

FIRE STATION NO. 11 STORAGE BUILDING

INVITATION TO BID NO. 2023C002



**Municipality of Anchorage
Maintenance & Operations
Capital Projects
PO Box 196650
Anchorage, AK 99519**

MUNICIPALITY OF ANCHORAGE
MAINTENANCE AND OPERATIONS DEPARTMENT
CAPITAL PROJECTS

2023C002 - FIRE STATION NO. 11 STORAGE BUILDING

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MUNICIPALITY OF ANCHORAGE PURCHASING DEPARTMENT

Invitation to Bid

No. 2023C002

Sealed bids will be received in accordance with the time schedule shown below by the Municipality of Anchorage at the Purchasing Department, 632 W. 6th Ave., Suite 520, Anchorage, Alaska 99501 for:

Fire Station No.11 Storage Building

Project Consists of demolishing the existing structure completely. Construct a new warm storage building.

ESTIMATED CONSTRUCTION COST: **Between: \$1,000,001 - \$3,000,000**

Site Visit: 10:00 A.M. Local Time, January 19, 2023
16716 Firehouse Lane, Eagle River, AK
99577

Pre-Bid Conference: N/A

Questions Due: 12:00 P.M. Local Time, January 24, 2023

Bid Opening: 2:00 P.M. Local Time, February 9, 2023

All Pre-Bid Conferences and/or Bid Openings may be attended in person or via conference call at this number (907) 343-6089. You may call in five (5) minutes before any scheduled conference. EMAILED BIDS WILL NOT BE ACCEPTED.

ALL QUESTIONS SHALL BE SUBMITTED PRIOR TO THE QUESTION DUE DATE THIS WILL BE THE FINAL OPPORTUNITY TO ASK QUESTIONS OR REQUEST CLARIFICATIONS.

Requests for interpretation or clarification of the bidding Documents shall be made in writing to the Purchasing Office (wwpur@muni.org). Please reference the Invitation to Bid Number & Project Title. Do not contact the specified department directly.

To maintain the project schedule, Interpretations, corrections, or changes to the Bidding Documents shall be made by Addendum and shall not be binding unless included in the Addendum. It is your responsibility to periodically check the website for addenda.

Municipality of Anchorage
ITB: 2023C002

At the above indicated time, the bids will be opened publicly and read. Bids must be received by the Purchasing Officer prior to the time fixed for opening of the bids to be considered. Time of receipt will be as determined by the time stamp in the Purchasing Office, Suite 520.

The Municipality of Anchorage reserves the right to reject any and all bids and to waive any informalities in the bids. No bidder may withdraw his bid after the hour set for the opening of bids or before the award of contract unless said award is delayed for a period exceeding forty-five (45) days from the time of the opening.

The Municipality shall not be responsible for bid preparation costs, nor for costs, including attorney fees, associated with any (administrative, judicial or otherwise) challenge to the determination of the lowest responsive and responsible bidder and/or award of contract, and/or rejection of bids. By submitting a bid, each bidder agrees to be bound in this respect and waives all claims to such costs and fees.

Contracts shall be awarded by written notice issued by the Purchasing Officer to the lowest responsive and responsible bidder; however, preference will be given to local bidders in compliance with Anchorage Municipal Code Section 7.20.040.

The Municipality of Anchorage assumes no responsibility for any interpretations or presentations made by any of its officers or agents unless such interpretations or presentations are made by written addendum to this Invitation to Bid.

Bonding Requirements are per MASS/MASS B or as per special provisions

THE MUNICIPALITY OF ANCHORAGE IS AN “EQUAL OPPORTUNITY EMPLOYER”

PUBLISH ONE TIME

Date: January 10, 2023

Senior Buyer Assigned to this Project:
Melanie A Clark

Chris Hunter

Chris Hunter
Deputy Purchasing Director

BIDDER'S CHECKLIST

INSTRUCTION TO BIDDER

I. GENERAL:

Bidders are advised that notwithstanding any instructions or implications elsewhere in this Invitation to Bid only the documents shown and detailed on this sheet need be submitted with and made part of their bid. Other documents may be required to be submitted after bid time, but prior to award. Bidders are hereby advised that failure to submit the documents shown and detailed on this sheet shall be justification for rendering the bid nonresponsive. Evaluation of bids for responsiveness shall be accomplished in accordance with Anchorage Municipal Code, Title 7.

II. REQUIRED DOCUMENTS FOR BID

NOTE: "Only the following listed items as marked with an "X" are required to be completely filled out and submitted with the bid."

- X Bid Proposal consisting of two (2) pages numbered 00 41 13 - 1 through 00 41 13 - 2 Bid Proposal Pages **must be manually signed.**
- X Erasures or other changes made to the Bid Proposal Sheet must be initialed by the person signing the bid.
- X Bid Bond, certified check, cashier's check, money order or cash shall be submitted with the bid in the amount indicated.
- X All Addenda issued shall be acknowledged in the space provided on the Bid Proposal sheet or by manually signing the Addenda sheet and submitting it prior to the bid opening in accordance with Anchorage Municipal Code 7.20.020C.

III. REQUIRED DOCUMENTS AFTER BID OPENING

The following documents are required within **five (5)** working days of notification by the Purchasing Office. Failure, in whole or in part, to submit the documents required below shall be grounds to determine the Bidder as non-responsive.

- X In accordance with AO No. 2019-130 (S), Anchorage Municipal Code 7.20.030 and 7.20.070, Contractor Questionnaire consisting of three (3) Pages, Prime Contractor Form Filled out by Prime Contractor **and** all known subcontractors.

NOTICE: As of December 3, 2019, there are new requirements for determining contractor responsibility. Please review AO NO. 2019-130 (S), AMC 7.20.030 and 7.20.070, and the attached Contractor Questionnaire before submitting a bid.

Municipality of Anchorage Contractor Questionnaire

Contractors/Vendors wishing to qualify for award of a bid or proposal offered by the Municipality of Anchorage shall submit this completed form and any supplemental information requested by this form within five days following a request by the Purchasing Officer.

This form is to be filled out by the prime, and subcontractors that perform work "on-site". On-site is defined as the physical place or places where the building or work called for in the contract will remain, and any other site where a significant portion of the building or work is constructed, provided that such site is established specifically for the performance of the contract or project.

Contractor/Vendor Name: _____

Owner(s) of Company (if sole proprietorship or partnership): _____

List all Alaska construction contractor's registration numbers, registration types and expiration dates of the Alaska business licenses held by your company in the past three years:

Has your company changed names, business license number, or contractor registration number in the past three years?

Yes No

If "Yes," explain on a separate signed page, including the reason for the change.

Has any owner, partner or (for corporations) officer of your company operated any business offering similar services outlined in the bid or proposal under any other name in the past three years?

Yes No

If "Yes," explain on a separate signed page, including the reason for the change.

Certifications & Disclosures

For these questions & certifications, "company" includes any entity that shares or has shared majority ownership or control with your company. "Determination of violation" includes any citations, orders or recommendations issued to or against the company.

Debarment

1. In the last three years has your company been debarred from bidding on, or being awarded, a state or federal project?

Yes No

Certifications and Disclosures – Prime and Sub Contractor Form

Occupational Safety & Health

Note: Only willful violations of state or federal occupational safety and health laws will result in disqualification; disclosure of other violations does not lead to automatic disqualification.

2. In the last three years has your company been determined to have committed a **willful violation** of state or federal occupational safety and health law? For purposes of this question, a state or federal occupational safety and health law includes laws enforced by the Occupational Safety and Health Administration (OSHA), Alaska Occupational Safety and Health (AKOSH), or another state’s occupational safety and health agency.

Yes No

3. In the last three years, has the federal Occupational Safety and Health Administration (OSHA), Alaska Occupational Safety and Health (AKOSH), or another state’s occupational safety and health agency, made a determination of violation against your company?

Note: If you have filed an appeal of a citation and the appropriate appeals board has not yet ruled on your appeal, you need not include information about it.

Yes No

If “Yes,” attach a separate signed page describing each citation.

Wage & Hour

Note: Only willful violations of state or federal wage and hour laws will result in disqualification; disclosure of other violations does not lead to automatic disqualification.

4. In the last three years has your company been determined to have committed a **willful violation** of state or federal wage and hour law?

Yes No

5. In the last three years has there been a determination of violation of wage and hour laws against your company? Wage and hour violations include failure to pay minimum wages, overtime, or prevailing wages.

Yes No

If “Yes,” attach a separate signed page describing each violation, identifying the claim by claimant, date, and status/outcome.

Unemployment Insurance & Workers’ Compensation

6. In the last three years has there been a determination of violation of unemployment insurance or workers’ compensation requirements against your company?

Yes No

If “Yes,” attach a separate signed page describing each violation, identifying the claim by claimant, date, and status/outcome.

Certifications and Disclosures – Prime and Sub Contractor Form

Licensing & Registration

7. If a license or certificate of fitness is required to perform any services provided by your company, has there been a determination of violation of any certificate of fitness requirements against your company in the last three years?

Yes No

If “Yes,” attach a separate signed page describing each violation, identifying the claim by claimant, date, and status/outcome.

Subcontracting

8. I certify that all independent subcontractors engaged by my company meet the definition of an independent contractor under Alaska Statute 23.30.230.

Yes No

9. I understand that my company is responsible for ensuring that each subcontractor my company uses on the project completes this form and associated documentation. I will submit any disclosures required by Anchorage Municipal Code.

I understand

10. I understand that my company is responsible for providing this form and any associated documentation for each subcontractor hired after award within 30 days of hire, and that the subcontractor may not begin work on the project until such information is provided.

I understand

11. I understand that my company is responsible for ensuring that if any event, such as a violation or loss of coverage, causes the information submitted by the subcontractor to change, the subcontractor shall submit updated certifications or disclosures within 30 days of occurrence to the department contract administrator.

I understand

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

Dated: _____ (Signature)

_____ (Printed name and title)

Right to Appeal: Anchorage Municipal Code provides that any person adversely affected in connection with the award of a municipal contract, including the Municipality’s determination on responsibility, may request that the mayor or assembly refer the matter to the bidding review board.

BID PROPOSAL
(CERTIFICATION)

TO: MUNICIPALITY OF ANCHORAGE
PURCHASING DEPARTMENT
632 W. 6TH AVENUE, SUITE 520
ANCHORAGE, ALASKA 99501

January 10, 2023

SUBJECT: Invitation to Bid No. 2023C002

PROJECT TITLE: Fire Station No. 11 Storage Building

Pursuant to and in compliance with subject Invitation to Bid, and other bid documents relating thereto, the bidder hereby proposes to furnish all labor and materials and to perform all work for the construction of the above referenced project in strict accordance with the bid documents at the prices established in the Bid Proposal, page **BP-1 through BP-2** submitted herewith.

The bidder agrees, if awarded the contract, to commence and complete the work within the time specified in the bid documents.

BASIC BID; LUMP SUM \$ _____

The bidder acknowledges receipt of the following addenda:

Addenda No. _____	Addenda No. _____
Addenda No. _____	Addenda No. _____
Addenda No. _____	Addenda No. _____

Enclosed is a Bid Bond in the amount of _____.
(Dollar Amount or Percentage of Bid)

Type of Business Organization

The bidder, by checking the applicable box, represents that it operates as () a corporation incorporated under the laws of the State of _____, () an individual, () an LLC, () a partnership, () a nonprofit organization, or () a joint venture. If a partnership or joint venture, identify all parties on a separate page

Company Name

Is this project Federally Funded?

Yes

No

BID PROPOSAL
(CERTIFICATION)
Continued

SUBJECT: Invitation to Bid No. 2023C002

PROJECT TITLE: Fire Station No. 11 Storage Building

Date

Alaska Contractor's License Number

Company Name (Printed)

Employer's Tax Identification Number

Authorized Representative Signature

Printed Name & Title

Company **Mailing** Address

Company Phone Number

City, State, Zip Code

Company Fax Number

Company **Physical** Address
(if different from mailing address)

Company Email Address

City, State, Zip Code

BID BOND

KNOW ALL MEN BY THESE PRESENTS, That we, _____

as Principal, and _____

_____ a corporation organized under the laws of the _____

_____ and authorized to transact surety business in the

State of Alaska, of _____

as Surety, and held and firmly bound unto the MUNICIPALITY OF ANCHORAGE, as

Obligee, in the full and just sum of _____

_____ (\$ _____) Dollars,

lawful money of the UNITED STATES, for the payment of which sum, well and truly to

be made, we bind ourselves, our heirs, executors, administrators, successors and

assigns, jointly and severally, firmly by these presents. WHEREAS, the said Principal is

herewith submitting its proposal for _____

The condition of this obligation is such that if the aforesaid Principal will, within the time required enter into a formal contract and give a good and sufficient bond to secure the performance of the terms and conditions of the contract, then this Obligation to be void; otherwise the Principal and Surety will pay unto the Obligee the amount stated above.

Signed, sealed, and delivered _____, 20_____.

WITNESS AS TO PRINCIPAL:

Contractor Name

Contractor Signature

(AFFIX CORPORATE SEAL)

Corporate Surety

Surety Business Address

(AFFIX SURETY SEAL)

By _____
(Attorney-In-Fact)

CONTRACT

Invitation to Bid No. **2021C** _____

Contract No. **C-2021** _____

NAME AND ADDRESS OF CONTRACTOR:

Check appropriate box:

Incorporated in the State of

MUNICIPALITY OF ANCHORAGE, acting through _____ (hereinafter the Owner).

