SECTION 230005
BASIC HVAC REQUIREMENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. This section applies to all sections of Division 23.
- B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.
- C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.
- D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under item "A" above.

1.02 APPLICATION

- A. This section applies to all mechanical work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required.
- B. The mechanical contractor is responsible for the installation and operation of the hvac systems and temperature control systems.
- C. The mechanical contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

1.03 INSPECTION OF SITE

- A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.
- B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

1.04 ALTERNATES AND SUBSTITUTIONS

- A. Refer to Division 01 - General Requirements for procedures.

1.05 DEVIATION FROM BASIS OF DESIGN MANUFACTURER

- A. Products identified within the schedules and details are used as the basis of design for laying out and coordinating with other trades such as structural, architectural, and electrical. Should the Division 23 Contractors submit equipment by a Manufacturer other than that indicated as the Basis of Design in the Drawings, Contractor shall then be responsible for evaluating the impacts of the proposed Manufacturer's equipment, even if the Manufacturer is listed in the specifications as an approved equal. This includes the proposed Manufacturer's electrical, architectural and structural requirements and their subsequent impacts on the current design (roof openings, curbs, structural support, etc.) and coordination of any differing dimensions and clearances with all other trades.

1.06 MATERIALS

- A. Mechanical equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.

- B. The Mechanical Trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 22, and 23 of these specifications, including all wiring devices, conduit, etc.
- C. Power wiring 120 volts and greater shall be by the Electrical Trades.

1.07 DRAWINGS

- A. The drawings are diagrammatic and show the general location and arrangement of all equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. The mechanical and electrical contractor shall check all documents including architectural, structural, plumbing, HVAC and electrical to avert possible installation conflicts. Arrange work accordingly, providing such fittings, traps, valves and accessories as may be required to meet such conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
- E. Do not scale drawings for measurements.
- F. Field verifications of actual existing conditions are required by the contractor since actual locations, distances, and levels will be governed by actual field conditions. All measurements shall be verified at the site.
- G. If during field verification, the contractor identifies that there may require substantial changes from the original plans, the contractor shall notify the architect for agreement on necessary adjustment before the installation is started
- H. Discrepancies shown between plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the Architect/Engineer for a decision.
- I. Drawings and specifications are intended to cover the completed installation of systems to function as described. The omission of the expressed reference to any item of labor and material necessary to comply with practice codes, ordinances, etc., shall not relieve the contractor from providing such additional labor and material at no cost to Owner.

1.08 CODES, PERMITS AND FEES

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for mechanical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 23 shall be the latest issue, unless otherwise noted.
- B. Rules of local utility companies and municipalities shall be complied with. Check with the utility company and/or municipality supplying service to the installation and determine all devices including, but not limited to: meters, regulators, valves which will be required and include the cost of all such items in the proposal.

- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.09 MAINTENANCE

- A. Provide 40 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.
- B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for owner and shall be bound in book or ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

1.10 WARRANTY AND GUARANTEE

- A. Contractor shall guarantee all work installed by themselves or their subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

1.11 SUBMITTALS

- A. Refer to Division 01 - General Requirements for procedures.
- B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (hvac equipment, piping equipment, etc.). Refer to other sections of the mechanical specifications for additional requirements.
- C. Engineer WILL NOT REVIEW:
 - 1. Submittals not specified.
 - 2. Submittals not reviewed by Contractor, including Contractor stamp with signature comments.
 - 3. Submittals made after work is delivered to site and/or installed.
 - 4. Submittal resubmissions unless resubmission is required by Architect/Engineer.
- D. Types of submittals include the following:
 - 1. Shop Drawings
 - 2. Product Data Sheets
 - 3. Samples
 - 4. Manufacturers Instructions
 - 5. Maintenance Data
 - 6. Warranty
- E. Installation of any item that requires submittal approval by the engineer shall be installed at the contractors risk. The contractor, at his cost, shall remove all work installed prior to approval of

the submittal.

- F. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from mistakes in submittals.

1.12 RECORD DRAWINGS

- A. Refer to Division 01 - General Requirements for procedures.
- B. Contractor shall provide the following record drawings as part of the Project closeout document process:
 - 1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.
 - 2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.
- C. Record drawings shall be maintained by the contractor up to date as the project progresses.
- D. Recording all deviations from the contract documents, indicate exact locations of all buried services both inside and outside of the building; include concealed piping and equipment in the entire contract. Final record drawings shall reflect the as-built conditions.

1.13 QUALITY ASSURANCE

- A. Other referenced standards:
 - 1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE

PART 2 PRODUCTS

2.01 SLEEVES AND ESCUTCHEONS

- A. Provide sleeves wherever pipes pass through exterior wall, and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleeves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit within the sleeve shall be sealed at each installation with a 3M approved sealant.

2.02 DIELECTRIC UNIONS

- A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

2.03 FILTERS

- A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment without all prefilters and final filters as specified. Immediately prior to final building acceptance by the owner, contractor shall replace all disposable type air filters with new.

2.04 BUILDING ATTACHMENTS FOR MECHANICAL WORK SUPPORTS

- A. General Requirements:
 - 1. Provide building attachments required for supporting mechanical work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.
 - 2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.

3. If specially designed building attachments are required, retain the services of a licenced structural engineer to design such building attachments.
 4. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.
 5. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.
- B. Attachments to Structural Steel:
1. Support mechanical work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.
 - a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.
 - b. Side beam clamp with retaining clips - for loads up to 120 lb.
- C. Cast in Place Concrete Inserts:
1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#
- D. Drilled Insert Anchors:
1. Where mechanical work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.
 2. Manufacturers: Hilti

PART 3 EXECUTION

3.01 GENERAL

- A. Existing piping and ductwork: when encountered during the course of work, protect, brace and support existing piping and ductwork where required for proper execution of the work.
- B. Interruption of existing active piping and ductwork: when the course of work makes shut-down of services unavoidable, the mechanical contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference with established operating routine.
- C. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderly fashion.
- D. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

3.02 ACCESSIBILITY

- A. Do not locate valves, traps, controls, unions, dampers, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in mechanical, electrical, and plumbing systems.

3.03 ACCESS DOORS AND PANELS

- A. Refer to Division 08 - Openings; Provide access doors in locations as required by applicable codes and as indicated below. Coordinate locations with architectural trades.
- B. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.
- C. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials Manufacturer: Milcor, Bilco.

3.04 CUTTING AND PATCHING

- A. Refer to Division 01 - General Requirements and Division 02 - Existing Conditions.
- B. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective, responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.
- C. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

3.05 ROUGH-IN FOR CONNECTION TO EQUIPMENT

- A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

3.06 MATERIAL AND EQUIPMENT

- A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

3.07 SEAL PENETRATIONS

- A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

3.08 SOUND CONTROL

- A. Penetrations shall be maintained airtight to prevent sound transfer.
- B. Piping, ductwork, etc. shall pass through sleeves. Pack sleeves tight with glass fiber or oakum and caulked on both sides with non-hardening acoustical sealant.

3.09 FIRESTOPPING

- A. Refer to Division 07 - Thermal and Moisture Protection for more information.
- B. Provide UL classified firestopping system for mechanical penetrations through rated walls and floors to maintain the fire rating.

3.10 DELIVERY, STORAGE AND HANDLING OF EQUIPMENT AND MATERIALS

- A. Refer to Division 01 - General Requirements; All equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.
- B. On-site storage shall be coordinated with Construction Manager and be performed in a manner as to avoid damage, deterioration and loss.
- C. Contractor shall provide temporary protection for installed equipment prior to project completion.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. All equipment shall be inspected prior to installation to assure that equipment is free from defect and damage.
- F. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- G. Protect dampers, grilles, louvers from damage to operating linkages and blades.

3.11 CLEANING

- A. Refer to Division 01 - General Requirements; all mechanical equipment and components shall be cleaned as frequently as necessary through the construction process and again prior to project completion.

3.12 CONTROL WIRING

- A. All control wiring for mechanical and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

**SECTION 230505
SELECTIVE DEMOLITION FOR HVAC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Demolition and extension of existing mechanical work.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.