Contract for _____

BID SCHEDULES

ITEMS

PLAN SHEET
FILE NUMBERS

AMOUNT

\$ _____

Total Amount : \$ _____

THIS CONTRACT, entered into by the MUNICIPALITY OF ANCHORAGE, ALASKA, acting through the Owner named above, and the individual, partnership, or corporation named above, hereinafter called the Contractor, WITNESSETH that the parties hereto do mutually agree as follows:

Statement of Work: The Contractor shall furnish all labor, equipment and materials and perform the Work above described, for the amount stated, in strict accordance with the Contract Documents.

CONTRACT DOCUMENTS

- I. This CONTRACT consisting of 4 pages.
- II. The Bid Proposal Section ___ consisting of ___ pages numbered as ___, **as contained in ITB 2021C_____.**
- III. The Contract Performance and Payment Bond _____.
- IV. The Contractor's Certificate of Insurance Dated _____.
- V. Municipality of Anchorage Standard Specifications dated 2015 (MASS) Incorporated by Reference, **as contained in ITB 2021C_____.**
- VI. Specifications consisting of the following:
Supplemental Provisions Section _____ consisting of _____ pages, with attachments Exhibit A through F, **as contained in ITB 2021C_____.**
- VII. Equal Opportunity Special Provisions and Forms Section _____ consisting of _____ pages, **as contained in ITB 2021C_____.**
- VIII. Disadvantaged/Women-Owned Business Enterprise (DBE/WBE) Specification Section _____ consisting of _____ pages, **as contained in ITB 2021C_____.**
- IX. The Laborers' and Mechanics' Minimum Rates of Pay dated September 1, 2015 Section _____ consisting of _____ pages, **as contained in ITB 2021C_____.**
- X. Submittal List Section _____ consisting of _____ page, **as contained in ITB 2021C_____.**
- XI. The Drawings consisting of _____ sheets numbered _____, **as contained in ITB 2021C_____.**

IN WITNESS WHEREOF, the parties hereto have executed this Contract as of the Contract Date entered below.

MUNICIPALITY OF ANCHORAGE, ALASKA

VENDOR _____

BY _____
Signature

BY _____
Signature

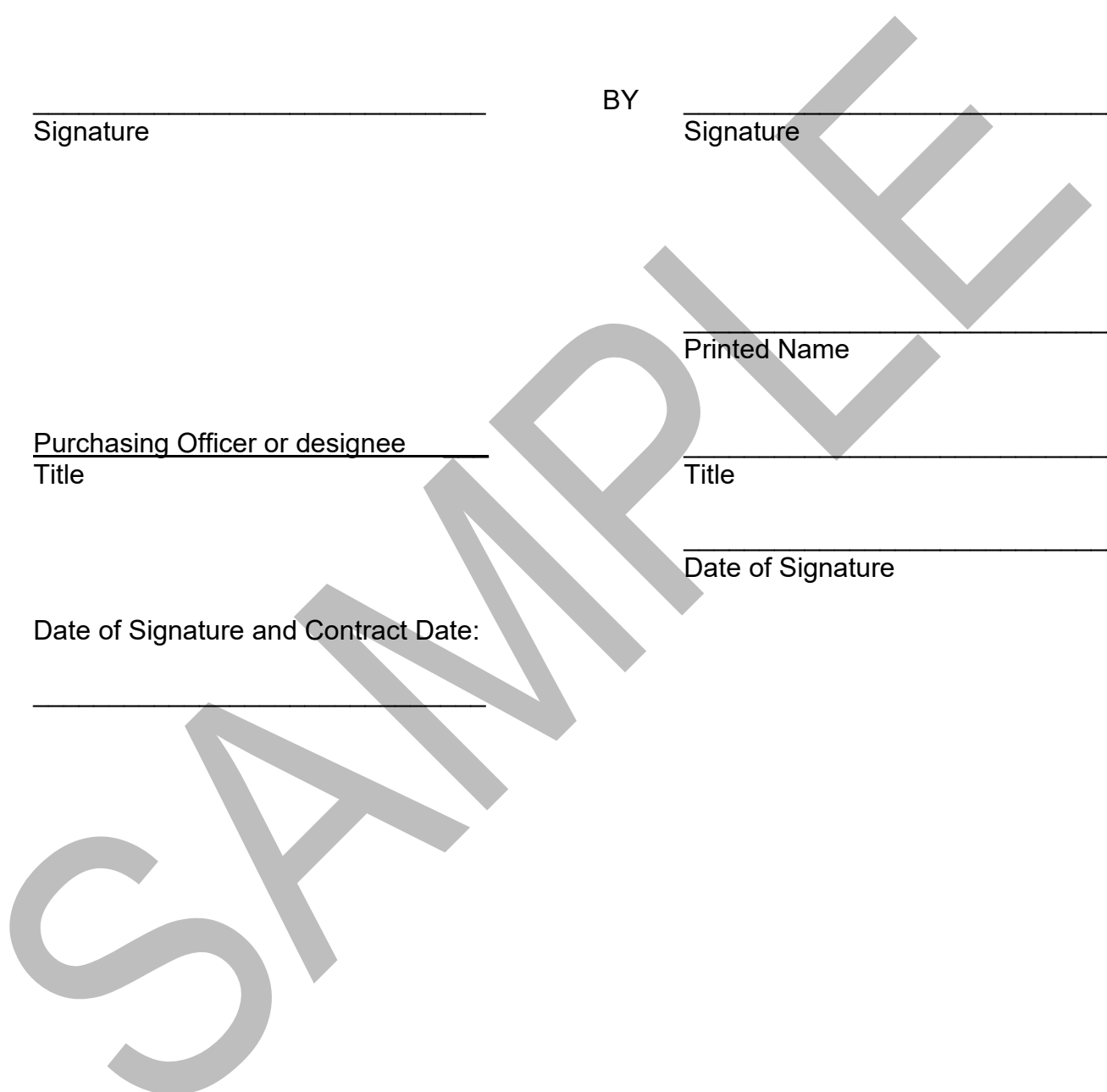
Printed Name

Purchasing Officer or designee
Title

Title

Date of Signature

Date of Signature and Contract Date:



**CONTRACT AND PERFORMANCE AND PAYMENT
BOND SIGNATURE INSTRUCTIONS**

1. The full name and business of the Contractor shall be inserted on Page 1 of the Contract and on the Performance and Payment Bond, hereinafter the Bond.
2. Two copies of the Contract and the Bond shall be manually signed by the Contractor. If the Contractor is a partnership or joint venture, all partners or joint ventures shall sign the Contract and the Bond except that one partner or one joint venturer may sign for the partnership or joint venture when all other partners or joint venturers have executed a Power-of-Attorney authorizing one partner or joint venturer to sign. The Power-of-Attorney shall accompany the executed contract and the Bond.
3. If the Contractor is a corporation, the President of the corporation shall execute the Contract and the Bond unless a Power-of-Attorney or corporate resolution shall accompany the executed Contract and Bond.
4. The Bond shall be returned to the Purchasing Division undated. The Contract Date shall be inserted on the Contract when the Municipality signs the Contract and the Bond shall be dated the same as the Contract Date.

SAMPLE

CONTRACT PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, That we _____
 _____ of _____
 as Principal, and _____
 a corporation organized under the laws of the _____
 _____ and authorized to transact surety business in the State of Alaska,
 of _____
 as Surety, are held and firmly bound unto the MUNICIPALITY OF ANCHORAGE, as Obligee, in the full and
 just sum of _____
 (\$ _____) Dollars, lawful money of the UNITED STATES, for the payment
 which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and
 assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION IS SUCH, that whereas the principal has entered into a certain
 contract dated the _____ date of _____ 20 _____, with the Obligee for the
 construction of _____

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

NOW THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants,
 terms, conditions, and agreements of said contract, and shall promptly make payments to all persons
 supplying labor and material in the prosecution of the work provided for in said contract, during the original
 term of said contract and any extensions of modifications thereof that may be granted by the Municipality, with
 or without notice to the Surety, then this obligation to be void; otherwise to remain in full force and effect.

This obligation is made for the use of said Obligee and also for use and benefit of all persons who may perform
 any work or labor or furnish any material in the execution of said Contract and may be sued on thereby in the
 name of said Obligee.

This said Surety, for the value received, hereby stipulates and agrees that no change, extension of time,
 alteration or addition to the terms of the contract or to the work to be performed thereunder or the
 specifications accompanying the same, shall in anywise affect its obligations on this bond, and it does hereby
 waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the
 work or to the specifications.

Whenever Principal shall be, and declared by Obligee to be in default under the Contract the Obligee having performed Obligee's obligations thereunder, the Surety may promptly remedy the default or shall promptly:

1. Complete the Contract in accordance with its terms and conditions, or
2. Obtain a bid or bids for submission to Obligee for completing the Contract in accordance with its terms and conditions and upon determination by Surety of the lowest responsible bidder, or, if the Obligee elects, upon determination by Obligee and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Obligee and make available as Work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price but not exceeding, including other costs and damages for which the Surety may be liable hereunder the amount set forth in the first paragraph hereof. The term "balance of the contract price" as used in this paragraph, shall mean the total amount payable by Obligee to Principal under the Contract and any amendments thereto, less the amount properly paid by Obligee to Principal.

IN TESTIMONY WHEREOF, the parties hereunto have caused the execution hererof in _____ original counterparts as of the _____ day of _____, 20_____.

WITNESS AS TO PRINCIPAL:

(AFFIX CORPORATE SEAL)

(AFFIX SURETY SEAL)

Principal Name

Principal Signature

Corporate Surety

Surety Business Address

BY:

(Attorney-In-Fact)

INSURANCE

By submitting a bid, the bidder agrees, if they are the successful bidder, to obtain and maintain the insurance required by this section. The bidder also agrees to provide the Municipality a copy of their Certificate of Liability Insurance prior to signing the contract and prior to commencement of any work under this contract.

GENERAL: The Contractor will not allow any subcontractor to commence work until the subcontractor has obtained insurance as listed in this section. The contractor and each subcontractor shall maintain this insurance throughout the life of this contract, including any maintenance and/or guarantee/warranty period. The contractor shall obtain separate insurance certificates for each contract.

ADDITIONAL INSURED: The Municipality of Anchorage shall be listed as an additional insured on all General and Auto Liability policies required by this contract. All policies shall contain a waiver of subrogation against the Municipality, except Professional Liability. All policies shall remain in effect during the life of the contract. The Contractors insurance certificate shall also indicate the Municipality of Anchorage as a certificate holder of the policy.

WORKERS COMPENSATION: The Contractor shall purchase and maintain during the life of this contract, workers compensation insurance for all employees who will work on this project and, if any work is sublet, the Contractor shall require the subcontractor similarly to provide such insurance. Employers' Liability with a minimum limit of \$500,000 shall be maintained and Workers Compensation with minimum limits as required by Alaska State Workers Compensation Statutes. The policy shall contain a waiver of subrogation against the Municipality.

NOTICE TO "OUT-OF-STATE" CONTRACTORS WORKING IN ALASKA: The Contractor shall provide evidence of Workers Compensation insurance, either State of Alaska Workers Compensation coverage or an endorsement to the Contractor's home state Workers Compensation policy, evidencing coverage for "other states" including Alaska, prior to execution of a contract or, if approved, before commencement of contract performance in Alaska.

GENERAL LIABILITY: The Contractor shall purchase and maintain, in force, during the life of this contract such general liability insurance as shall protect the Owner and the Contractor against losses which may result from claims for damages for bodily injury, including accidental death, as well as from claims for property damages which may arise from any operations under this contract whether such operations be those of the Contractor, a subcontractor or anyone directly or indirectly employed by either of them.

<u>Commercial General Liability</u>	<u>Minimum Limits</u>
Products/Completed Operations	\$2,000,000
Personal & Advertising Injury	\$1,000,000
Each Occurrence	\$1,000,000
General Aggregate	\$2,000,000
Medical Payments	\$5,000
<u>Commercial Auto Liability</u>	<u>Minimum Limits</u>
Combined single limit (Bodily Injury and Property Damage)	\$1,000,000
Including all owned, hired, and non-owned	
<u>Workers Compensation and Employers Liability</u>	<u>Minimum Limits</u>
Per Alaska statute	\$500,000
<u>Errors and Omissions</u>	<u>Minimum Limits</u>
Professional Liability (Not required unless limits appear in space provided)	
<u>Umbrella Liability</u>	<u>Minimum Limits</u>
(Not required unless limits appear in space provided)	
\$ _____ S.I.R.	

Each insurance policy required by this section shall require the insurer to give advance notice to the MOA/Contract Administrator prior to the cancellation of the policy. IF the insurer does not notify the MOA upon policy cancellation, it shall be the Contractor's responsibility to notify the MOA of such cancellation.

COMPLIANCE WITH LAWS

The Contractor shall observe and abide by all applicable laws, regulations, ordinances and other rules of the State of Alaska and/or any political subdivisions thereof, or any other duly constituted public authority wherein work is done or services performed, and further agrees to indemnify and save the Municipality of Anchorage harmless from any and all liability or penalty which may be imposed or asserted by reason of the Contractor's failure or alleged failure to observe and abide thereby.