1.03 SUMMARY

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of minor electrical demolition as described in this specification.
- B. The demolition documents plans and specification have been prepared from existing non-as built documents and cursory non-invasive field investigation.
- C. It is the contractors obligation to become familiar with the extent of demolition and the existing condition before submitting their bid.
- D. During demolition if the contractor discovers unforeseen significant non-code compliance conditions of the existing installation they shall notify the Architect and Engineer immediately in writing.
- E. The contractor shall become familiar with the drawings and scope of work of other trades as the work scope of those trades relates to mechanical equipment and connection requirements.
- F. During demolition the contractor shall record on site as-builts all hydronic system piping capped branches, capped supply air, return air and exhaust ducts for reuse in renovated project space.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping and ductwork to be demolished serve only equipment and facilities within the demolition areas.
- B. Demolition drawings are based on casual field observation and existing record documents.
- C. Report discrepancies to Owner before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Identify locations for capping piping and ductwork before any demolition work commences.
- B. Confirm isolation valve locations for hydronic piping. Repair leaking isolation valves or replace inoperable valves before commencing piping demolition.
- C. Cap and seal air-tight supply, return and exhaust air ductwork at shaft walls before commencing sheet metal demolition

3.03 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. Remove, relocate, and extend existing mechanical piping or sheet metal work to accommodate new construction.
- B. Remove hydronic water piping back to isolation valve.
- C. Remove all supply, return and exhaust air ductwork back to main connection.

3.04 CLEANING AND REPAIR

- A. Refer to Division 01 - General Requirements for procedures.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.

**SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Pipe markers.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 NAMEPLATES

- A. Manufacturers:
 - 1. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
 - 2. Brady Corporation: www.bradycorp.com.
 - 3. Champion America, Inc: www.champion-america.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Letter Color: White.
- C. Letter Height: 1/4 inch.
- D. Background Color: Black.

2.02 TAGS

- A. Manufacturers:
 - 1. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
 - 2. Brady Corporation: www.bradycorp.com.
 - 3. Champion America, Inc: www.champion-america.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.03 PIPE MARKERS

- A. Manufacturers:
 - 1. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
 - 2. Brady Corporation: www.bradycorp.com.
 - 3. Champion America, Inc: www.champion-america.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Color: Comply with ASME A13.1.

- C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with nameplates. Small devices, such as inline pumps, may be identified with tags.
- F. Identify control panels and major control components outside panels with nameplates.
- G. Identify thermostats relating to terminal boxes or valves with nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify air terminal units and radiator valves with numbered tags.
- J. Identify piping, concealed or exposed, with pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

**SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

1.02 RELATED REQUIREMENTS

- A. Section 23 0005 - Basic HVAC Requirements.

1.03 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008 (Reaffirmed 2017).
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 2. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Details of how TOTAL flow will be determined; for example:
 - 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
 - 2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
 - f. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
 - g. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Owner and Engineer and for inclusion in operating and maintenance manuals.

3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
 6. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Report date.
- E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 3 EXECUTION

2.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 3. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 2. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
- F. Approved TAB Agencies:
 1. Baromatic.
 2. Enviroaire.
 3. Controls Solutions Inc. (CSI).
 4. Environmental Testing Services.
 5. Substitutions must be approved by Engineer during Bid Phase.

2.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 1. Systems are started and operating in a safe and normal condition.

2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Beginning of work means acceptance of existing conditions.

2.03 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

2.04 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

2.05 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
- M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
- N. On fan powered VAV boxes, adjust air flow switches for proper operation.
- O. For fans with variable pitch sheaves: Sheaves in equipment provided by manufacturer are for final belt and sheave sizing ONLY. TAB contractor shall be responsible for providing and installing final sheave and belt for fan.

2.06 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

2.07 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Plumbing Pumps.
 - 2. HVAC Pumps.
 - 3. Boilers.
 - 4. Packaged Roof Top Heating/Cooling Units.
 - 5. Air Coils.
 - 6. Terminal Heat Transfer Units.

7. Induction Units.
8. Air Handling Units.
9. Air Terminal Units.
10. Air Inlets and Outlets.
11. Kitchen exhaust fans and make-up air units, regardless of provides or installs.
12. Airflow measuring stations.

2.08 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 1. Manufacturer.
 2. Model/Frame.
 3. HP/BHP.
 4. Phase, voltage, amperage; nameplate, actual, no load.
 5. Service factor.
 6. Starter size, rating, heater elements.
 7. Sheave Make/Size/Bore.
- B. V-Belt Drives:
 1. Identification/location.
 2. Required driven RPM.
 3. Driven sheave, diameter and RPM.
 4. Belt, size and quantity.
 5. Motor sheave diameter and RPM.
 6. Center to center distance, maximum, minimum, and actual.
- C. Pumps:
 1. Identification/number.
 2. Manufacturer.
 3. Size/model.
 4. Impeller.
 5. Service.
 6. Design flow rate, pressure drop, BHP.
 7. Actual flow rate, pressure drop, BHP.
 8. Discharge pressure.
 9. Suction pressure.
 10. Total operating head pressure.
 11. Shut off, discharge and suction pressures.
 12. Shut off, total head pressure.
- D. Combustion Equipment:
 1. Boiler manufacturer.
 2. Model number.
 3. Serial number.
 4. Firing rate.
 5. Burner manifold gas pressure.
 6. Ambient temperature.
 7. Heat output.
- E. Cooling Coils:
 1. Identification/number.
 2. Location.

3. Service.
 4. Manufacturer.
 5. Air flow, design and actual.
 6. Entering air DB temperature, design and actual.
 7. Entering air WB temperature, design and actual.
 8. Leaving air DB temperature, design and actual.
 9. Leaving air WB temperature, design and actual.
 10. Water flow, design and actual.
 11. Water pressure drop, design and actual.
 12. Entering water temperature, design and actual.
 13. Leaving water temperature, design and actual.
 14. Saturated suction temperature, design and actual.
 15. Air pressure drop, design and actual.
- F. Heating Coils:
1. Identification/number.
 2. Location.
 3. Service.
 4. Manufacturer.
 5. Air flow, design and actual.
 6. Water flow, design and actual.
 7. Water pressure drop, design and actual.
 8. Entering water temperature, design and actual.
 9. Leaving water temperature, design and actual.
 10. Entering air temperature, design and actual.
 11. Leaving air temperature, design and actual.
 12. Air pressure drop, design and actual.
- G. Electric Duct Heaters:
1. Manufacturer.
 2. Identification/number.
 3. Location.
 4. Model number.
 5. Design kW.
 6. Number of stages.
 7. Phase, voltage, amperage.
 8. Test voltage (each phase).
 9. Test amperage (each phase).
 10. Air flow, specified and actual.
 11. Temperature rise, specified and actual.
- H. Induction Units:
1. Manufacturer.
 2. Identification/number.
 3. Location.
 4. Model number.
 5. Design air flow.
 6. Design nozzle pressure drop.
 7. Final nozzle pressure drop.
 8. Final air flow.

- I. Air Moving Equipment:
 - 1. Location.
 - 2. Manufacturer.
 - 3. Model number.
 - 4. Serial number.
 - 5. Arrangement/Class/Discharge.
 - 6. Air flow, specified and actual.
 - 7. Return air flow, specified and actual.
 - 8. Outside air flow, specified and actual.
 - 9. Total static pressure (total external), specified and actual.
 - 10. Inlet pressure.
 - 11. Discharge pressure.
 - 12. Sheave Make/Size/Bore.
 - 13. Number of Belts/Make/Size.
 - 14. Fan RPM.
- J. Exhaust Fans:
 - 1. Location.
 - 2. Manufacturer.
 - 3. Model number.
 - 4. Serial number.
 - 5. Air flow, specified and actual.
 - 6. Total static pressure (total external), specified and actual.
 - 7. Inlet pressure.
 - 8. Discharge pressure.
 - 9. Sheave Make/Size/Bore.
 - 10. Number of Belts/Make/Size.
 - 11. Fan RPM.
- K. Duct Traverses:
 - 1. System zone/branch.
 - 2. Duct size.
 - 3. Design velocity.
 - 4. Design air flow.
 - 5. Test velocity.
 - 6. Test air flow.
 - 7. Duct static pressure.
 - 8. Air temperature.
- L. Flow Measuring Stations:
 - 1. Identification/number.
 - 2. Location.
 - 3. Manufacturer.
 - 4. Model number.
 - 5. Serial number.
 - 6. Design Flow rate.
 - 7. Design pressure drop.
 - 8. Actual/final pressure drop.
 - 9. Actual/final flow rate.
 - 10. Station calibrated setting.