(Remainder of Page Initially left Blank)



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) shall be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: PHONE (A/C, No, Ext): _____ FAX (A/C, E-MAIL ADDRESS: _____)	
INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
	INSURER A :	
	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS								
	GENERAL LIABILITY <input type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE OCCUR <input type="checkbox"/> GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input type="checkbox"/> PRO <input type="checkbox"/> LOC						EACH OCCURRENCE \$ DAMAGE TO RENTED PREMISES (Ea occurrence) \$ MED EXP (Any one person) \$ PERSONAL & ADV INJURY \$ GENERAL AGGREGATE \$ PRODUCTS - COMP/OP AGG \$ \$								
	AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO <input type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> SCHEDULE D AUTOS <input type="checkbox"/> NON-OWNED AUTOS						COMBINED SINGLE LIMIT (Ea accident) \$ BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$ \$								
	UMBRELLA LIAB <input type="checkbox"/> EXCESS LIAB OCCUR CLAIMS- DED RETENTION \$						EACH OCCURRENCE \$ AGGREGATE \$ \$								
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below Y / N <input type="checkbox"/> N / A						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">WC STATUTORY LIMITS</td> <td style="width: 50%;">OTHER</td> </tr> <tr> <td>E.L. EACH ACCIDENT</td> <td>\$</td> </tr> <tr> <td>E.L. DISEASE - EA</td> <td>\$</td> </tr> <tr> <td>E.L. DISEASE - POLICY LIMIT</td> <td>\$</td> </tr> </table>	WC STATUTORY LIMITS	OTHER	E.L. EACH ACCIDENT	\$	E.L. DISEASE - EA	\$	E.L. DISEASE - POLICY LIMIT	\$
WC STATUTORY LIMITS	OTHER														
E.L. EACH ACCIDENT	\$														
E.L. DISEASE - EA	\$														
E.L. DISEASE - POLICY LIMIT	\$														

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

- The Municipality of Anchorage is an additional insured on Auto and General Liability policies. All policies, including workers compensation, contain a WAIVER OF SUBROGATION against the Municipality, except Professional Liability, .
- CANCELLATION: "Should any of the above described policies be cancelled before the expiration date thereof, notice will be delivered in accordance with the Policy Provisions."

CERTIFICATE HOLDER	CANCELLATION SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. Authorized Representative
---------------------------	--

CERTIFICATE OF COMPLIANCE

FIRE STATION 11 STORAGE BUILDING

I (WE) HEREBY CERTIFY THAT ALL WORK HAS BEEN PERFORMED AND MATERIALS SUPPLIED IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT FOR THE ABOVE WORK, AND THAT:

- A. Not less than the prevailing rates of wages as ascertained by the governing body of the contracting agency has been paid to laborers, workmen, and mechanics employed on this work:
- B. There have been no unauthorized substitutions of subcontractors' nor have any subcontractors been entered into without the names of the subcontractors have been submitted to engineer prior to the start of such subcontracted work;
- C. No subcontract was assigned or transferred or performed by any subcontractor other than the original subcontractor, without prior notice having been submitted to the engineer together with the names of all subcontractors;
- D. All claims for material and labor and other service performed in connection with these specifications have been paid.
- E. All monies due the State Industrial Accident Fund, the State Unemployment Compensation Trust Fund, the State Tax Commission, hospital associations and/or others have been paid.

_____ (Date)

_____ (Contractor)

IN WITNESS WHEREOF, the undersigned has signed and sealed this instrument this _____ day of _____ 2022

STATE OF ALASKA)
) ss
 THIRD JUDICIAL DISTRICT)

THIS IS TO CERTIFY that on this _____ day of _____, 20____, before me, the undersigned, a Notary Public in and for the State of Alaska, personally appeared _____, known to me to be the individual named in the foregoing instrument, and he/she acknowledged to me that he/she executed the foregoing instrument as a free act and deed for the uses and purposes therein stated.

WITNESS my hand and official seal this day and year in this certificate first above written.

Notary Public in and for Alaska
My commission expires: _____

**MUNICIPALITY OF ANCHORAGE
STANDARD SPECIFICATIONS-BUILDINGS**

**(MASSB)
GENERAL CONDITIONS
SECTION 00 72 13
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GENERAL CONDITIONS SECTION 00700

SECTION 00 72 13.01 DEFINITIONS

In these Contract Documents, the following words or expressions shall have the meaning given below:

AASHTO	- American Association of State Highway and Transportation Officials
ACI	- American Concrete Institute
ANSI	- American National Standards Institute
API	- American Petroleum Institute
APWA	- American Public Works Association
ASA	- American Standard Association
ASHRAE	- American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.
ASTM	- American Society for Testing and Materials
AWS	- American Welding Society
AWWA	- American Water Works Association
IBC	- International Building Code
ICBO	- International Conference of Building Officials
IEEE	- Institute of Electrical and Electronics Engineers
IFC	- International Fire Code
IMC	- International Mechanical Code
ISO	- Insurance Service Office
IPC	- International Plumbing Code
MASS	- Municipality of Anchorage – Standard Specifications
MASSB	- Municipality of Anchorage – Standard Specifications/Buildings
NEC	- National Electrical Code
NEMA	- National Electrical Manufacturer's Association
NESC	- National Electrical Safety Code
NFC	- National Fire Code
NFPA	- National Fire Protection Association
OSHA	- Occupational Safety and Health Act

Addendum (Addenda) - Written or graphic communications issued prior to the execution of the Contract that modify or interpret the Bidding Documents and become part of the Contract Documents upon execution of the Contract.

Additional Work - Work not specifically provided for in the Contract as awarded but which is consistent with the original Scope of Work and for which a price for similar work is provided in the Contract.

Alternate – A defined portion of the work that is priced separately and provides options in the final scope of the project.

Architect/Engineer – The author and interpreter of the Contract Documents.

Assembly - The Anchorage Assembly of the Municipality of Anchorage.

Beneficial Occupancy Date - The date, established by the Owner's Representative, when construction is sufficiently completed in accordance with the Contract Documents and the Owner occupies or utilizes the Work, or a designated portion thereof, for the use for which it is intended.

Bid Proposal - The written proposal of the Bidder, on the form furnished, for the Work contemplated.

Bidder - Any individual, firm, partnership, corporation, or combination thereof formally submitting a Bid for the Work contemplated and acting directly or through an authorized representative.

Bidding Documents - The Invitation to Bid, Instruction to Bidders, Bidders Check List, Bid Forms, Contract Forms, Contract Conditions, Supplementary Conditions, Technical Specifications, Construction Drawings, and all Addenda.

Bid Guarantee - The security furnished by the Bidder as a guarantee to enter into a Contract for the Work contemplated if the Bidder is awarded the Contract.

Change Order/Request for Proposal – A written proposal prepared by the Contractor describing and documenting added costs or time extensions that the Contractor feels have been incurred due to unforeseen work and other matters not contemplated or adequately provided for in the Contract Documents.

Change Order/Contract Amendment - A written agreement entered into between the Contractor and the Owner to amend the Contract Documents or to otherwise provide for unforeseen work and other matters not contemplated or adequately provided for in the Contract Documents.

Contract - The four- (4-) page form agreement entitled "Contract" executed by the Contractor and then by the Owner on behalf of the Municipality. The Contract represents the entire and integrated agreement between the parties and supersedes all prior negotiations, representations, or agreements, either written or oral.

Contract Completion Date - The calendar date specified in the proposal for the full completion of all Work required by the Contract Documents, except as otherwise provided in the Contract.

If a number of calendar days is specified in the proposal for the completion of the Contract, the Contract Completion Date will be the specified number of days after the effective date of the Notice to Proceed, including authorized time extensions.

Contract Documents - The Contract and those documents described in page 2 of the Contract. The Contract Documents can only be amended by written Change Order. Instructions, clarifications, and directives issued by the Owner's Representative under Article 5.1 are not Contract Documents.

Contract Item (Bid Item, Pay Item) - A specifically described unit of Work for which a price is provided in the Contract.

Contractor - The individual, firm, corporation, partnership, or joint venture executing the Contract and performing the Work under the terms of the Contract Documents or, where applicable, the designated subcontractors or the employees of the individual, firm, corporation, partnership, or joint venture.

Days -

Calendar: Unless otherwise designated in the Supplementary Conditions, days as used in the Contract Documents are consecutive calendar days.

Working: A working day is defined as any day on which the Contractor is required to work by the Contract Documents or any other day not otherwise defined herein as a nonworking day.

Nonworking: A nonworking day is defined as Sunday, a recognized holiday, a day on which the Contractor is specifically required by the Supplementary Conditions to suspend construction operations, or a day on which a suspension order is in effect. Recognized holidays shall be: New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, and Christmas Day. When any of the above days falls on a Saturday, the preceding Friday shall be counted as a holiday. When any of the above days falls on a Sunday, the following Monday shall be counted as a holiday.

Drawings - Graphic and textural information organized for the purpose of conveying data regarding design intent and construction requirements and listed and referred to on page 2 of the Contract.

Extra Work - Work not within the original Scope of Work but which is determined by the Owner's Representative to be essential for the satisfactory completion of the Contract.

Final Acceptance Date - The date on which the Work in its entirety has been constructed, inspected, accepted, and a Certificate of Completion issued, pursuant to the provisions of Article 5.27 - Final Inspection.

Furnish – To purchase and deliver to the Project.

Indicated - Shown on the Drawings, noted on Drawings, specified, or a combination thereof.

Inspector - The authorized representative of the Owner assigned to observe the Work.

Install – To set in place and make usable.

Liquidated Damages - The amount prescribed herein to be paid to the Owner, or to be deducted from any payments due or to become due the Contractor, for each day's delay in completing the whole or any specified portion of the Work beyond the time allowed in the Contract or as extended by the Change Order.

Municipality – The Municipality of Anchorage.

New Material and Equipment – Equipment and material that has not previously been used and is in production.

Necessary - Needed, as reasonably inferred from the Contract Documents, in order to make the Work complete and available for use.

Notice to Proceed - The written communication issued by the Owner to the Contractor authorizing the latter to proceed with the Work and that identifies the Owner's Representative and establishes the time of commencement and date of completion.

Notice-to-Resume - The written notice issued by the Owner's Representative that terminates a period of suspension of Work, reinstates the counting of Contract time, and requires the Contractor to resume Contract Work.

Or Equal - Whenever a material, article, or piece of equipment is identified on the Drawings or in the Project Manual by reference to manufacturers' or vendors' names, trade names, or catalog numbers, it is intended merely to establish a standard; and any material, article, or equipment of other manufacturers and vendors that will perform in an equal or better manner the duties imposed by the general design will be considered equally acceptable provided the material, article, or equipment so proposed will not require a change in the related work and is, in the opinion of the Owner's Representative, of equal or better substance and function.

Owner - The Department or Agency of the Municipality of Anchorage identified in page one (1) of the Contract. "Owner" does not include those Municipal employees, such as the Building Official and the Fire Marshal and their staffs, who enforce certain building, health and safety, and fire codes.

Owner's Representative – The person authorized to act on the Owner's behalf.

Performance and Payment Bond - The form of security, approved by the Municipality, that is furnished by the Contractor and the Contractor's Surety, guaranteeing the complete and faithful performance of all the obligations and conditions placed upon the Contractor by the Contract.

Product Data - Brochures, illustrations, diagrams, and other information prepared by the manufacturer and furnished by the Contractor to illustrate a material, product, or system for some portion of the Work.

Project - The total construction of which the Work performed under the Contract Documents may be the whole or a part.

Project Manual - The bound information that includes the bidding requirements, contract conditions, contract forms, and technical specifications.

Provide – To furnish, install, and/or to perform all work necessary to complete the Work.

Purchasing Officer - That person within the Municipality of Anchorage who is vested under the Anchorage Municipal Code with all authority pertaining to the procurement of supplies, services, and construction prior to execution of the Contract.

Request For Information (RFI) – A written document prepared by the Contractor to request information, clarification or deviation to the Contract Documents. Each RFI shall be numbered consecutively and a log maintained of submittals and responses.

Record Drawings – Detailed drawings that accurately depict all changes in location (both horizontal and vertical), material, equipment, and other elements of Work accomplished by the Contractor.

Samples - Physical examples that illustrate materials, equipment, or workmanship and establish standards by which the Work or a product will be judged.

Shop Drawings - All drawings, diagrams, illustrations, schedules, and other data that are prepared by the Contractor, a Subcontractor, a manufacturer, a supplier, or a distributor and which illustrate the equipment, material, or some portion of the Work.

Street Closure - Any action that renders one or more lanes of a street unusable to vehicular traffic.

Subcontractor - Any individual, firm, corporation, partnership or joint venture acting for or on behalf of the Contractor in the performance of a part of the Contract. This does not include those working for hire or suppliers of material or equipment.

Substantial Completion Date - The date upon which the improvements that are the subject matter of the Contract have been inspected and, in the opinion of the Owner's Representative, are essentially completed and available for the Owner's beneficial use for the purpose and in the manner intended by the Contract Documents, and all required testing and inspections have been satisfactorily completed.

Supplementary Conditions - That portion of the Project Manual entitled Supplementary Conditions that modify and expand the General Conditions and set forth conditions or requirements unique to the Project.

Surety - The Company or Association that is bound with and for the Contractor for the acceptable performance of the Contract and for the payment of all obligations arising out of the Contract. Regarding the Bid Guarantee, "Surety" refers to the Company or Association that will forfeit the sum of the Guarantee when the Bidder fails to execute the Contract after the Bid is accepted by the Municipality.

Technical Specifications - Divisions 1 through 49 of the Project Manual that define the qualitative requirements for products, materials, and workmanship.

Time and Material Work - Work performed by the Contractor at the written direction of the Owner's Representative for which no item is provided in the Contract and for which no unit price or lump sum basis can be agreed upon.

Unit Prices – A cost quoted by a bidder for a single, specified unit of work. Unit prices may be additive and/or deductive.

Utility Company - The person, corporation, company, agency, or other entity that furnishes service through, operates, or owns a conduit, pipe, wire, cable, or other transmission line for the purpose(s) of petroleum and petroleum products, electricity, sanitary sewer, communications, steam, water, natural gas, and storm sewer.

Winter Suspension - The period of time during which no fieldwork is accomplished due to adverse winter weather conditions as permitted by Article 5.25 – Suspension of Work

Work - Work shall mean the furnishing of all labor, materials, equipment, and other incidentals necessary or convenient for the successful completion of all the duties and obligations imposed by the contract.

Working Titles – Working titles that are adjectives or have masculine genders such as "workman" and "flagman" or are pronouns such as "he," "his," and "him" are used in the Contract Documents for the sake of brevity and are intended to refer to persons of either gender.

Written Notice - A written communication delivered in person to the individual or to a member of a firm, to an officer of a corporation, or to a representative of an agency for whom it is intended, or sent by mail to the business address stated in the Contract Documents.

SECTION 00 72 13.02 BIDDING REQUIREMENTS AND CONDITIONS

Article 2.1 Examination of Bidding Documents and Site

The Bidder shall examine carefully the site of the proposed Work and the Bidding Documents before submitting a Bid. By submitting a Bid, the Bidder acknowledges that the Bidder has made such examination and is satisfied as to the conditions to be encountered in performing the Work and as to the requirements of the Bidding Documents.

The Municipality assumes no responsibility for any understanding or representations concerning conditions made by any of its officers, agents, or employees prior to the execution of this Contract, unless such understanding or representations are expressly stated in the Bidding Documents or Addenda.

When soil boring data are provided by the Bidding Documents, the Bidder shall assume responsibility for any conclusions the Bidder may draw from such data. The bidder shall be responsible for obtaining and analyzing such additional data as the bidder may require and shall be responsible for conclusions drawn from that information.

By submitting a bid, the Contractor declares that the Contractor has carefully examined the contract documents, that the Contractor has full knowledge thereof, and that the Contractor has investigated the site and satisfied himself as to the conditions affecting the Work, including, but not limited to, those bearing upon transportation, disposal, handling, and storage of materials; availability of labor, water, electrical power, and roads uncertainties of weather; physical conditions at the site including all existing utilities, the conformation and conditions of the ground, and the character of equipment and facilities needed preliminary to and during prosecution of the Work. The Contractor further declares that the Contractor is satisfied as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all prior exploratory work, as well as from information presented by the drawings and specifications made a part of this contract. Any failure by the Contractor to acquaint himself with the available information will not relieve him from responsibility for properly estimating the difficulty or cost of successfully performing the Work.

The Bidder shall comply with the requirements of the Equal Opportunity Special Provisions as contained in the Bid and resulting Contract.

Article 2.2 Interpretation or Correction of Bidding Documents

Bidders shall notify the Purchasing Officer promptly of any error, omission, or inconsistency that they discover during examination of the Bidding Documents and the proposed construction site.

Bidders shall request interpretation or clarification of the Bidding Documents in writing to the Purchasing Officer. The Purchasing Officer will consider requests that arrive at least seven (7) working days prior to the date for opening Bids. The Contractor may present oral questions at a pre-bid conference if one is provided for in the Bidding Documents. The Purchasing Officer will issue interpretations, corrections, or changes, if any, to the Bidding Documents by Addendum. Bidders shall not rely upon interpretations, corrections, and changes made in any other manner, including orally, at the pre-bid conference. Interpretations, corrections, and changes shall not be binding unless included in an Addendum.

Article 2.3 Preparation and Submission of Bids

Bidders shall submit manually signed Bid Proposals on forms furnished and shall submit Bids in a sealed envelope addressed as indicated in the Invitation to Bid, plainly marked with the Invitation Number.

Bidders shall quote on all items, unless specifically allowed otherwise by the Invitation to Bid. Failure to do so will disqualify the Bid. When quotations on all items are not required, Bidders shall insert the words "no bid" in the space provided for any item where no quotation is made. The person signing the bid shall initial every erasure or change made to the Bid Proposal forms, if any.

Contractor shall provide a lump sum price, typed or written in ink, for each bid item called for. The bid shall be submitted in both words and figures. If there is a discrepancy between the written words and figures, the written words will govern. In case of error in the extension of prices, the price for each bid item will govern. The Purchasing Officer may reject Bids that show any omissions, alteration of the forms, additions not called for, conditional or alternate bids not called for, qualified bids, or irregularities of any kind.

Article 2.4 Bid Guarantee

Bidders shall accompany each Bid with a certified check, cashier's check, or Bid Bond, in the amount of ten percent (10%) of the total amount of the Bid, if the total amount of the bid is \$100,000 or more, with surety acceptable to the Municipality. If the total bid amount of the bid is less than \$100,000, accompany the bid with a bid guarantee, in the form specified above, in an amount of \$1,000. Bid Guarantees for the three (3) low Bidders will be held until the Contract is executed. All other Bid Guarantees will be returned within seven (7) days of the bid opening. Bidders shall submit Power-of-Attorney for the person signing the Bid Bond for the Surety.

SECTION 00 72 13.03 AWARD AND EXECUTION OF CONTRACT

Article 3.1 General

The provisions of Section 00700.03 are intended to be supplemental to, and not to replace, Title 7 of the Anchorage Municipal Code.

Article 3.2 Receipt and Opening of Bids

Submit bids to the Purchasing Officer or his designated representative at the Municipal Purchasing Department prior to the time of opening specified in the Invitation to Bid. The Purchasing Officer or his designated representative will record the exact date and time of receipt of Bids. The Purchasing Officer will not consider late Bids but will hold them unopened until the time of award and then return them to the Bidder unless other disposition is requested or agreed to by the Bidder. The Time of Bid receipt will be determined by the time stamp of the Municipal Purchasing Department.

The Purchasing Officer will not consider facsimile bids; however, he will consider facsimile modifications of bids already submitted in writing if the facsimiles are received prior to the time of bid opening fixed in the Invitation to Bid. Facsimile modifications shall not reveal the amount of the original or revised bid. Modifications shall state a plus or minus to the affected bid item.

No liability will attach to the Municipality for the premature opening of or the failure to open a Bid not properly addressed and identified.

The Contractor may withdraw bids by written request prior to the time specified for bid opening in the Invitation to Bid.

If any one party offers more than one Bid, by or in the name of his clerk, partner, or other person, the Purchasing Officer will reject all such Bids. A party who has quoted prices to a Bidder is not thereby disqualified from quoting prices to other Bidders or from submitting a Bid directly for the Work.

Article 3.3 Bidder Qualifications

The Purchasing Officer reserves the right to determine whether a Bidder is a responsible contractor. The Purchasing Officer may require the Bidder to submit such information as he may deem necessary to determine a bidder's responsibility. Failure or refusal on behalf of the Bidder to submit the required information, in whole or in part, may be grounds for the purchasing Officer to determine the Bidder as non-responsible.

The Purchasing Officer will determine whether a Bidder is responsible on the basis of any or all of the following criteria:

1. The skill and experience demonstrated by the Bidder in performing contracts of a similar nature;
2. The Bidder's record for honesty and integrity;
3. The Bidder's capacity to perform in terms of facilities, personnel, and financing;
4. The Bidder's past performance under Municipal contracts. If the Bidder has failed in any material way to perform his obligations under any contract with the Municipality, the Bidder may be determined as a non-responsible Bidder.

A Bidder's representations concerning his qualifications will be construed as a covenant under the Contract. Should it appear that the Bidder has made a material misrepresentation, the Owner will have the right to terminate the Contract for the Contractor's breach, and the Owner may then pursue such remedies as provided in the Contract Documents or as provided by law or equity.

Any determination that a Bidder is non-responsible will be made by the Purchasing Officer. The Purchasing Officer will make such determination in writing to the Bidder setting forth the reasons for such determination and the Bidder's right to request a review of this determination by the Bidding Review Board.

If a Contractor has had a contract terminated by the Owner for cause as provided in Article 5.29 – Termination of Contract by Owner, the Contractor may not be allowed to bid on the owner's future contracts for a period of two (2) years. This two- (2-) year period shall commence from the date of the termination of the Contractor by the Owner.

All bidders shall hold a valid Alaska Contractor's license per Alaska Statute AS 08.18.

Article 3.4 Action on Bids

The Municipality reserves the right to reject any and all Bids and to waive any informalities and irregularities in a Bid or during award of the Contract.

The Municipality may reject any bid which is unbalanced if it is in the best interest of the Municipality to do so. A bid is unbalanced when, in the opinion of the Purchasing Officer, it allocates a disproportionate share of costs or profit, or both, to the price of one (1) or more items of Work and reduces the share of costs or profit, or both allocated to the price of another item or items of Work, and if there is a reasonable possibility that the bid will not result in the lowest overall cost of the Work to the Municipality.

Unless otherwise stated in the Bidding Documents, the Municipality will award the Contract, if any, to the responsible Bidder who submits the low responsive Bid. When the Bidding Documents contain a basic bid and alternates, the Purchasing Officer will use the total of the basic bid plus the alternatives he selects to determine the low Bidder.

When the Bidding Documents contain a basic bid and additive alternates, the Purchasing Officer will determine the low Bidder by the lowest combination of the basic bid and as many additive alternates as the Purchasing Officer selects within the funds available. The Purchasing Officer will select, in most cases, additive alternates in the order listed in the Bid. However, the Purchasing Officer may bypass any additive alternate whose selection would cause the Contract to exceed the funds available. The Purchasing Officer will compare all bids based upon the same combination of basic bid plus selected additive alternates.

When the Bidding Documents contain deductive alternates, the Purchasing Officer will determine the low Bidder by the lowest basic bid. If the lowest basic bid exceeds the funds available, the Purchasing Officer will determine the low Bidder by eliminating deductive alternates in the order listed in the Bid until the award can be made within the available funds. The Purchasing Officer may bypass any deductive alternate to maximize the use of available funds. The Purchasing Officer will compare all bids based upon the same combination of basic bids and selected deductive alternatives.

The amount of the Contract shall be the total sum of the amounts computed from the estimated quantities and unit prices and/or the lump sum awarded by the Purchasing Officer and specified on page one (1) of the Contract.

The Purchasing Officer will give a written, signed Notice of Award or rejection within forty-five (45) days of Bid opening. The notice will be in writing and signed by the Purchasing Officer. A Notice of Award, and no other act of the Municipality or its representatives, constitutes an acceptance of a Bid. The acceptance of a Bid shall bind the successful Bidder to execute the Contract.

Article 3.5 Bonds and Insurance

If the amount of the contract is \$100,000 or more, the successful Bidder shall furnish the Purchasing Officer a Performance and Payment Bond in the full amount of the Contract and shall maintain the Bond in force during the continuance of this Contract including the one- (1-) year warranty period. For projects less than \$100,000, the requirement for Performance and Payment Bond is deleted. The Bond shall be for the faithful performance of this Contract in all respects including, but not limited to, payments for all materials and labor. All alterations, extensions of time, additional Work and other changes authorized by the Contract Documents may be made without securing the consent of the Surety or Sureties. The bond shall be with a good and sufficient corporate surety acceptable to the Municipality and a Power-of-Attorney for the person signing the Bond for the Surety must be submitted with the Bond.

The successful Bidder shall furnish the Purchasing Officer with a certificate of insurance pursuant to the provisions of Article 6.9

The Bidder shall exercise positive efforts to comply with the Equal Employment Opportunity policies of the Municipality of Anchorage. The Bidder shall familiarize him/herself with the Equal Opportunity Special Provisions for Municipal Contracts, including submittal requirements for bids, prior to award and after award.

Article 3.6 Execution of Contract

The Bidder whose Bid is accepted shall execute the Contract and furnish the required bonding and insurance within five (5) working days after Notice of Award of the Contract is issued.

The Municipality will consider the Contract executed by the successful Bidder when two (2) copies of the Contract, signed by an authorized representative of the Contractor, and the required bond and insurance certificate are received by the Purchasing Officer. Failure or neglect of the Contractor to execute the Contract within the time specified may result in a forfeiture of the Bid Guarantee and award of the Contract to the next lowest Bidder.

The Owner will execute the Contract within ten (10) working days after execution by the Contractor as set forth above. The date the Contract is executed by the Owner is the Contract Date. The rights and obligations provided for in the Contract shall become effective and binding upon the parties as of the Contract Date.

The Municipality will supply the Contractor with four (4) sets of the Contract Documents. The Contractor may obtain any additional documents required from the Architect/Engineer by compensating the Owner for the cost of the printing.

The Municipality will issue the Notice to Proceed within seven (7) working days after the Contract Date unless otherwise specified in the Supplementary Conditions. The effective date of the Notice to Proceed shall be within ten (10) working days of the Contract Date. The Municipality will designate the Owner's Representative, and calculate or identify the completion date in the Notice to Proceed.

Article 3.7 Contractor's Warranty

The Contractor shall warranty all materials and workmanship for one (1) year from the Final Acceptance Date except when a different period is identified in the Supplementary Conditions. Under this warranty, the Contractor shall promptly remedy, without cost to the Owner, any and all defects in material and workmanship, including any consequential damages resulting from defective materials or workmanship.

All warranty work shall be subject to the same contract provisions, including materials, quality of work, authority of the Owner's Representative and inspection, as provided for in the original work; however, all such work shall be at the sole cost of the Contractor. If the defect, in the opinion of the Owner's Representative, is of such nature as to demand immediate repair, the Owner has the right to take corrective action, and the Contractor shall bear the cost thereof. If the contract includes work in different geographic locations, then the Municipality may accept the work in one location and may begin the warranty period for that location independently of the completion of the work in the other locations.

SECTION 00 72 13.04 SCOPE OF WORK

Article 4.1 Intent of the Contract Documents

The intent of the Contract Documents is to provide for the execution and completion of the Work in its entirety. Except as otherwise specifically provided herein, the Contractor shall provide all permits, transportation, handling, materials storage, labor, tools, implements, machinery, supplies, water, heat, utilities, cleaning supplies and activities, and incidentals and shall do all things necessary to perform and to complete the Work.