M. Terminal Unit Data:

1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Minimum static pressure.
7. Minimum design air flow.
8. Maximum design air flow.
9. Maximum actual air flow.
10. Inlet static pressure.

N. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

**SECTION 230713
DUCT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.

1.02 RELATED REQUIREMENTS

- A. Section 23 0005 - Basic HVAC Requirements.
- B. Section 23 3100 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 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 C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation 2020.
- F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
- J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
1. CertainTeed Corporation: www.certainteed.com/#sle.
 2. Johns Manville: www.jm.com/#sle.
 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
 2. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
1. CertainTeed Corporation: www.certainteed.com/#sle.
 2. Johns Manville: www.jm.com/#sle.
 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
 2. Maximum Service Temperature: 450 degrees F.
 3. Maximum Water Vapor Absorption: 5.0 percent.
- C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 3. Secure with two coats of vapor barrier mastic and glass tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
1. Aeroflex USA, Inc: www.aeroflexusa.com/#sle.
 2. Armacell LLC: www.armacell.us/#sle.
 3. K-Flex USA LLC: www.kflexusa.com/#sle.
 4. Substitutions: See Section 01 6000 - Product Requirements

- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 180 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
- D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.05 DUCT LINER

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Note: Choose the liner type - Elastomeric Foam or Glass Fiber.
- C. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 180 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.
- D. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; rigid board and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer.
 - 1. Fungal Resistance: No growth when tested according to ASTM G21.
 - 2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
 - 3. Service Temperature: Up to 250 degrees F.
 - 4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
 - 5. Minimum Noise Reduction Coefficients:
 - a. 1 inch Thickness: 0.45.
- E. Adhesive: Waterproof, fire-retardant type, ASTM C916.
- F. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.

3. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.
- E. Slope exterior ductwork to shed water.
- F. External Duct Insulation Application:
 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 2. Secure insulation without vapor barrier with staples, tape, or wires.
 3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- G. Duct and Plenum Liner Application:
 1. Adhere insulation with adhesive for 90 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

- A. Exhaust and Relief Ducts Within 10 ft of Exterior Openings:
 1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
- B. Outside Air Intake Ducts:
 1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
- C. Plenums:
 1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
 2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.
- D. Return Air Ducts:
 1. Duct Liner: 1 inch thick. First 10 feet from equipment only.
- E. Supply Ducts:
 1. Duct Liner: 1 inch thick. First 10 feet from equipment only.
 2. Located in plenum or unconditioned space:
 - a. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
 3. Located exposed in conditioned space:
 - a. No insulation required.
- F. Transfer Ducts:
 1. Duct Liner: 1 inch thick. First 10 feet from equipment only.
- G. Ducts Exposed to Outdoors:
 1. Flexible Elastomeric Duct Insulation: 2 inches thick
 2. Cover finished insulation with field applied a glass cloth jacket embedded in Foster No. 60-60 fire resistive mastic.

**SECTION 233100
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-wall rectangular ducts and fittings.
- B. Single-wall round ducts and fittings.
- C. Sheet metal materials.
- D. Sealants and gaskets.
- E. Hangers and supports.

1.02 RELATED REQUIREMENTS

- A. Division 03 - Concrete
- B. Division 07 - Thermal Moisture Protection: Firestopping
- C. Section 23 0005 - Basic HVAC Requirements
- D. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.
- E. Section 23 0713 - Duct Insulation: External insulation and duct liner.
- F. Section 23 3300 - Air Duct Accessories.
- G. Section 23 3700 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.
- 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 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.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.
- I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- J. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.
- K. UL 1978 - Grease Ducts Current Edition, Including All Revisions.
- L. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.05 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
- B. Product Data: Provide data for duct materials, duct liner, duct connections, and factory fabricated fittings.
- C. Shop Drawings: Submit 1/4 scale, double line shop drawings that indicate duct fittings, duct size, bottom of duct elevations, necessary offsets to accommodate building structure, particulars such as gages, sizes, welds, elevations, all fittings, and configuration prior to start of work for all systems.

1.06 REGULATORY REQUIREMENTS

- A. Construct ductwork to SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 1995, Second Edition with Addendum No. 1.

PART 2 PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCT AND FITTING ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCT AND FITTING ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. McGill AirFlow LLC.
 - b. Spiral Manufacturing Co., Inc.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- D. Galvanealed Sheet Steel (FOR EXPOSED, PAINTED DUCTWORK): Comply with ASTM A653-09; hot dipped zinc iron coated steel, annealed, coating designation "A" (A60, A40)
- E. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- F. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- I. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

2.04 SEALANTS AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 3 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant
 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative
 7. Service: Indoor and outdoor
 8. Service Temperature: Minus 40 to plus 200 deg F.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
 1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg pressure class, positive or negative.

2.05 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.06 DUCTWORK FABRICATION

- A. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Provide turning vanes in all mitered elbows.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- D. T's, bends, and elbows: construct according to SMACNA (DCS).
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- F. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- G. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- H. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.07 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Flat Oval Ducts: Machine made from round spiral lockseam duct.
 - 1. Manufacture in accordance with SMACNA (DCS).
 - 2. Fittings: Manufacture at least two gages heavier metal than duct.
 - 3. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
 - 1. UL labeled.
 - 2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
 - 3. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
 - 4. Maximum Velocity: 4000 fpm.
 - 5. Temperature Range: Minus 20 degrees F to 175 degrees F.
- D. Kitchen Cooking Hood and Grease Exhaust: Nominal 3 inches thick ceramic fiber insulation between 20 gage, 0.0375 inch, Type 304 stainless steel liner and 24 gage, 0.0239 inch aluminized steel sheet outer jacket.
 - 1. Tested and UL listed for use with commercial cooking equipment in accordance with NFPA 96.
 - 2. Certified for zero clearance to combustible material in accordance with:
 - a. UL 2221 with a 2 hour rating.
 - 3. Materials and construction of the modular sections and accessories to be in accordance with the terms of the following listings:
 - a. UL 1978.
 - b. UL 2221.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- D. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- E. Install round ducts in maximum practical lengths.
- F. Install ducts with fewest possible joints.
- G. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- H. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- I. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

- J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- K. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- L. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- M. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- N. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- O. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- P. Kitchen Hood Exhaust: Provide residue traps at base of vertical risers with provisions for clean out.
- Q. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- R. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- S. Use double nuts and lock washers on threaded rod supports.

3.02 HANGERS AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.03 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.04 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.
 - 13. All locations, Laboratory Exhaust Ducts: Seal Class A.

3.05 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 6. Supply-air ducts, dampers, actuators, and turning vanes.
 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 6. Provide drainage and cleanup for wash-down procedures.
 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.06 FIELD QUALITY CONTROLS

- A. Perform tests and inspections.
- B. Leakage Tests:
1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 4. Keep open ends of ductwork covered during construction.

5. Test for leaks before applying external insulation.
 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 7. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCAACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.07 SCHEDULES

- A. Supply Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 12
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectuangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- B. Return Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- C. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.

- c. SMACNA Leakage Class for Rectangular: 24.
- d. SMACNA Leakage Class for Round and Flat Oval: 12.
- 2. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
 - a. Type 316, stainless-steel sheet.
 - 1) Exposed to View: No. 4 finish.
 - 2) Concealed: No. 2D finish.
 - b. Pressure Class: Positive or negative 6-inch wg.
 - c. Minimum SMACNA Seal Class: A.
 - d. SMACNA Leakage Class: 3.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- E. Intermediate Reinforcement:
 - 1. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
- F. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

- c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90 degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90 degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90 degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Welded.
- G. Branch Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 - 1) Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - c. Velocity 1000 fpm or Lower: 90-degree tap.
 - d. Velocity 1000 to 1500 fpm: Conical tap.
 - e. Velocity 1500 fpm or Higher: 45-degree lateral.