When words that have a well-known technical or trade meaning are used to describe Work, materials, or equipment, such words shall be interpreted in accordance with that meaning.

Reference to Standard Specifications, manuals, or codes of any technical society, organization, or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest Standard Specification, manual, code or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated.

However, no provisions of any referenced Standard Specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the respective duties and responsibilities of the Owner, the contractor, or the Owner's Representative nor any of their consultants, agents, or employees from those set forth in the Contract documents.

With reference to the Drawings, the order of precedence is as follows:

1. Figures (numerals) govern over scaled dimensions.
2. Detailed Drawings govern over general Drawings or standard details.

Article 4.2 Interpretation of Contract, Specifications, and Drawings

The Contract Documents are intended to be complementary and to describe and provide for a complete description of the entire scope of Work. A requirement occurring in one section of the Contract Documents is as binding as though occurring in all.

In cases of conflict in the requirements of the Contract Documents, such conflicts shall be reconciled by the acceptance of the following order of precedence for the various Contract Documents: (1) the Contract; (2) the Bid Proposal; (3) Supplementary Conditions; (4) the Technical Specifications (Division 1 through Division 16); (5) the Drawings; (6) the General Conditions (Section 00700); and (7) standards incorporated by reference in any of the above.

Where the Technical Specifications and Drawings are silent or lack detail, the Contractor shall use the best general practice and approved material and workmanship of first quality.

The Contractor shall carefully study and compare the Contract Documents and shall at once report to the Owner's Representative any error, inconsistency, or omission he may discover, including any requirement that may be contrary to any law, ordinance, rule, regulation, or order of any public authority bearing on the performance of the Work.

The Contractor shall take no advantage of any errors or omissions in the Contract Documents or of any discrepancies within them. Contractor shall assume all risk and expense when knowingly performing Work where such error or omission is not called to the attention of the Owner's Representative.

The Contractor shall accompany all requests for interpretation or clarification of the Contract documents with a completed Request For Information (RFI) form. Each request shall clearly and completely state the basis for lack of clarity in the Contract documents and shall refer to the applicable specifications, drawings, and details that give rise to the request. If not provided in the Contracts Documents, the Contractor shall obtain a copy of the RFI form from the Owner's Representative. The Owner's Representative will respond to the RFI in writing within ten (10) working days.

Article 4.3 Changed Conditions

The Contractor shall promptly, within two (2) working days and before such conditions are disturbed, notify the Owner's Representative in writing of: (1) subsurface conditions or otherwise concealed conditions at the site differing materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this contract. The Owner's Representative will promptly investigate the conditions, and if he finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of this contract, the Municipality will make an equitable adjustment and modify the contract in writing accordingly.

The Owner's Representative will not allow a claim under this clause unless the Contractor has given the notice required above. However, the Owner's Representative may extend the time prescribed for completion of Work. Reference Article 5.21 – Changes in the Work.

The Contractor shall not submit a claim for an equitable adjustment hereunder after the date of final payment under this contract.

If the parties are unable to agree on the terms of an equitable adjustment, the Owner's Representative may order such work done and pay for such work as provided in Article 5.21 – Changes in the Work and allow such additional time for performance as he may deem proper. If the Contractor does not agree with such adjustments, he may make claim under Article 5.22, Claims for Additional Compensation.

Article 4.4 Temporary Utilities

The Contractor shall provide and pay all costs for temporary utilities, including gas, water, sanitary sewer, telephone, and electricity, necessary to perform the Work. The Contractor shall pay for these costs during periods of suspensions of work. The Owner does not represent that utility service is available to the site.

The Contractor shall provide temporary heat, including fuel and power, as required to protect materials and Work from the elements. The Contractor shall provide and maintain temporary toilets and shall provide drinking water for all those connected with the Work.

Article 4.5 Surveying

Before starting Work, the Contractor shall locate all general reference points and take such steps as are necessary to prevent their dislocation. If disturbed, the Contractor shall replace reference points as directed by the Owner's Representative. The Contractor shall employ a competent Land Surveyor, licensed in the State of Alaska, to lay out the Work, and shall be responsible for its accuracy.

Article 4.6 Disposal Sites

Except as otherwise stated in the Supplementary Conditions, the Contractor shall make his own arrangements and assume all costs in connection with disposal sites. The Contractor shall furnish a disposal site for trees, brush, oversized boulders, and other objectionable debris. The Contractor shall dispose of unusable excavation at either the Anchorage Regional Landfill off Hiland Road or at a Contractor-furnished disposal site. Unusable excavation or any material containing stumps, brush, or other construction debris will be charged at the current disposal fee at the Anchorage Regional Landfill. The Contractor shall obtain and comply with a grading and fill permit for each disposal site he furnishes, in conformance with the most current International Building Code (IBC), as adopted and amended by the Municipality of Anchorage. Contractor shall locate and maintain the disposal site in such a manner as to prevent a public nuisance.

The Contractor shall obtain written permission from the property owner(s) for such disposal sites and shall furnish the Owner's Representative with a copy of this permission and a Municipal Grading and Fill Permit. The written permission shall specifically provide that the property owner will not hold the Municipality, its employees, agents, or consultants liable for use of or damage to this property. The Contractor shall be held liable for any trespass and property damage incurred outside of the disposal site.

Waste Disposal. Prior to construction, the Contractor shall submit a description of his scheme for disposing of unsuitable materials and waste resulting from the Work under this Contract. If any material is disposed of in unauthorized areas, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed areas.

Article 4.7 Protection of Persons and Property

The Contractor shall be responsible for initiating, supervising, and maintaining of all safety programs and precautions in a manner to prevent damage, injury, or loss to the Work employees, the public, and property. These safety requirements are applicable to the Work whether on-site or off the site for Work under the control, custody, or care of the Contractor. These responsibilities include adjacent sites and their improvements including landscaping, walks, roadways, structures, and utilities. If the Contractor encounters material on the site that may be reasonably identified as asbestos-containing material (ACM), polychlorinated biphenyl (PCB), or other hazardous materials not requiring abatement as part of the Work, the Contractor shall stop the Work immediately in the affected area and notify the Owner's Representative and Owner in writing. The Work shall not be resumed in the affected area until a final determination has been made by the Owner's Representative on the status of the material in question.

The Contractor shall be solely and continuously responsible, twenty-four (24) hours per day, seven (7) days per week, until contract completion for the safety measures outlined above and the following:

- (a) Erecting and maintaining, as required by existing conditions and progress of work, all safeguards for safety and protection, including barricades, danger signs, traffic control devices, and other warnings against hazards.
- (b) Providing reasonable access at all times for emergency units such as the Anchorage Police Department, the Anchorage Fire Department, and the Anchorage Fire Department's Hazardous Materials Response Team.

During periods of suspension of work, refer to Article 5.25 – Suspension of Work, for areas of responsibilities.

Protection of Water Resources. The Contractor shall control the disposal of fuels, oils, bitumens, calcium chloride, acid, or harmful materials, both on and off the premises, and shall comply with applicable federal, state, and municipal laws concerning pollution of waterways while performing Work under this Contract. Special measures shall be taken

to prevent chemicals, fuels, oils, greases, bituminous materials, and sewage from entering established drainages.

Article 4.8 Public Convenience and Access

The Contractor shall conduct the Work in such a manner as to cause minimum inconvenience to pedestrians and vehicular traffic and to persons conducting commercial enterprises or residing along the route of Work. The Contractor shall not block entrances or driveways for more than three (3) hours without prior approval of the Owner's Representative. The Contractor shall provide and maintain temporary pedestrian bridges, ramps, or culverts at entrances of adequate width and strength for the service required. All work involved in providing for construction, maintenance, and use of entrances and driveways is the responsibility of the Contractor and will not be paid for separately and will be considered incidental to the lump sum and prices contained in the Contract Documents. It is the Contractor's responsibility to provide adjacent property owners and/or tenants with written notification of closure of access and to provide an Owner's Representative-approved alternative access at all times for the property owners, the tenants, and the public no less than forty-eight (48) hours prior to closure.

The Contractor shall be responsible for maintaining access at all times for emergency vehicles.

The Contractor shall, prior to the commencement of Work, submit any written agreements between the Contractor and property owners regarding access and use of private property within the project limits for any purposes associated with this Project. Any such agreements shall indemnify the Municipality from any and all actions that result from activities of the Contractor

If the Work of the Contractor is delayed because of any construction activities or transportation activities related to nearby construction, whether municipal or private projects and regardless of whether the activities were authorized by the Owner, the Contractor is not entitled to additional compensation from the Owner but will be entitled to an extension of time to the extent that such delay is unavoidable through reasonable efforts on the Contractor's part. Except as to a possible entitlement to such an extension of time, the Contractor shall hold harmless, defend, and indemnify the Owner from and against any and all claims, damages, losses, and expenses, including attorneys' fees, by the Contractor or third parties, arising directly or otherwise out of the construction and/or transportation activities as indicated above.

Article 4.9 Street Closures

The Contractor shall conduct construction operations so as to offer the least interference to vehicular traffic. Provide vehicular access to emergency units to and through all work areas at all times. Do not close two (2) adjacent parallel streets at the same time.

The Contractor shall submit requests for all street closures or partial closures to the Owner's Representative and the Municipal Permit Office and will not commence closures

or partial closures until the Owner's Representative and the Permit Office issue approvals.

In the case of arterial street closures, do not commence street closures or partial street closures until after giving forty-eight- (48-) hours advanced notice to the public.

Prepare and submit four (4) copies of an acceptable Traffic Control Plan (TCP) to be employed during construction. Deliver the TCP to the Owner's Representative within ten (10) days of the effective date of the Notice to Proceed, or five (5) working days before commencement of Work, whichever is the earlier date. The Owner's Representative will review and accept or reject the plan within five (5) working days of submission. Successive submittals will also be reviewed within five (5) working days.

The TCP shall conform to the standards in the latest edition of the Municipality of Anchorage Standard Specifications (MASS), Part VI of the Manual of Uniform Traffic Control Devices (MUTCD), and shall also conform to the requirements in the latest edition and supplements of the Alaska Traffic Manual (ATM). When conflict exists between MASS and the ATM, the requirements of MASS and these General Conditions shall govern.

Article 4.10 Maintenance and Drainage

The Contractor will maintain all detour routes, haul routes, streets under construction, ditches, water courses, existing drainage patterns, siltation controls, gutters, sidewalks, walkways, and bike trails affected by the Work until the Final Acceptance Date. This includes but is not limited to shaping, grading, and dust control. The Contractor will maintain existing drainage patterns disturbed as a result of construction, including reestablishment of drainage ditches, swales and gutter flow lines to their preconstruction condition, grade, and elevation.

When cleaning paved streets, curb and gutters, and alleys and sidewalks, the Contractor shall not flush the streets using only water but shall use such methods as established by the Director of Health and Human Services for sweeping operations. The Contractor shall prevent any spillage from entering any storm drains.

The Contractor shall restore all streets, drainage ditches, swales, water courses, gutters, sidewalks, walkways, and bike trails used by the Contractor or interrupted by his Work to their preexisting condition. The Contractor shall construct and maintain any drainage and siltation control necessary to accommodate water released by pumping or dewatering operations and contain the water to prevent inconvenience to pedestrian and vehicular traffic.

The Contractor shall repair or replace any culverts, swales, catch basins, or storm drains damaged during construction at no expense to the owner.

Upon receipt of the building permit, the Contractor shall prepare and implement an Erosion and Sediment Control Plan on the construction site prior to starting construction and maintain it throughout the construction period. The Erosion and Sediment Control Plan shall be readily accessible on site.

All costs associated with maintenance of drainage patterns and repair or replacement of drainage ditches, swales, catch basins, storm drains, gutter flow lines, and any other drainage appurtenances are incidental to the Contract or to the item under construction, and no separate payment will be made.

Dust and Mud Control

- a. The Contractor shall maintain all excavations, embankments, stockpiles, access roads, waste areas, borrow areas, and all other work areas free from excess dust and mud to such reasonable degree as to avoid causing a hazard or nuisance to others.
- b. All existing paved areas and roadways, especially heavily traveled roads, adjacent to the project construction site or used as haul roads, shall be kept clean of dirt, mud, and debris resulting from the Contractor's operation during the construction period.

Article 4.11 Utilities

Whenever the Contract Documents require permanent connections to be made to utility lines, the Contractor shall, unless otherwise specified in the Supplementary Conditions, be responsible for making the connection to the utility line at the point(s) indicated on the Drawings, including making all necessary applications with the Utility Company, for paying the fees and for performing the work associated with making the connections indicated. The Contractor is not responsible for bringing utility lines to the point of connection. The Contractor shall pay all costs for utility service prior to the date of Substantial Completion.

Locations of utilities shown on the Drawings are not exact. Aboveground utilities have been field-located. Belowground utilities are shown as depicted on record documents prepared by others. The Contractor shall not hold the Owner liable for damages to utilities incurred during construction due to deficiencies or omissions on the Drawings or these provisions. At least forty-eight (48) hours prior to commencing work, the Contractor shall contact all local utility companies to obtain underground utility locates and shall exercise due care to prevent damage to utilities. Should a utility be damaged, the Contractor shall immediately notify the utility company and have the damage repaired, at no cost to the Owner. The utility has the right to do work or have its contractor do work in connection with making repairs to the utility lines damaged by the Contractor. If any Utility Company determines that a utility has to be temporarily raised, lowered, moved, guyed,

shored, braced, or otherwise protected during construction, the Contractor shall do so at his own expense and to the satisfaction of the utility company.

The Contractor shall maintain all utility service connections whether marked on the Drawings or not. In addition, the Contractor shall repair or replace all utility service connections (at his own cost) that are damaged by his actions.

At a sufficient distance, prior to encountering a known obstacle or tie-in to an existing conduit, pipe, or manhole, the Contractor shall expose and verify the exact location of the obstacle, pipe, or manhole so that proper alignment and/or grade may be determined before the pipe sections are laid in the trench and backfilled. The Contractor shall notify the Owner's Representative of the results of this verification prior to commencement of the Work affected by results of verification, so that any modification to the contract drawings or supplementary instructions may be supplied by the Owner's Representative. The Contractor shall allow the Owner's Representative one complete working day to review the verification results and provide any design modifications or supplementary instructions necessary. No additional payment will be made for this Work.

The Contractor shall bear all costs incurred for removal and alignment of backfilled pipe sections due to improper verification methods.

Unless otherwise specified in the Supplementary Conditions, it is the intent of the Contract Documents that utilities will not be relocated to facilitate construction. If the Owner's Representative determines that an existing utility must be relocated because it is in direct conflict with the facility being constructed, the existing utility will be relocated by the Utility Company at no charge to the Contractor.

The Contractor shall be responsible for coordinating the Work with any work of a Utility Company and shall not interfere with the initial installation, relocation, reconstruction, or replacement of any utility including the making of necessary service connections by the utility company. If the Work of the Contractor is delayed because of any acts or omissions of the utility company, the Contractor will not be entitled to additional compensation from the owner but may be entitled to an extension of time.

Article 4.12 Utility Connections

Whenever the Contract Documents require permanent connections to be made to utility lines, the Contractor shall, unless otherwise specified in the Supplementary Conditions, make the connection to the utility line, or have the Utility Company make the connection, at the point(s) indicated on the Drawings. The Contractor shall make all necessary applications to the Utility Company and pay all fees and perform all Work associated with making the connections that is not performed by the Utility Company. The Contractor is not responsible for bringing utility lines to the point of connection. The Contractor shall pay all costs for utility service prior to the Date of Substantial Completion.

Article 4.13 As-Built Documentation

The Contractor shall maintain As-Built Documents on the job site consisting of a complete set of Drawings and the Project Manual on which all changes of material, equipment, dimensions, or other changes in the Work shall be recorded (i.e., "marked up") and kept current on a daily basis and shall be made available to the Owner's Representative at all times. This shall include the following:

1. Placing special emphasis on items of the Work that have been or will be concealed and showing substitutions for items specified or shown, and including all approved changes.
2. Requiring Subcontractors, including mechanical and electrical, to keep their portions up to date and correct.
3. Dimensioning all relocations and routing adequately to ensure easy access for maintenance or remodeling.

Upon completion of the marked-up As-Built Documents, the Architect/Engineer will furnish to the Contractor a CD of the drawings along with a complete full size paper set. The Contractor shall only employ personnel for this task who are proficient in the preparation of architectural or engineering drawings.

All additions and corrections shall be neat, clean, and legible and shall match the adjacent existing line work and lettering annotated in type, density, size, and style. If additional drawings are required, the Contractor shall prepare them upon the same size as the original Drawings. Drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at his expense.

The Architect/Engineer will review all Record Documents for completeness and conformance to the standards stated above. The Contractor shall make all corrections, changes, additions, and deletions required to conform to the standards. The Architect/Engineer may periodically review the status of the Record Documents during the course of the Work. Failure of the Contractor to keep the Record Documents current and in the required condition will be considered cause for additional withholding from the progress payments as provided in MASS Section 00700.07 Measurement and Payment, Article 7.4 Progress Payments

Approved final As-Built Documents, bearing certification of their correctness, shall be delivered to the Owner's Representative prior to the pre-final inspection. The Certificate of Completion shall not be issued until after receipt of final As-Built Documents. All Work associated with the development, preparation, and presentation of all Record Documents shall be incidental to the improvements being constructed, and no separate payment will be made.

Article 4.14 Operations and Maintenance (O&M) Manuals

The Contractor shall provide to the Owner's Representative thirty (30) days prior to the Substantial Completion date three (3) sets of Operations and Maintenance (O&M) manuals and one CD of the scanned O&M for all items of material and equipment as required by the Technical Specifications. The manuals shall be bound in hardcover binders with removable pages. The manuals shall be prepared in three (3) sets: Architectural, Mechanical Equipment, and Electrical Equipment. In addition to the requirements in the Technical Specifications, the manuals shall each contain an Index, by Specification Section; a key plan that graphically locates items of equipment; a list of contractors and subcontractors with addresses and telephone numbers; and a list of local representatives with addresses and telephone numbers.

1. The Contractor shall assemble all copies of the manuals in three-ring, hardcover binders. The Contractor shall be responsible for the following: Clearly label each binder on the cover and the end of the binder to designate the system or equipment for which it is intended with reference to the building and equipment number and the Specification Section where the equipment information is provided. Include the date of completion of the project.
2. Provide each binder with title page, typed table of contents with page numbers, and heavy section dividers with numbered plastic index tabs.
3. Divide each manual into sections paralleling the equipment specifications.
4. Where more than one binder is required, they shall be labeled "Vol. 1," "Vol. 2," and so on. Place the table of contents for the entire set, identified by volume number, in each binder.
5. Submit the manual organization and format to Owner's Representative for approval prior to manual preparation.
6. Hole punch all data for binding and composition and shall arrange printing so that punching holes does not obliterate data.
7. When standard technical data are provided, edit and delete all non-relevant information that is not applicable to the specific equipment or material provided.
8. Material in manuals shall be suitable for photographic reproduction. Where copies of identical material are included, the clarity and quality of copies shall equal the original.

Contents: Each manual shall be complete in all respects regarding equipment, controls, accessories, and associated appurtenances, and shall include the following:

1. Diagrams and illustrations.
2. A detailed description of the function of each principal component of the system.
3. Performance and nameplate data.
4. Installation instructions.
5. Procedure for starting.
6. Proper adjustment information.
7. Test procedures and results of factory tests where required.
8. Procedure for operating.
9. Shutdown instructions for both short and extended durations.
10. Emergency operating instructions and troubleshooting guide.
11. Safety precautions.
12. Maintenance and overhaul instructions, illustrated with detailed assembly drawings showing each part with part numbers and sequentially numbered parts list. Include instructions for ordering spare parts, and complete preventive maintenance and overhaul instructions required to ensure satisfactory performance and longevity of the equipment.
13. Lubrication instructions and diagrams showing point to be greased or oiled; recommend type, grade, and temperature range of lubricants; and frequency of lubrication.
14. List of electrical relay settings and control and alarm contact settings.
15. Electrical interconnection wiring diagram for equipment furnished, including all control and lighting systems.
16. Referral to individual Specification Sections for additional O&M requirements.

Article 4.15 Temporary Erosion Control During Construction

The Contractor shall provide all temporary erosion control measures necessary during construction for the prevention of water pollution, erosion, and/or siltation. These measures are for the protection of all streams, lakes, ponds, wetlands, and tidal waters.

The Contractor is directed to Alaska State regulation 18 Alaska Administrative Code [ACC] 70, which states that no person may conduct an operation that causes or contributes to a violation of water quality standards set forth in 19AAC70.010 through 18ACC70.032.

Unless a temporary erosion control plan during construction is specifically called out and included in the drawings and other contract documents, the Contractor shall provide a plan describing temporary erosion control measures to be employed during construction.

Deliver the plan to the Owner's Representative within ten (10) days of the effective date of the Notice to Proceed or five (5) days before the commencement of Work, whichever is the earlier date. The Owner's Representative will review and accept or reject the plan within five (5) working days of submission, and will review successive submittals within five (5) working days. The Contractor shall install the approved temporary erosion control measures immediately after mobilization and before commencing excavation.

Temporary erosion control measures include such items as silt fences, sedimentation ponds, intercepting embankments and channels, check dams, rock lining, mulching, jute matting, seeding, sodding, and other erosion control devices as required. Where erosion is expected to be a severe problem, the Contractor shall schedule and perform clearing, grubbing, grading, filling, and other operations such that permanent erosion control measures follow immediately.

Permanent erosion control measures are those work items specified elsewhere in the Contract Documents that are intended to provide permanent erosion control such as paving, seeding and other measures as required.

Temporary erosion control measures shall remain in place and in good working condition until Work is complete under the Contract. The Contractor is responsible for the continued maintenance of these temporary erosion control items and replacement of damaged items. The Owner's Representative may suspend Work if the Contractor fails to carry out the requirements of the temporary erosion control plan. After suspension of the Work, the Owner may perform or contract the performance of the erosion control measures and deduct those costs from the Contractor's progress payments.

Payment for this Work is incidental to the Contract, and no separate payments will be made.

SECTION 00 72 13.05 CONTROL OF WORK

Article 5.1 Authority of the Owner's Representative

The Owner's Representative will observe the Work in progress on behalf of the Owner, and will be identified at the time the Notice to Proceed is issued. The Owner's Representative is not responsible for construction means, methods, techniques, sequences, or procedures or for safety precautions and programs in connection with the Work. Visits and observations made by the Owner's Representative will not relieve the Contractor of his obligation to conduct comprehensive inspections of the Work, to furnish materials, to perform acceptable Work, and to provide adequate safety precautions, in conformance with the intent of the Contract. The Work will not be considered completed until a Certificate of Completion is issued by the Owner's Representative. The Contractor shall at all times carry out and fulfill the written instructions and written directions of the Owner's Representative regarding the Contract Documents.

The Owner's Representative has the authority to order changes in the Work requiring an adjustment in the Contract amount and/or time. However, any change in the Work shall be in accordance with Article 5.21 – Changes in the Work. Any single change in the Work, or cumulative changes in the Work, which will cause the total value of the Contract to exceed the limits stated in AMC 7.15.080 requires Assembly approval.

The Owner's Representative will in all cases make determinations on any and all questions that may arise concerning the quality, quantity, and acceptability of materials furnished, the Work performed, the rate of progress of the Work, and the interpretation of Contract Documents.

If the Contractor determines that instructions, clarifications, or directions issued by the Owner's Representative constitute a change in the requirements of the Contract Documents, he may make claim as provided under Article 5.22 - Claims for Additional Compensation.

Article 5.2 Prosecution of the Work

The Contractor shall not commence Work until a written Notice to Proceed has been received by the Contractor. He shall commence the Work within ten (10) days after the effective date specified in the Notice to Proceed and shall prosecute the Work vigorously and continuously.

Article 5.3 Construction Progress Schedule and Schedule of Values

Within ten (10) days after the effective date of the Notice to Proceed and prior to commencement of the Work, the Contractor shall submit, to the Owner's Representative a Construction Progress Schedule in the form of a time-scaled bar chart, the elements of which shall be the Divisions and Sections of the Project Manual, weather and ground condition restraints, and Work suspensions and other significant influences on the Contract amount and/or the time for completion of the Work. The Contractor shall include other significant features of the Work such as the submittal schedule, permit acquisition plan, material procurement milestones, plant and equipment procurement dates, and shipping schedules. The bar chart shall include a graph representing the monthly percent of Work to be completed. The bar chart shall be revised and resubmitted as required by the Owner's Representative, when conditions cause changes to the construction schedule, or on a monthly basis, whichever is sooner.

When required by the Owner's Representative, the Contractor shall also deliver, at the same time the Construction Progress Schedule is delivered and in a form satisfactory to the Owner's Representative, a Schedule of Values for Contract Payments for those lump sum items designated by the Owner's Representative. The Contractor shall submit monthly partial Payment Estimates based on the Schedule of Values. All Schedules of Values and Payment Estimates shall, as a minimum, be organized to be consistent with the Divisions and Sections of the Project Manual. The Owner's Representative may require submission of revised construction schedules demonstrating the manner in which the Contractor will achieve the necessary rate of progress, all without additional cost to

the Owner. Partial Payment Estimates may be appropriately reduced if the Owner's Representative determines that the Contractor has failed to supply the Owner with the requested or necessary information.

In addition to the time-scaled bar chart described above, and when specified in the Supplementary Conditions, the Contractor shall develop and submit to the Owner's Representative for approval a time-scaled Critical Path Method (CPM) schedule. Both a hard copy and electronic copy of the CPM schedule shall be submitted. The Contractor shall revise and resubmit the CPM schedule to reflect any alteration in the sequence of scheduled activities or of the critical path with each partial payment request and at such other times as the Owner's Representative may require, and at any time the Contractor determines that the critical path is altered by changes or other circumstances. The Contractor shall submit the initial CPM schedule to the Owner's Representative no later than twenty-one (21) days from the effective date of the Notice to Proceed and at least monthly thereafter.

The Contractor shall organize the scheduled activities to be consistent with those Specifications Divisions and Sections required for the Work. Each Division and Section of the Specifications and each item in the Schedule of Values shall be represented by one or more scheduled activities. In addition, one or more scheduled activities shall be used to represent the submittal schedule, permit acquisition, materials procurement, plant and equipment procurement, shipping, and all other significant elements of the Work. The Contractor shall include activities that address weather and ground condition restraints, critical dates, holidays, periods of Work suspension, and all other restraints (i.e., all events that are critical or will become critical to the schedule).

All schedules, whether they are bar chart schedules or CPM schedules, shall include enough detail to adequately describe all important activities necessary to complete the Work. Unless otherwise agreed to by the Owner's Representative, no single activity in any schedule will be allowed to represent more than \$50,000 of the total scope of the Work. Providing the initial schedule and monthly schedule updates shall be considered a payable activity and appropriate payment amounts shall be included in the Schedule of Values. Failure to provide adequate schedules will result in non-payment in accordance with the amounts established in the Schedule of Values.