**SECTION 233300
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Backdraft dampers - fabric.
- D. Combination fire and smoke dampers.
- E. Duct access doors.
- F. Duct test holes.
- G. Fire dampers.
- H. Flexible duct connectors.
- I. Smoke dampers.
- J. Volume control dampers.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project procedural and administrative requirements.
- B. Division 07 - Thermal and Moisture Protection: Firestopping
- C. Section 23 0005 - Basic HVAC Requirements
- D. Section 23 3100 - HVAC Ducts and Casings.
- E. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- B. NFPA 92 - Standard for Smoke Control Systems 2018.
- C. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- E. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.
- F. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.
- G. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 - General Requirements for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

- A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 BACKDRAFT DAMPERS - FABRIC

- A. Fabric Backdraft Dampers: Factory-fabricated.
 - 1. Blades: Neoprene coated fabric material.
 - 2. Birdscreen: 1/2 inch nominal mesh of galvanized steel or aluminum.
 - 3. Maximum Velocity: 1000 fpm (5 mps) face velocity.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
 - 1. Nailor Industries, Inc: www.nailor.com.
 - 2. Ruskin Company: www.ruskin.com.
 - 3. United Enertech: www.unitedenertech.com.
 - 4. Greenheck: www.greenheck.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- C. Provide factory sleeve and collar for each damper.
- D. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
- E. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.
- F. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.
- G. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.05 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.06 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.07 FIRE DAMPERS

- A. Manufacturers:
 - 1. Nailor Industries, Inc: www.nailor.com.
 - 2. Ruskin Company: www.ruskin.com.
 - 3. United Enertech: www.unitedenertech.com.
 - 4. Greenheck: www.greenheck.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- D. Fusible Links: UL 33, separate at 165 degrees F with adjustable link straps for combination fire/balancing dampers.

2.08 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.09 SMOKE DAMPERS

- A. Manufacturers:
 - 1. Nailor Industries, Inc: www.nailor.com.
 - 2. Ruskin Company: www.ruskin.com.
 - 3. United Enertech: www.unitedenertech.com.
 - 4. Greenheck: www.greenheck.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.
- C. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by electric actuator.

2.10 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Single Blade Dampers:
 - 1. Blade: 24 gage, 0.0239 inch, minimum.
- C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 - 1. Blade: 18 gage, 0.0478 inch, minimum.
- D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- E. Quadrants:
 - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- G. Demonstrate re-setting of fire dampers to Owner's representative.
- H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

**SECTION 238124
PACKAGED ARCHIVE ROOM AIR CONDITIONER - FLOOR MOUNTED**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air conditioning units.
- B. Controls and control panels.

1.02 RELATED REQUIREMENTS

- A. Section 236313 - Air Cooled Refrigerant Condensers.

1.03 SUBMITTALS

- A. Product Data: Provide for manufactured products and assemblies. Indicate water, drain, refrigeration, rough-in connections, and electrical characteristics and connection requirements.
- B. Shop Drawings: Indicate manufactured products and assemblies. Indicate water, drain, refrigeration, rough-in connections, and electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.
- D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 WARRANTY

- A. Warranty: Include coverage of refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Liebert, a brand of Vertiv Co: www.vertivco.com

2.02 AIR CONDITIONING UNITS

- A. Description: Packaged, water cooled, factory assembled, pre-wired and pre-piped unit, consisting of cabinet, fans, filters, humidifier, and controls.
- B. Assembly: Down-flow air delivery, in draw-through configuration.
- C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.03 CABINET AND FRAME

- A. Structural Frame: 10 gauge, 0.1345 inch (3.42 mm) welded steel suitably braced for rigidity, capable of supporting compressors and other mechanical equipment and fittings with welded tubular steel floor stand with adjustable legs and vibration isolation pads.
- B. Doors and Access Panels: 18 gauge, 0.0478 inch (1.21 mm) galvanized steel with polyurethane gaskets, hinges to allow removal of panels, and concealed fastening devices.

2.04 EVAPORATOR FANS AND MOTORS

- A. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch motor sheave, minimum of two matched belts, drive rated minimum 2.0 times nameplate rating of motor.

2.05 COMPRESSORS

- A. Type: Semi-hermetic with suction gas cooled motors, vibration isolators, thermal overloads, oil sight glass, manual reset high pressure switch, pump down low pressure switch, suction line strainer, reversible oil pumps, 1750 rpm.
- B. Refrigeration Circuits: Two, each with hot gas mufflers, thermal expansion valve with external equalizer, liquid line solenoid valve, liquid line filter-drier, refrigerant sight glass with moisture indicator, service shut-off valves and charging valves and accumulator sized for liquid seal under light load.

2.06 EVAPORATOR COILS

- A. Alternate row circuits, direct expansion cooling coils of seamless copper tubes expanded into aluminum fins in A-frame configuration.
- B. Mount coil assembly in stainless steel drain pan.

2.07 CONDENSERS

- A. Air Cooled Refrigerant Condenser:
 - 1. Corrosion resistant cabinet.
 - 2. Copper tube aluminum fin coils arranged for two circuits.
 - 3. Multiple direct drive propeller fans with permanently lubricated ball bearings.
 - 4. Single phase motors with internal overload protection.
 - 5. Provide capacity control by cycling fans.

2.08 FILTERS

- A. Media: Pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid; enclosed in cardboard frame; 2 inch (50 mm) nominal thickness.

2.09 REFRIGERANT REHEAT COIL

- A. Hot gas refrigerant coil of seamless copper tubes expanded into aluminum fins with three way solenoid valve on first stage refrigerant circuit.

2.10 ELECTRICAL PANEL

**SECTION 260005
BASIC ELECTRICAL REQUIREMENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. This section applies to all sections of Division 26 and Division 28.
- B. Drawings and general provisions of the contract, including Division 00 and Division 01 specification sections, apply to work of this section.
- C. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.
- D. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under Item "A" above.

1.02 DRAWINGS

- A. The drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

1.03 INSPECTION OF SITE

- A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.
- B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

1.04 TEMPORARY FACILITIES

- A. Provide and remove upon completion of the project, in accordance with the general conditions, a complete temporary electrical and telephone service during construction.

1.05 ALTERNATES

- A. Refer to Division 01 - General Requirements for procedures.

1.06 GUARANTEE

- A. Contractor guarantees that the installation is free from defects and agrees to replace or repair, any part of this installation which becomes defective within a period of one year following final acceptance, unless noted otherwise, provided that such failure is due to defects in the equipment, material or installation or to follow the specifications and drawings. File with the Owner any and all guarantees from the equipment manufacturers.

1.07 CODES, PERMITS AND FEES

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations. Applicable publications listed in all sections of Division 26 shall be the latest issue, unless otherwise noted.
- B. Rules of local utility companies shall be complied with. Check with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items in proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.08 STANDARDS OF MATERIAL AND WORKMANSHIP:

- A. All materials shall be new, unless noted otherwise. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable standard specifications of the following recognized authorities:
 - 1. N.S.I. - American National Standards Institute
 - 2. S.T.M. - American Society for Testing Materials
 - 3. C.E.A. - Insulated Cable Engineers Association
 - 4. E.E.E. - Institute of Electrical and Electronics Engineers
 - 5. E.C. - National Electrical Code (NFPA 70)
 - 6. E.C.A. - National Electrical Contractors Association
 - 7. E.M.A. - National Electrical Manufacturer's Association
 - 8. F.P.A. - National Fire Protection Association
 - 9. L. - Underwriters Laboratories, Inc.
- B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.
- C. All equipment of the same or similar systems shall be by the same manufacturer.

1.09 RECORD DRAWINGS

- A. Refer to Division 01 - General Requirements for procedures. All literature shall be furnished in accordance with requirements listed in Division 01.
- B. Contractor shall provide the following record drawings as part of the Project closeout document process:
 - 1. Contract Documents, specifications and submittals, indicating "As-Built" conditions and actual products selected for use.
 - 2. Product and Maintenance manuals for all equipment listed within this specification manual and in Contract Documents. Provide with parts lists as applicable.

1.10 SUBMITTALS

- A. Refer to Division 01 - General Requirements for procedures.
- B. Contractor shall provide submittals where items are referred to by symbolic designation on the drawings. All submittals shall bear the same designation (light fixtures, wiring devices, etc.). Refer to other sections of the electrical specifications for additional requirements.
- C. Engineer WILL NOT REVIEW:
 - 1. Submittals not specified.

2. Submittals which do not indicate optional equipment being provided.
3. Submittals not reviewed by Contractor; including Contractor stamp with signature comments.
4. Submittals made after work is delivered to site and/or installed.
5. Submittal resubmissions unless resubmission is required by Architect/Engineer.

1.11 MANUFACTURERS LISTED

- A. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.
- B. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer five (5) days prior to bid date.

1.12 USE OF EQUIPMENT

- A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.
- B. Do not use Owner's light fixtures for temporary lighting except as allowed and directed by the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT

- A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the Architect/Engineer for resolution.
- B. Equipment location shall be as close as practical to locations shown on the drawings.
- C. Working clearances shall not be less than specified in NFPA 70 (National Electric Code).