Article 5.4 Unusual Working Hours, Holidays, Saturdays, and Sundays

The Contractor shall give the Owner's Representative forty-eight (48) hours advance notice of his intention to work overtime, Saturdays, nights, Sundays, holidays, or anytime outside the usual working hours. In no case shall the Contractor do any such Work without first notifying the Owner's Representative to allow arrangements for proper inspection. Unless of an emergency nature, the Owner will not pay for work performed in violation of this paragraph.

The Contractor shall reimburse the Owner all costs for inspection work performed on Sundays or recognized holidays except when this work is required by a permit issued by an agency after the contract has been executed.

Article 5.5 Shop Drawings

The Contractor shall submit for review to the Owner's Representative six (6) copies of those Shop Drawings required by the Contract Documents 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.

The Shop Drawings submitted by the Contractor shall bear his specific written and signed certification that he has verified that the Work shown is in conformance with the contract documents; that he has determined and verified quantities, dimensions, field measurements, and related field construction criteria; and has checked and coordinated the submittal with the requirements of the Work. The Contractor shall indicate on the Shop Drawing submittal any deviation from the requirements of the Contract Documents.

All Shop Drawings shall be clear and legible. Any Drawings submitted that appear to be carelessly prepared, erroneous, or unchecked will be returned to the Contractor for further action and resubmittal.

The Owner's Representative shall submit the Shop Drawings to the Architect/Engineer. With reasonable promptness, the Architect/Engineer will review and approve or take other appropriate action on the submittals, but only for conformance with the design concept of the Work and with the information given in the Contract Documents. The Architect/Engineer's approval of a specific item will not indicate approval of an assembly of which the item is a component.

The Architect/Engineer will state the reasons for rejection and/or resubmittal requirements if applicable.

The Contractor shall specifically note if revisions on resubmittals are other than those requested by the Architect/Engineer on previous submittals.

The Architect/Engineer, upon his approval, will return two copies of the Shop Drawings to the Contractor. If the Contractor requires more than two (2) copies, he shall submit such additional copies.

The Architect/Engineer's approval of Shop Drawings does not relieve the Contractor of responsibility for any deviation from the Contract Documents unless the Contractor has informed the Architect/Engineer in writing of the specific deviation and the Architect/Engineer has approved the specific deviation in writing. Errors and omissions that may occur in the Shop Drawings are the responsibility of the Contractor. The Contractor is not relieved of this responsibility by the Architect/Engineer's approval of the Shop Drawings.

When Shop Drawings are required on a portion of the Work, the Contractor shall not commence that portion of Work or any item relying on said portion of Work until the Architect/Engineer gives written approval of the Shop Drawings.

The Contractor shall keep one copy of all Contract Documents, including modifications, and one copy of approved Shop Drawings in good order and available to the Architect/Engineer or his representative at the construction site.

Article 5.6 Product Data

The Contractor shall submit for approval six (6) copies of complete Product Data for those items for which submittals are required by the Contract Documents including, but not limited to: specific performance data, material description, rating, capacity, working pressure, material gauge or thickness, brand name, catalog number, and operations and maintenance data. The Contractor shall submit such submittals with reasonable promptness and in such sequence as to not cause a delay in the Work, in the Work of the Owner, or any separate Contractor. With reasonable promptness, the Architect/Engineer will review and approve or take other action on the submittals. The Contractor shall not order equipment before receiving approval by the Architect/Engineer.

Product Data for equipment approved by the Architect/Engineer shall not in any case supersede the Contract Documents. The approval by the Architect/Engineer shall not relieve the Contractor from responsibility to correct deviations from Drawings or Specifications, unless he has in writing called the Architect/Engineer's attention to such deviations at the time of submission and secured the Architect/Engineer's written approval, nor shall it relieve him from responsibility to correct errors of any sort in the items submitted. The Contractor shall check and approve the item described by the Product Data with the Contract Documents for deviations and errors prior to submittal to the Architect/Engineer for approval. It shall be the responsibility of the Contractor to ensure that items to be furnished fit the space available as shown in the Contract Documents.

Upon approval of the equipment by the Architect/Engineer, the Contractor shall furnish four (4) copies of Product Data of all equipment or components together with operations and maintenance instructions.

Article 5.7 Submittal List

The Contractor shall complete, submit, and/or comply with all requirements as indicated in the Submittal List located in the bidding documents. The Contractor is hereby advised that the Submittal List is not an all-inclusive document. The Submittal List does not relieve the Contractor from his obligation to comply with all submittals, certifications, or other requirements as specified in these specifications or in the plans. The Contractor is responsible for determining that all submittals, certifications, and/or requirements are met, whether or not specifically addressed in the Submittal List.

Article 5.8 Materials

All materials and equipment furnished under the Contract shall be new unless otherwise specified and shall be of good quality, shall be free from defects, and shall conform to the requirements of the Contract Documents. Substitute materials shall not be used unless

approved by the Owner's Representative prior to installation. When required by the Owner's Representative, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

In order to establish standards of quality, the Technical Specifications may refer to certain products by name and catalog number. This does not eliminate from competition other products of equal or better quality by other manufacturers. The words "approved equal" are implied regardless of whether or not they appear.

The Contractor shall furnish the Owner's Representative with the list of proposed substitutions within ten (10) calendar days of the effective date of the Notice to Proceed (or such time as may be approved by the Owner's Representative), together with complete engineering and catalog data in sufficient time prior to their use to give the Owner's Representative adequate time for review. Failure on the part of the Contractor to obtain the necessary approval prior to ordering or using such alternate material or equipment shall not relieve the Contractor of furnishing acceptable material or equipment as required by the Contract Documents.

When the Owner's Representative judges the proposed substitute material or items of equipment to be unacceptable, the Contractor shall abide by the Owner's Representative's decision and shall furnish the specified material or item of equipment. The Owner's Representative will approve or disapprove proposed substitutions in writing within a reasonable time.

The Contractor shall store materials in such a manner as to ensure the preservation of their quality and fitness for use. When considered necessary to protect materials against cold or dampness, or to keep them clean and free from dust, dirt, or other detrimental matter, suitable sheds, platforms, and covers will be used that provide easy access to stored materials for inspection whenever access is requested by the Owner's Representative.

The Contractor shall apply, install, connect, erect, use, clean, and condition manufactured articles, material, and equipment as directed by the Manufacturer. In the event of conflict between the manufacturer's directions and the Contract Documents, the higher standard requirements shall govern.

Article 5.9 Testing of Materials

The Contractor shall conduct all tests in accordance with methods as described and designated in the Contract Documents. The Owner shall provide and pay for tests of materials that are required on site, unless otherwise specified in the Supplementary Conditions. The Contractor shall provide and pay for all factory testing, mill testing, and other off-site testing as specified or required to conform to codes and industry standards.

The Contractor shall provide such labor and facilities as may be required for collecting and forwarding samples to the local testing laboratory necessary for testing and shall hold the materials represented by the samples until tests have been made and the materials found equal to the requirements of the Specifications. The Contractor in all cases shall furnish the required samples without charge.

The Owner's Representative may periodically require repetitive testing of materials in constant use. The Contractor shall pay for retesting when materials have previously been tested and have not met the requirements of the Contract Documents.

In the absence of any definite Specification, materials and tests shall meet the specifications and requirements of the American Society for Testing and Materials (ASTM) and the American Association of State Highway Transportation Officials (AASHTO).

Wherever a particular ASTM or AASHTO specification is referred to by number, such reference shall include all amendments and additions thereto adopted by the ASTM or AASHTO prior to the award of the Contract.

Repetitive testing of materials in constant use may be required periodically by the Owner's Representative. Required retesting shall be accomplished at the expense of the Contractor when materials have previously been tested and have not met the requirements of the Contract Documents.

Article 5.10 Contractor's Authorized Representatives and Employees

The Contractor shall, within five (5) days after the Notice to Proceed, in writing, name the Superintendent, and file with the Owner's Representative a list of all persons who are authorized to sign documents on behalf of the Contractor to fully bind the firm.

The Superintendent shall be thoroughly qualified and experienced, shall be completely familiar with the requirements of the Contract Documents, shall direct all Work, and shall be present at the project site or readily available at all times while Work is in progress.

The Contractor shall employ only qualified journeymen, mechanics, operators, tradesmen, and installers who are thoroughly skilled and experienced in their respective trades or specialties. When apprentices and helpers are employed, they shall be under the supervision of qualified journeymen mechanics and tradesmen at all times.

The Contractor shall at all times enforce strict discipline and good order among his employees and Subcontractors and shall not employ on the Work any unfit person or anyone not skilled in the task assigned to him. The Owner's Representative may require the Contractor to remove from the Work any employee or Subcontractor that the Owner's Representative deems incompetent, careless, or otherwise objectionable.

Article 5.11 Subcontracting

If any part of the Work to be done under the Contract is subcontracted, the subcontracting shall be done in accordance with the following provisions:

The Contractor shall provide the Owner's Representative, in writing, a list of Subcontractors within 10 days of Notice to Proceed and prior to subcontractor working on site, together with a summary of the extent and character of the Work each Subcontractor shall do. If, for sufficient reason, at any time before or during the progress of the Work, the Owner's Representative determines that any Subcontractor is incompetent or undesirable, he will notify the Contractor accordingly. The Contractor will take immediate steps for cancellation of such subcontract. Subletting by Subcontractors shall be subject to the above.

The Contractor shall be fully responsible to the Owner for the acts and omissions of his Subcontractors and of persons either directly or indirectly employed by them. Nothing contained in the Contract Documents shall create a contractual relation between any Subcontractor and the Municipality.

The subcontracting of any of the Work to be done shall in no way relieve the Contractor of any part of his obligations under the Contract.

Article 5.12 Right of the Municipality to Do Work

The Municipality has the right to do Work and may award other Contracts in connection with the Work under this Contract or nearby projects. The Contractor shall conduct his operations to interfere as little as possible with other Contractors or Subcontractors on or near the Work.

Article 5.13 Safeguarding of Excavations

The Contractor shall provide such safeguards and protections around and in the vicinity of all excavations as may be necessary to prevent damage to property or injury to persons.

Contractor shall backfill all trench excavations to the top of the trench at the end of each working day, except, at Contractor's option, he may leave open a "bell-hole" if it is properly barricaded and if adequate signing and warning lights are placed to prevent inadvertent entry by vehicular or pedestrian traffic. If groundwater or surface water results in standing water in the remaining excavation, the Contractor shall provide continuous pumping during the nonworking hours to maintain the excavation in a dewatered condition. All roadways shall be left in a drivable condition for normal vehicular and transport operations at the end of each day's operation, except where the Owner's Representative has approved road or lane closures.

These requirements shall in no way relieve the Contractor of the obligation to restore private property to its preconstruction condition.

Article 5.14 Use of Explosives

In the handling and storage of explosives, the Contractor must comply with all federal, state and municipal laws, and shall use every precaution to prevent injury to persons and damage to property. The Contractor shall provide secure storage places, identified with warning signs. Only persons licensed and experienced in the handling of explosives shall be allowed to use them. Before detonating explosives, the Contractor shall sound a warning and remove all persons from within the radius of danger. The Contractor shall provide proof of license to the Owner's Representative prior to handling and use of explosives.

Article 5.15 Duties of Inspectors

Inspectors will be authorized to inspect all Work and Materials. Such inspection may extend to all or any part of the Work and to the preparation, fabrication, or manufacture of the materials to be used. Inspectors will not be authorized to alter or waive the provisions of the Contract. Inspectors will not be authorized to issue instructions contrary to the Contract Documents or to act as supervisors for the Contractor.

Inspectors will immediately inform the Contractor of any deficiency known to exist in the Work and any laboratory test results related to the Work.

The Contractor's responsibility for Work performed under the Contract shall in no way be relieved because of the presence or absence of an inspector. An inspector, by his presence, does not render Work acceptable.

Article 5.16 Inspection

The Contractor shall allow the Architect/Engineer and his representatives and the Owner's Representative access to all parts of the Work at all times and shall furnish them with every reasonable facility for ascertaining whether or not the Work is in accordance with the requirements and intent of the Contract Documents. Upon the request of the Owner's Representative, the Contractor shall, at any time before Final Acceptance of the Work, remove or uncover such portions of the finished Work as may be directed. After examination, the Contractor shall restore said portions of the Work to the standard required by the Contract Documents. Should the Work thus exposed or examined, prove acceptable, the Owner will pay for the uncovering, removing, replacing of the coverage, and restoration of the parts removed as extra work.

Should the Work so exposed or examined prove unacceptable, the Contractor shall pay for the uncovering, removing, replacing of the covering, and restoration of the parts removed.

Article 5.17 Work Limits, Easements, and Rights-of-Way

The Owner will provide work limits, rights-of-way and easements for the Work. Information regarding the width and status of easements is shown on the Drawings. The

Contractor shall comply with all Supplementary Conditions, provisions, stipulations, and restrictions thereof. The Contractor shall confine his operations to the designated work areas, rights-of-way and easements and shall observe all restrictions. Prior to the start of construction of this project, the Contractor will ensure that all permits necessary for the construction of the project, including right-of-entry for driveway reconstruction, have been obtained and will ensure that they are available on the job site at all times.

The Contractor will be responsible for any trespass upon adjacent property or injury thereto resulting from or in connection with his operations. The Contractor shall be liable for any claims that may be made on account of trespass and shall provide a written statement from the property owner of full restoration or satisfactory resolution prior to Final Acceptance of the Work. The Contractor shall not have the right to remove materials from a right-of-way, easement, or work area unless otherwise provided in the Contract Documents.