3.02 COORDINATION

- A. Install work to avoid interference with work of other trades including, but not limited to, architectural and mechanical trades. Remove and relocate any work that causes an interference at Contractor's expense. Disputes regarding the cause of an interference will be resolved by the Construction Manager or Architect/Engineer.

3.03 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

- A. Refer to Division 01 - General Requirements and Division 02 - Existing Conditions.
- B. All cutting, patching and repair work shall be performed by the contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.04 EXCAVATION AND BACKFILLING

- A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.
- B. Where conduit is installed less than 30" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical drawings.
- C. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each

side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

- D. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling. Tamp, roll as required.

3.05 EQUIPMENT FOUNDATION AND SUPPORTS

- A. Shall be as required or as shown on plans or specified.
- B. Provide concrete base keeping bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment. Coordinate requirements with Division 03 - Concrete.
- C. For equipment suspended from ceilings or walls, furnish and install all inserts, rods, structural steel frames, brackets and platforms required.

3.06 EQUIPMENT CONNECTIONS

- A. Make connections to equipment, motors, lighting fixtures, and other items included in the work in accordance with the approved shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the drawings, but called out by the equipment manufacturer's shop drawings shall be provided.

3.07 ACCESS DOORS AND PANELS

- A. Refer to Division 08 - Openings; Provide access doors in locations as required per N.E.C. Coordinate locations with architectural trades.

3.08 CLEANING

- A. Refer to Division 01 - General Requirements; All equipment shall be cleaned as frequently as necessary through the construction process and again prior to project completion.
- B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

3.09 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

- A. Refer to Division 01 - General Requirements; All equipment and materials shall be delivered, stored and secured per manufacturer's recommendations.
- B. On-site storage shall be coordinated with Construction Manager and be performed in a manner as to avoid damage, deterioration and loss.

3.10 DRAWINGS AND MEASUREMENTS

- A. Electrical drawings are not intended to be scaled for rough-in measurements nor to serve as submittals. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor.

**SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition and extension of existing electrical work.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements.
- C. Section 26 0005 - Basic Electrical Requirements.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Demolition drawings are based on casual field observation and existing record documents.
- C. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. 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.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
 - 2. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Notify Owner before partially or completely disabling system.
 - 2. Notify local fire service.
 - 3. Make notifications at least 24 hours in advance.
 - 4. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
 - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
 - 2. PCB- and DEHP-containing lighting ballasts.

3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
 - B. Remove, relocate, and extend existing installations to accommodate new construction.
 - C. Remove abandoned wiring to source of supply.
 - D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
 - 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 abandoned panelboards and distribution equipment.
 - G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
 - H. Repair adjacent construction and finishes damaged during demolition and extension work.
 - I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.04 CLEANING AND REPAIR

- A. See Division 01 - General Requirements.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.
- C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

**SECTION 260519
VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Heat shrink tubing.
- F. Oxide inhibiting compound.
- G. Wire pulling lubricant.
- H. Cable ties.
- I. Firestop sleeves.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Section 07 8400 - Firestopping.
- D. Section 26 0005 - Basic Electrical Requirements.
- E. Section 26 0505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- F. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- G. Section 26 0536 - Cable Trays for Electrical Systems: Additional installation requirements for cables installed in cable tray systems.
- H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.
- J. Division 31 - Earthwork: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC) 2012.

- G. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2009.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- K. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- L. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- M. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- N. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- O. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet.
 - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
- H. Manufactured wiring systems are not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- H. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
- I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- J. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.

- 4) Neutral/Grounded: Gray.
- b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
- c. Equipment Ground, All Systems: Green.
- d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 - 1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com.
 - b. Encore Wire Corporation: www.encorewire.com.
 - c. General Cable Technologies Corporation: www.generalcable.com.
 - d. Southwire Company: www.southwire.com.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Stranded.
 - b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 METAL-CLAD CABLE

- A. Manufacturers:
 - 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 - 2. Encore Wire Corporation: www.encorewire.com/#sle.
 - 3. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Stranded.
 - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Provide oversized neutral conductors where indicated or required.
- G. Grounding: Full-size integral equipment grounding conductor.
- H. Armor: Steel, interlocked tape.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as

- applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 0526.
 - C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
 - D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 - E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
 - F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
 - G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
 - H. Mechanical Connectors: Provide bolted type or set-screw type.
 - I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated without specific routing, determine exact routing required.
 - 3. Arrange circuiting to minimize splices.
 - 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.

5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
 - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
 - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- H. Terminate cables using suitable fittings.
 1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- I. Install conductors with a minimum of 12 inches of slack at each outlet.
- J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- M. Make wiring connections using specified wiring connectors.
 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- O. Insulate ends of spare conductors using vinyl insulating electrical tape.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- C. Correct deficiencies and replace damaged or defective conductors and cables.

**SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.
- C. Section 26 0005 - Basic Electrical Requirements
- D. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- E. Section 26 0536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.
- H. Division 31 - Earthwork: Excavating, trenching and fill.

1.03 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Project Record Documents: Record actual locations of grounding electrode system components and connections.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- F. Grounding Electrode System:
 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 3. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in

- accordance with NFPA 70.
4. Ground Ring:
 - a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
 - b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
 - c. Provide ground enhancement material around conductor.
 - d. Provide connection from ground ring conductor to:
 - 1) Perimeter columns of metal building frame.
 - 2) Ground rod electrodes located as indicated.
 5. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
 7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
 - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
- H. Cable Tray Systems: Also comply with Section 26 0536.
- I. Pole-Mounted Luminaires: Also comply with Section 26 5600.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
 - 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
 - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 - 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 - 4. Manufacturers - Mechanical and Compression Connectors:
 - a. Advanced Lightning Technology (ALT): www.altfab.com
 - b. Burndy LLC: www.burndy.com
 - c. Harger Lightning & Grounding: www.harger.com
 - d. Thomas & Betts Corporation: www.tnb.com
 - 5. Manufacturers - Exothermic Welded Connections:
 - a. Burndy LLC: www.burndy.com
 - b. Cadweld, a brand of Erico International Corporation: www.erico.com
 - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com
- D. Ground Bars:
 - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 - 2. Size: As indicated.
 - 3. Holes for Connections: As indicated or as required for connections to be made.
 - 4. Manufacturers:
 - a. Advanced Lightning Technology (ALT): www.altfab.com
 - b. Erico International Corporation: www.erico.com
 - c. Harger Lightning & Grounding: www.harger.com
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com
- E. Ground Rod Electrodes:
 - 1. Comply with NEMA GR 1.
 - 2. Material: Copper-bonded (copper-clad) steel.
 - 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
 - 4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
 - 5. Manufacturers:
 - a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
 - b. Erico International Corporation: www.erico.com/#sle.

- c. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
- d. Harger Lightning & Grounding: www.harger.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

**SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, and cutting and patching requirements.
- C. Division 03 - Concrete: Concrete equipment pads.
- D. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- E. Section 26 0005 - Basic Electrical Requirements
- F. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- G. Section 26 0536 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.
- H. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- I. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- J. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 5B - Strut-Type Channel Raceways and Fittings Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Division 03.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
 3. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com
 - b. Erico International Corporation: www.erico.com
 - c. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com
 - d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com
 - e. Thomas & Betts Corporation: www.tnb.com
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
1. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Erico International Corporation: www.erico.com/#sle.
 - c. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

- d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - e. Thomas & Betts Corporation: www.tnb.com/#sle.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
- 1. Comply with MFMA-4.
 - 2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
 - 3. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com
 - b. Thomas & Betts Corporation: www.tnb.com
 - c. Unistrut, a brand of Atkore International Inc: www.unistrut.com
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- 1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
 - c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
 - d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
 - e. Outlet Boxes: 1/4 inch diameter.
 - f. Luminaires: 1/4 inch diameter.
- F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
- 1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - 2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 - 3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
 - 4. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com
 - b. Erico International Corporation: www.erico.com
 - c. PHP Systems/Design: www.phpsd.com
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com
- G. Anchors and Fasteners:
- 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Division 03.
 - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Conduit Support and Attachment: Also comply with Section 26 0533.13.
- I. Cable Tray Support and Attachment: Also comply with Section 26 0536.
- J. Box Support and Attachment: Also comply with Section 26 0533.16.
- K. Secure fasteners according to manufacturer's recommended torque settings.
- L. Remove temporary supports.

3.02 FIELD QUALITY CONTROL

- A. See Division 01 - General Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

**SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Flexible metal conduit (FMC).
- D. Electrical metallic tubing (EMT).
- E. Rigid polyvinyl chloride (PVC) conduit.
- F. Conduit fittings.
- G. Accessories.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Division 07 - Thermal and Moisture Protection: Firestopping.
- D. Section 07 8400 - Firestopping.
- E. Section 26 0005 - Basic Electrical Requirements
- F. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
- G. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- H. Section 26 0529 - Hangers and Supports for Electrical Systems.
- I. Section 26 0533.16 - Boxes for Electrical Systems.
- J. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- K. Section 28 4600 - Fire Detection and Alarm: Fire alarm wiring in conduit.
- L. Division 31 - Earthwork: Excavating, trenching and fill.
- M. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2015.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2015.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2013.
- E. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit 2004.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit 2018.

- I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2016.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- N. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- P. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
- D. Embedded Within Concrete:
 - 1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - 2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- K. Exposed, Exterior: Use galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.
- M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
 - 1. Maximum Length: 6 feet.
- N. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
- O. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
 - 3. Underground, Interior: 1 inch (27 mm) trade size.
 - 4. Underground, Exterior: 1 inch (27 mm) trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedeg.com
 - 2. Republic Conduit: www.republic-conduit.com
 - 3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:

1. AFC Cable Systems, Inc: www.afcweb.com
 2. Electri-Flex Company: www.electriflex.com
 3. International Metal Hose: www.metalhose.com
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.05 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com
 2. Republic Conduit: www.republic-conduit.com
 3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
 5. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.06 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
1. Cantex Inc: www.cantexinc.com
 2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com
 3. JM Eagle: www.jmeagle.com
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.07 ACCESSORIES

- A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

- D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
- E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- E. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal all conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - 5. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - 6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
 - 9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 10. Group parallel conduits in the same area together on a common rack.
- F. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
 7. Use of wire for support of conduits is not permitted.
- G. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.
- I. Underground Installation:
1. Provide trenching and backfilling in accordance with Division 31.
- J. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Secure conduits to prevent floating or movement during pouring of concrete.

- K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Division 03 with minimum concrete cover of 2 inches on all sides unless otherwise indicated.
- L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
 - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 - 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 - 3. Where conduits are subject to earth movement by settlement or frost.
- M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
 - 1. Where conduits pass from outdoors into conditioned interior spaces.
 - 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- N. Provide grounding and bonding in accordance with Section 26 0526.
- O. Identify conduits in accordance with Section 26 0553.

3.03 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 03 - Concrete: Concrete.
- C. Division 07 - Thermal and Moisture Protection: Firestopping.
- D. Division 08 - Openings: Access Doors.
- E. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- F. Section 26 0005 - Basic Electrical Requirements.
- G. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- H. Section 26 0529 - Hangers and Supports for Electrical Systems.
- I. Section 26 0533.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- J. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- K. Section 26 2726 - Wiring Devices:
 - 1. Wall plates.
- L. Section 26 2813 - Fuses: Spare fuse cabinets.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. SCTE 77 - Specification for Underground Enclosure Integrity 2017.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

- J. UL 508A - UL Standard for Safety Industrial Control Panels 2018.
- K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
 - 1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.
- C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Keys for Lockable Enclosures: Two of each different key.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use suitable concrete type boxes where flush-mounted in concrete.
 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 6. Use shallow boxes where required by the type of wall construction.
 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 12. Wall Plates: Comply with Section 26 2726.
 13. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com
 - b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com
 - c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com
 - d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com
 - e. Thomas & Betts Corporation: www.tnb.com
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
 - b. Back Panels: Painted steel, removable.
 - c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Division 08 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 7. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - 8. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
- I. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.

- M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- O. Close unused box openings.
- P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- Q. Provide grounding and bonding in accordance with Section 26 0526.

3.03 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 09 - Finishes: Interior and Exterior Painting.
- C. Section 09 9113 - Exterior Painting.
- D. Section 09 9123 - Interior Painting.
- E. Section 26 0005 - Basic Electrical Requirements
- F. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- G. Section 26 0536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
- H. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.
- I. Section 26 2726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.04 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Identify ampere rating.

- 2) Identify voltage and phase.
- 3) Identify power source and circuit number. Include location when not within sight of equipment.
- 4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
- 5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
- b. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
- c. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
- d. Transfer Switches:
 - 1) Identify voltage and phase.
 - 2) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
5. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
6. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
 - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 9123 and 09 9113.
7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
8. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.
- C. Identification for Conductors and Cables:
 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- D. Identification for Cable Tray: Comply with Section 26 0536.
- E. Identification for Boxes:
 1. Use voltage markers to identify highest voltage present.
 2. Use voltage markers or color coded boxes to identify systems other than normal power system.
 - a. Color-Coded Boxes: Field-painted in accordance with Division 09 per the same color code used for raceways.
- F. Identification for Devices:
 1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
 2. Use identification label to identify fire alarm system devices.
 - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
 3. Use identification label to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
- G. Identification for Luminaires:
 1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Caution and Warning Messages:
 1. Minimum Size: 2 inches by 4 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/2 inch.

5. Color: Black text on yellow background unless otherwise indicated.
- D. Format for Receptacle Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Power source and circuit number or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Black text on clear background.
- E. Format for Fire Alarm Device Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Designation indicated and device zone or address.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Red text on white background.

2.03 VOLTAGE MARKERS

- A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- B. Minimum Size:
 1. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
 2. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- C. Legend:
 1. Markers for Voltage Identification: Highest voltage present.
 2. Markers for System Identification:
 - a. Emergency Power System: Text "EMERGENCY".
- D. Color: Black text on orange background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:
 1. Tape for Buried Power Lines: Black text on red background.
 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.05 FLOOR MARKING TAPE

- A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

2.06 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.

2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 1. Surface-Mounted Equipment: Enclosure front.
 2. Flush-Mounted Equipment: Inside of equipment door.
 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 4. Elevated Equipment: Legible from the floor or working platform.
 5. Branch Devices: Adjacent to device.
 6. Interior Components: Legible from the point of access.
 7. Boxes: Outside face of cover.
 8. Conductors and Cables: Legible from the point of access.
 9. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

**SECTION 260573
POWER SYSTEM STUDIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
 - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Section 26 0005 - Basic Electrical Requirements.
- C. Section 26 0553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
- D. Section 26 2416 - Panelboards.
- E. Section 26 2813 - Fuses.
- F. Section 26 2816.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011.
- B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis 1997.
- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems 2006.
- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations 2018, with Errata (2019).
- G. NEMA MG 1 - Motors and Generators 2018.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 70E - Standard for Electrical Safety in the Workplace 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.

2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Submit study reports prior to or concurrent with product submittals.
 2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.05 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Study reports, stamped or sealed and signed by study preparer.
- C. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
1. Identify modifications made in accordance with studies that:
 - a. Can be made at no additional cost to Owner.
 - b. As submitted will involve a change to the contract sum.

1.06 POWER SYSTEM STUDIES

- A. Scope of Studies:
1. Perform analysis of new electrical distribution system as indicated on drawings.
 2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
 3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
- B. General Study Requirements:
1. Comply with NFPA 70.
 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:
1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
 - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
 - 1) Obtain up-to-date information from Utility Company.
 - b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
 - c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
 - d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
 - e. Protective Devices:

- 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
 - 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
 - f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
 - g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
- D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
 2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
 - a. Maximum utility fault currents.
 - b. Maximum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
 2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
 3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
 - a. Maximum and minimum utility fault currents.
 - b. Maximum and minimum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
- F. Study Reports:
1. General Requirements:
 - a. Identify date of study and study preparer.
 - b. Identify study methodology and software product(s) used.
 - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
 - d. Identify base used for per unit values.
 - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
 - f. Include conclusions and recommendations.
 2. Short-Circuit Study:
 - a. For each scenario, identify at each bus location:
 - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
 - 2) Fault point X/R ratio.
 - 3) Associated equipment short circuit current ratings.

- b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
- 3. Arc Flash and Shock Risk Assessment:
 - a. For the worst case for each scenario, identify at each bus location:
 - 1) Calculated incident energy and associated working distance.
 - 2) Calculated arc flash boundary.
 - 3) Bolted fault current.
 - 4) Arcing fault current.
 - 5) Clearing time.
 - 6) Arc gap distance.
 - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.07 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.
- B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
 - 1. Materials: Comply with Section 26 0553.
 - 2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
 - a. Include the following information:
 - 1) Arc flash boundary.
 - 2) Available incident energy and corresponding working distance.
 - 3) Nominal system voltage.
 - 4) Equipment identification.
 - 5) Date calculations were performed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install arc flash warning labels in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL

- A. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Adjust equipment and protective devices for compliance with studies and recommended settings.
- D. Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from studies. Obtain direction before proceeding.

SECTION 262413 SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 03 - Concrete: Concrete equipment pads.
- C. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- D. Section 26 0005 - Basic Electrical Requirements.
- E. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- F. Section 26 0529 - Hangers and Supports for Electrical Systems.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- I. Section 26 2300 - Low-Voltage Switchgear.
- J. Section 26 2813 - Fuses: Fuses for fusible switches.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 400 - Standard for Installing and Maintaining Switchboards 2007.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NEMA PB 2 - Deadfront Distribution Switchboards 2011.
- G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less 2013.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- L. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- M. UL 891 - Switchboards Current Edition, Including All Revisions.

- N. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:
1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
 2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
 3. Obtain Utility Company approval of switchboard prior to fabrication.
 4. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
 2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 3. Include documentation of listed series ratings as indicated in Section 26 0573.
- C. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.
- D. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for

permanent factory-installed space heaters.

- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Switchboards:
 - 1. Schneider Electric; Square D Products: www.schneider-electric.us (Base Bid)
 - 2. Eaton Corporation: www.eaton.com

2.02 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Service Entrance Switchboards:
 - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.
 - 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
 - 3. Comply with Utility Company requirements for electrical service.
 - 4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
- E. Switchboards With Fire Pump Taps: Provide separate bussed vertical section with suitable lugs for fire pump connection to line side of main service disconnect device(s).
- F. Service Conditions:
 - 1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude: Less than 6,600 feet.
 - b. Ambient Temperature:
 - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
 - 2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- G. Short Circuit Current Rating:
 - 1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- I. Bussing: Sized in accordance with UL 891 temperature rise requirements.

1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 4. Phase and Neutral Bus Material: Copper
 5. Ground Bus Material: Copper
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
 2. Load Conductor Terminations:
 - a. Lug Material: copper conductors.
 - b. Lug Type:
 - 1) Provide mechanical lugs unless otherwise indicated.
- K. Enclosures:
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
 - b. Outdoor Locations: Type 3R.
 2. Finish: Manufacturer's standard unless otherwise indicated.
- L. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
- N. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- O. Owner Metering:
1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
 2. Measured Parameters:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase and neutral.
 - c. Frequency (Hz).
 - d. Real power (kW): For each phase, 3-phase total.
 - e. Reactive power (kVAR): For each phase, 3-phase total.
 - f. Apparent power (kVA): For each phase, 3-phase total.
 - g. Power factor.
 3. Meter Accuracy: Plus/minus 1.0 percent.
- P. Instrument Transformers:
1. Comply with IEEE C57.13.
 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
 - 1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
 - 2) Provide electronic trip circuit breakers where indicated.
 - b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 3000.
- H. Provide grounding and bonding in accordance with Section 26 0526.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable circuit breaker tripping function settings as indicated.

- L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- M. Provide filler plates to cover unused spaces in switchboards.

3.02 FIELD QUALITY CONTROL

- A. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.1.
- D. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
 - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- F. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
- G. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- H. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.03 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

**SECTION 262416
PANELBOARDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Division 03 - Concrete: Concrete equipment pads.
- D. Section 26 0005 - Basic Electrical Requirements.
- E. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- F. Section 26 0529 - Hangers and Supports for Electrical Systems.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- I. Section 26 2200 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.
- J. Section 26 2813 - Fuses: Fuses for fusible switches and spare fuse cabinets.
- K. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA PB 1 - Panelboards 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

- K. UL 67 - Panelboards Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- M. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- N. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- O. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include documentation of listed series ratings as indicated in Section 26 0573.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Panelboard Keys: Two of each different key.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com
- B. Eaton Corporation: www.eaton.com
- C. Schneider Electric; Square D Products: www.schneider-electric.us
- D. Siemens Industry, Inc: www.usa.siemens.com
- E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.

- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
 - b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.
 - 1. Provide Surge Protective Devices internally mounted within all panels which are specified as part of the Emergency distribution power system.
- L. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- M. Load centers are not acceptable.

2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Copper
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase and Neutral Bus Material: Copper
 - 2. Ground Bus Material: Copper
- D. Circuit Breakers:
 - 1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
- E. Enclosures:
 - 1. Provide surface-mounted enclosures unless otherwise indicated.
 - 2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Copper
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Copper
 - 3. Ground Bus Material: Copper
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Lug Material: Copper

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
6. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
 - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
10. Provide the following features and accessories where indicated or where required to complete installation:

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 0529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 26 0526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide filler plates to cover unused spaces in panelboards.

- M. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
1. Fire detection and alarm circuits.
 2. Intrusion detection and access control system circuits.
 3. Video surveillance system circuits.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Test AFCI circuit breakers to verify proper operation.
- G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

**SECTION 262726
WIRING DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Section 26 0005 - Basic Electrical Requirements.
- D. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- E. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- F. Section 26 0533.16 - Boxes for Electrical Systems.
- G. Section 26 0533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.
- H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 26 0583 - Wiring Connections: Cords and plugs for equipment.
- J. Section 26 0953 - Distributed Digital Lighting Controls

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2017h.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2017g.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2015).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
 - 6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for receptacles installed in areas listed below:
 - 1. All 15 and 20-ampere 125 and 250-volt nonlocking type receptacles in the areas listed below shall be listed tamper-resistant receptacles, unless otherwise excluded in NEC.
 - a. Dwelling units in all areas specified in NEC 210.52 and 550.13.
 - b. Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities.
- E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- F. Provide GFCI protection for receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.
 - 1. Outlet shall be readily accessible.
- H. Provide GFCI protection for outlets serving vending machines. Outlets shall be readily accessible.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with gray stainless steel wall plate.
- C. Wiring Devices Connected to Emergency Power: Red with stainless steel wall plate factory engraved "Emergency".

2.03 WALL SWITCHES

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

2.04 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com
 - 3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com
 - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - 2. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
 - 3. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:
 - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
 - 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 - 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 - 4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
- E. USB Charging Devices:
 - 1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
 - a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
 - 2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

2.05 WALL PLATES

- A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com
 2. Leviton Manufacturing Company, Inc: www.leviton.com
 3. Lutron Electronics Company, Inc: www.lutron.com
 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
 5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches above finished floor.
 - b. Receptacles: 18 inches above finished floor or 6 inches above counter.
 2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- N. Identify wiring devices in accordance with Section 26 0553.

3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

**SECTION 262813
FUSES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Section 26 0005 - Basic Electrical Requirements.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0573 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.
- E. Section 26 2416 - Panelboards: Fusible switches.
- F. Section 26 2816.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements Current Edition, Including All Revisions.
- C. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses Current Edition, Including All Revisions.
- D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com
- B. Littelfuse, Inc: www.littelfuse.com
- C. Mersen: ep-us.mersen.com

2.02 APPLICATIONS

- A. Service Entrance:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. Feeders:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.

- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
- H. Class L Fuses: Comply with UL 248-10.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

SECTION 265100 INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Ballasts and drivers.
- D. LED emergency power supply units.
- E. Emergency Lighting Control Units (Transfer Switches)
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, repairs.
- C. Section 26 0005 - Basic Electrical Requirements.
- D. Section 26 0533.13 - Conduit for Electrical Systems.
- E. Section 26 0529 - Hangers and Supports for Electrical Systems.
- F. Section 26 0533.16 - Boxes for Electrical Systems.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 26 0935 - Distributed Digital Lighting Control System: Devices for automatic control of lighting, including occupancy sensors, daylighting controls, networked control stations and motion sensors.
- I. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.
- J. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).
- B. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- C. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information 2002 (Reaffirmed 2008).
- D. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.
- E. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- G. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems 2006.
- H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 2006.

- I. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2016.
- J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
- N. UL 1598 - Luminaires Current Edition, Including All Revisions.
- O. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits Current Edition, Including All Revisions.
- P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70 and NFPA 101.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

- B. Lithonia Lighting is base bid, with approved substitutions allowed.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70 and NFPA 101.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s), light engines, drivers and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.
 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
 4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.
- H. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
 2. Tested in accordance with IES LM-79 and IES LM-80.
 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
1. Sealed maintenance-free lead calcium unless otherwise indicated.
 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 BALLASTS AND DRIVERS

- A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- B. Dimmable LED Drivers:
 1. Dimming Range: Continuous dimming from 100 percent to 10 percent relative light output unless dimming capability to lower level is indicated, without flicker.
 2. Control Compatibility: Fully compatible with the dimming controls to be installed.
- C. Dimmable LED Drivers: Comply with Section 26 0935 - Distributed Digital Lighting Control System.

2.05 LED EMERGENCY POWER SUPPLY UNITS

- A. Manufacturers:
 1. Iota Engineering, LLC: www.iotaengineering.com/#sle.
 2. Lithonia Lighting: www.lithonia.com/#sle.
 3. Philips Emergency Lighting/Bodine: www.bodine.com/#sle.
 4. Manufacturer Limitations: Where possible, for each type of luminaire provide fluorescent emergency power supply units produced by a single manufacturer.
 5. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
- B. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.
- E. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.
- F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.

2.06 EMERGENCY LIGHTING CONTROL DEVICES (TRANSFER DEVICES)

- A. Manufacturers:
 1. Philips Emergency Lighting Bodine: www.philips.com/bodine
 2. Iota Engineering: www.iotaengineering.com
 3. Engineer pre-approved equal
- B. General Requirements:
 1. The emergency lighting control device shall work in conjunction with an auxiliary generator or a central inverter system to power light fixtures for egress lighting regardless of fixture wall switch position.
 2. All units shall be UL924 listed and approved.
- C. Operation:
 1. Device shall sense loss of normal power and switch the AC driver input power connected to an unswitched generator (or central inverter) supplied lighting circuit.

2. The device shall be capable of bypassing the wall switch when the auxiliary generator (or central inverter) powers.
 3. Unit shall be capable of 120/277 volt operation.
- D. Equipment:
1. Emergency Lighting Control Device - 3 Amp
 - a. For use within a single luminaire. Device shall be suitable for indoor and damp locations and capable of being used with fluorescent or LED lighting loads. Device shall be UL listed for installation inside, on top of or remote from the fixture. Shall include power loss sensing, UL924 listed and approved.
 2. Emergency Lighting Control Device - 20 Amp
 - a. For use adjacent to local switching means. Device shall be suitable for indoor and damp locations and capable of being used with incandescent, fluorescent and LED lighting loads. Shall include power loss sensing, UL 924 listed and approved.
 3. Branch Circuit Emergency Lighting Transfer Switch
 - a. Mounted onto junction box type, verify with field conditions. Device shall be suitable for indoor, damp and plenum (UL 2043) locations and capable of being used with incandescent, fluorescent and LED lighting loads. Shall include power loss sensing, UL 924 listed and approved.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- B. Verify that suitable support frames are installed where required.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Suspended Ceiling Mounted Luminaires:
 1. Do not use ceiling tiles to bear weight of luminaires.
 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
 4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 5. See appropriate Division 09 section where suspended grid ceiling is specified for additional requirements.

- G. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
 - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Suspended Luminaires:
 - 1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 - 2. Install canopies tight to mounting surface.
- I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Emergency Lighting Units:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- M. Exit Signs:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- N. LED Emergency Power Supply Units:
 - 1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
- O. Identify luminaires connected to emergency power system in accordance with Section 26 0553.
- P. Install lamps in each luminaire.

3.03 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

**SECTION 284600
FIRE DETECTION AND ALARM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transmitters for communication with supervising station.
- B. Circuits from protected premises to supervising station, including conduit.
- C. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.
- D. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements: Project administrative and procedural requirements.
- B. Division 02 - Existing Conditions: Demolition, cleaning and disposal requirements, cutting and patching requirements, and repairs.
- C. Division 07 - Thermal and Moisture Protection: Materials and methods for work to be performed by this installer.
- D. Division 08 - Openings: Door hardware, coiling fire doors and smoke and/or fire curtains to be released by fire alarm system.
- E. Division 14 - Conveying Equipment: Elevator systems monitored and controlled by fire alarm system and sensors and interlocks by fire alarm system.
- F. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- G. Section 21 3000 - Fire Pumps: Supervisory devices.
- H. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.
- I. Section 26 0005 - Basic Electrical Requirements.
- J. Section 26 0505 - Selective Demolition for Electrical
- K. Section 26 0533.13 - Conduit for Electrical Systems.
- L. Section 26 0533.16 - Boxes for Electrical Systems.
- M. Section 26 0553 - Identification for Electrical Systems.

1.03 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. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.
- F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- G. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Contractor shall provide submittals for equipment listed herein. Refer to Division 01 for submittal procedures.
- B. Evidence of designer qualifications.
- C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
1. Copy (if any) of list of data required by authority having jurisdiction.
 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
 4. System zone boundaries and interfaces to fire safety systems.
 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 7. List of all devices on each signaling line circuit, with spare capacity indicated.
 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
 11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
 12. Certification by Contractor that the system design complies with Contract Documents.
- D. Evidence of installer qualifications.
- E. Evidence of instructor qualifications; training lesson plan outline.
- F. Evidence of maintenance contractor qualifications, if different from installer.
- G. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
 2. Submit documentation of satisfactory inspections and tests.
 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- H. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 4. List of recommended spare parts, tools, and instruments for testing.
 5. Replacement parts list with current prices, and source of supply.
 6. Detailed troubleshooting guide and large scale input/output matrix.

7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- I. Project Record Documents: Have one set available during closeout demonstration:
 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- J. Closeout Documents:
 1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
- C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Alarm Control Units and Accessories:
 1. National Time & Signal: www.natsco.net.
 2. Provide control units made by the same manufacturer.
- B. Initiating Devices and Notification Appliances:
 1. Same manufacturer as control units.
 2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
 - 1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
 - 2. Protected Premises: Entire building shown on drawings.
 - 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards.
 - b. The requirements of the local authority having jurisdiction .
 - c. Applicable local codes.
 - d. Contract Documents (drawings and specifications).
 - e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
 - 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
 - 5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
 - 6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
 - 7. Program notification zones and voice messages as directed by Owner.
 - 8. Fire Command Center: Location indicated on drawings.
 - 9. Fire Alarm Control Unit: New, located at fire command center.
- B. Supervising Stations and Fire Department Connections:
 - 1. Public Fire Department Notification: By on-premises supervising station.
 - 2. On-Premises Supervising Station: Existing proprietary station operated by Owner, located at _____.
 - 3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
- C. Circuits:
 - 1. Initiating Device Circuits (IDC): Class B, Style A.
 - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
 - 3. Notification Appliance Circuits (NAC): Class B, Style W.
- D. Spare Capacity:
 - 1. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
- E. Power Sources:
 - 1. Primary: Dedicated branch circuits of the facility power distribution system.
 - 2. Secondary: Storage batteries.
 - 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
 - 4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
 - 1. Sprinkler water control valves.
 - 2. Dry-pipe sprinkler system pressure.
 - 3. Dry-pipe sprinkler valve room low temperature.

4. Fire pump(s).
 5. Elevator shut-down control circuits.
 6. Chute interlocks and controls.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
 2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
- C. Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
 2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
 3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.
- D. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
- E. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
 2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Division 08.

2.04 COMPONENTS

- A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
- D. Remote Annunciators: locate per plans.
- E. Initiating Devices:
1. Addressable Systems:
 - a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
 - b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
- F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
- G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- H. Locks and Keys: Deliver keys to Owner.
- I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.

1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 1. Hands-On Instruction: On-site, using operational system.
 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
 1. Initial Training: 1 session pre-closeout.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 1. Initial Training: 1 session pre-closeout.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 1. Be prepared to conduct any of the required tests.
 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 3. Have authorized technical representative of control unit manufacturer present during demonstration.

4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

3.05 MAINTENANCE

- A. See Division 01 for additional requirements relating to maintenance service.
- B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- C. Provide trouble call-back service upon notification by Owner:
 1. Provide on-site response within 2 hours of notification.
 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- F. Comply with Owner's requirements for access to facility and security.