Should the Contractor desire to go outside designated work areas, rights-of—way or easements, he shall provide the Owner's Representative with written permission from the property owner before entering such property. The written permission shall specifically provide that the property owner will not hold the Municipality or its employees, agents, or consultants liable for use of or damage to this property.

Article 5.18 Responsibility for Damages

The Contractor shall be responsible for all damages to property; injury to persons; and loss, expense, inconvenience, and delay that may be caused by or that may result from any act, omission, or neglect of the Contractor, his Subcontractors, or his employees in the performance of the Work.

It is specifically understood between the parties executing the Contract that the Contract Documents do not make anyone a third-party beneficiary, nor does the Contract authorize anyone not a party to maintain a lawsuit for personal injuries or property damage.

Article 5.19 Repair of Damages Caused by Contractor

All damage and injury to property that is caused by or that results from the carrying out of the Work, or from any act, omission, or neglect of the Contractor, his Subcontractors, or his employees, shall promptly be remedied by the Contractor either by the repairing, rebuilding, or replacing of the property damaged or in some other manner satisfactory to the owner of such property. In case of failure on the part of the Contractor to promptly and satisfactorily remedy such damage or injury, the Municipality may proceed to repair, rebuild, or replace such property as required, and the cost thereof will be deducted from any monies due or that may become due the Contractor.

In applying the above provisions, the repairing, rebuilding, or replacing of damaged property shall be understood to include the providing of any temporary facilities that may be needed to maintain normal service until the required repairing, rebuilding, or replacing is accomplished.

This provision also applies to all areas used by the Contractor for staging of the construction and shall include restoring those properties to their original condition to the satisfaction of the Owner's Representative.

Article 5.20 Unauthorized and Defective Work

Any unauthorized or defective Work found to exist during construction shall be immediately remedied by the Contractor. If the Contractor fails to correct unauthorized or defective Work, the Owner may, three (3) days after a written notice to the Contractor, correct such deficiencies and deduct the cost thereof from any payment due the Contractor without prejudice to any other remedy including the use of Article 5.29 – Termination of Contract by Owner.

Article 5.21 Changes in the Work

The Owner's Representative shall have the authority to order changes in the Work requiring an adjustment in the Contract amount and/or time. Such changes in the Work shall be performed in accordance with any supplemental Drawings and instructions as the Owner's Representative may issue. Any single change in the Work, or cumulative changes in the Work, which will cause the total value of the Contract to exceed the limits stated in AMC 7.15.080, requires Assembly approval. The Owner will pay for additions to the Work or take credit for reductions to the Work using one of the four methods described below.

- 1) Negotiated unit or lump sum prices.
- 2) Time and Material prices (when the Owner's Representative determines that contract prices or negotiated prices do not apply).
- 3) Contract unit or lump sum prices (if they have been included as a part of the Contract).
- 4) No cost changes (when the Owner's Representative determines that a change is necessary which does not affect the price or time for the work).

Prior to the Owner's Representative authorizing payment for changed work, the Contractor shall furnish a Change Order Proposal that is itemized as required by the Owner's Representative for both additions and deletions to the Work.

The Contractor's Change Order Proposal shall be in sufficient detail to permit an analysis of all materials, labor, equipment, subcontracts, insurance, bonds, overhead costs and profit and shall cover all Work involved to accomplish the modification whether deleted,

added or changed. Any amount claimed for subcontracts shall be supported by a similar price breakdown. The Contractor agrees that it will incorporate the provisions of this Article 5.21 into all agreements with lower tier subcontractors.

If the Contractor's Change Order Proposal includes a request for a time extension, a justification thereof shall also be furnished. The Change Order Proposal together with the price breakdown and time extension justification shall be furnished by such date as may be specified by the Owner's Representative.

Each Change Order Proposal shall include a clear summary of the contract requirements; the reason for the requested change; a description of the change and whether additional time or other compensation is requested or credit offered to the Owner. Unless agreed at the time of the Owners Representative's acceptance of the Change Order Proposal, and formalized by an executed Change Order, any and all increased costs or delays resulting directly or indirectly from an unapproved Change Order Proposal will be borne solely by the Contractor.

1) Negotiated Changes: When extra work is ordered by the Owner's Representative to be performed on a negotiated unit or lump sum basis, the Contractor will be required to submit a properly itemized Change Order Proposal covering all the additional work and/or work to be deleted. The proposal will be itemized for the various components of work and segregated by labor, material, and equipment costs in a format satisfactory to the Owner's Representative. Each proposal will include similar itemized costs for all subcontractors, regardless of tier. The labor, material and equipment components of each proposal shall include the following:

Allowances for Profit and Overhead for Negotiated Changes:

Contractor Change Order Proposals for the performance of changed work shall include all direct costs for labor, materials, and equipment as described above. The Owner's Representative will review the proposals for reasonableness and adequate detail in order to reach agreement with the Contractor before including allowances as described below:

- In addition to the direct costs of labor, materials and equipment incurred by the Contractor, the Contractor shall be entitled to an allowance for profit and overhead. This allowance shall be 20% of direct costs.
- If work is performed by a subcontractor, the subcontractor actually performing the work shall be entitled to those allowances for profit and overhead listed above, and each subsequent higher tiered subcontractor or Contractor shall be allowed an additional 10% markup on the subcontractor's direct costs, up to a maximum of two tiers of subcontractors.

The allowance made in accordance with the terms outlined above will be understood to be complete reimbursement and compensation for all indirect costs associated with changed work including, but not limited to job office overhead, home office overhead, project management, superintendents, general foremen, estimating, engineering, detailing, legal, accounting, shop drawings, submittals, costs of small tools and small equipment, warranty, bond cost, insurance premiums, and profits.

Any allowance made by the Contractor to a Subcontractor, other than specified herein, shall be at the expense of the Contractor.

2) Time & Material Changes: When extra work is ordered by the Owner's Representative to be performed on a time and materials basis, the Contractor will be required to perform the extra work at the actual direct cost for labor, materials and equipment plus allowances for profit and overhead. In order for payment to occur, the Contractor must document all direct costs in a manner acceptable to the Owner's Representative. The contractor shall provide daily time sheets with the names of all Contractor's employees working on the changed work, the number of hours each employee works on the changed work, and a description of the work performed. In addition, the Contractor shall provide daily records of all equipment used to perform the changed work showing the number of hours each piece of equipment was used, a description of the work performed, and the name of the equipment operator. All materials incorporated into the changed work shall be documented with itemized invoices from vendors and suppliers.

Labor:

Labor costs shall include the direct hourly cost of labor stated on the certified payroll for each labor classification plus other direct labor costs including, but not limited to, FICA, Workers' Compensation, ESC, and public liability and property damage insurance when premiums are based on a percentage of payroll. The labor costs shall include only those direct labor hours required to perform the changed work for workers and working foremen. Supervision above the level of working foremen (such as general foremen, superintendents, and project managers, etc.) shall not be included in labor costs and shall be considered to be included in the Overhead and Profit Markup as described later in this Article 5.21.

Materials:

Costs for materials and supplies, including freight, will be based on the net actual cost of the material and supplies required to perform the changed work, as verified by appropriate vendor and third party invoices. Material costs shall reflect cost reductions available to the Contractor due to trade discounts, volume rebates, and price reductions for prompt payments, if applicable. Material costs

must be itemized to display the unit price for each specific item incorporated into the work

Owned Equipment (over \$500):

For any machinery or special equipment (other than small tools less than \$500) the Contractor shall include costs for the rental rates in the current edition and appropriate volume of the "Rental Rate Blue Book For Construction Equipment," (hereinafter referred to as the "Blue Book"), published by Dataquest, Inc. Hourly rental rates shall be determined as follows:

- The established hourly rental rate shall be equal to the monthly rate for the basic equipment plus the monthly rate for applicable attachments necessary to perform the work, both divided by 176, all multiplied by the area adjustment factor, plus the estimated hourly operating costs listed in the Blue Book.
- The area adjustment factors shall be applied for those sections the "Blue Book" containing an area adjustment map.
- The "Equipment Life" adjustment factor sections shall not apply.

For equipment not listed in the Blue Book, the Contractor shall receive a rental rate as agreed upon before the changed work is begun. If agreement cannot be reached, the Owner's Representative reserves the right to establish a rate based on similar equipment shown in the Blue Book or based on prevailing commercial rates in the area.

Rented Equipment (over \$500):

Costs for equipment brought to the work site and rented or leased specifically for work required under this section shall be included at the actual rental rate and supported by invoices from the equipment vendor. Rental rates for equipment shall be consistent with prevailing rates for similar equipment in the area.

Costs for rented equipment previously on the site and utilized specifically for changed work shall be included at the actual rental rate and supported by invoices from the equipment vendor, provided the hourly rate for this equipment shall not be greater than the hourly rate paid for that same equipment for other work in this contract.

Time for both owned and rented equipment will be estimated to the nearest one-quarter hour for purposes of computing compensation to the Contractor for equipment utilized under these rates.

The equipment rates for both owned and rented equipment as determined above shall be full compensation for providing the required equipment and no additional compensation will be made for other costs such as, but not limited to, fuels, lubricants, replacement parts or maintenance. Cost of repairs, both major and minor, as well as charges for mechanic's time utilized in servicing equipment to ready it for use prior to moving to the project and similar charges will not be allowed.

When it is necessary to obtain equipment from sources beyond the project limits exclusively for changed work, the actual cost of transferring the equipment to the site of the work and return will be allowed as an additional item of expense. Where the move is made by common carrier, the move-in allowance will be limited to the amount of the freight bill or invoice. If the Contractor hauls the equipment with his own forces, the allowance will be limited to the rental rate for the hauling unit plus operator wages. Move-in allowance shall not be made for equipment brought to the project for changed work which is subsequently retained on the project and utilized for completion of contract items.

- In addition to the direct costs of labor, materials and equipment incurred by the Contractor, the Contractor shall be entitled to an allowance for profit and overhead. This allowance shall be 15% of direct costs.
- If work is performed by a subcontractor, the subcontractor actually performing the work shall be entitled to those allowances for profit and overhead listed above, and each subsequent higher tiered subcontractor or Contractor shall be allowed an additional 10% markup on the subcontractor's direct costs, up to a maximum of two tiers of subcontractors.

The allowance made in accordance with the terms outlined above will be understood to be complete reimbursement and compensation for all indirect costs associated with changed work including, but not limited to job office overhead, home office overhead, project management, superintendents, general foremen, estimating, engineering, detailing, legal, accounting, shop drawings, submittals, costs of small tools and small equipment, warranty, bond cost, insurance premiums, and profits.

Any allowance made by the Contractor to a Subcontractor, other than specified herein, shall be at the expense of the Contractor.

3) Unit Price Changes: When extra work is ordered by the Owner's Representative to be performed on a unit price basis, the contract amount will be adjusted for both added quantities and deductive quantities in accordance with those unit prices that have been incorporated into the Contract, unless the Owner's Representative determines there is a

more equitable method. For changed work authorized by the Owner's Representative, the Contractor shall submit a Change Order Proposal itemizing the quantities of each item of work for which there is an applicable unit price. The applicable unit prices will be applied to the net differences of all quantities of the same item. These unit prices will be considered to cover all direct and indirect costs of furnishing and installing the item, including all profit and overhead for contractor and subcontractor.

4) No Cost Changes: The Owner's Representative shall have authority to order changes in the Work that in his opinion do not require an adjustment in the Contract amount or an extension of time and are not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and the Contractor. The Contractor shall carry out such written orders promptly.

If the Contractor claims that such written instructions or orders involve extra costs or an extension of time, he shall make his claim by following the procedures set forth in Article 5.22 - Claims for Additional Compensation. The Contractor shall proceed with the Work as directed by the Owner's Representative while his claim is being evaluated and shall not delay the Work while waiting for a decision.

Article 5.22 Claims for Additional Compensation

Except as elsewhere restricted, the Contractor may make a claim for additional compensation when he believes that he has incurred additional costs due to the acts, errors, or omissions of the Owner. If the Contractor becomes aware of any act or occurrence that may form the basis of a claim, the Contractor shall make every effort to mitigate the extent of any amounts claimed for additional compensation and shall immediately inform the Owner's Representative in writing of the potential for the claim, providing sufficient information to outline the basis of the claim. If the matter is not resolved within seven (7) days, the Contractor shall, within the next fourteen (14) days, submit written notice of the facts that may form the basis of the claim.

Thereafter, the Contractor shall submit the claim in writing to the Owner's Representative within twenty-one (21) days of the submission of the written notice of the facts unless the Owner's Representative agrees in writing to an extension of time for good cause shown. The Owner's Representative may grant up to a sixty (60) day extension only upon the written request of the Contractor in which all reasons for the request are stated. The Contractor agrees that unless these written notices are provided, the Contractor will have no entitlement to compensation for the acts, errors, or omissions of the Owner, the Architect/Engineer, or any other Contractor employed by the Owner. The Contractor shall in all cases continue performance of the Contract.

The written claim presented by the Contractor shall be complete and adequately stated. It shall specifically include the facts and circumstances surrounding the claim and the Contract provisions under which the claim is made; the Contractor's assertion as to the

original requirements of the Contract Documents and the basis for that assertion or position, citing all pertinent Specifications, Details, Plan notes or other Contract provisions; a clear certification that the Contractor's Bid Costs were in fact based on the stated original interpretation; the Contractor's assertion as to the revised requirements of the Contract Documents, citing all pertinent Contract provisions, or lack thereof, and other records on which that assertion or position is based; a narrative description of the increase in the Scope of Work resulting from the revision in the requirements; the Pay Items and quantities affected by the alleged change; references to previous notices of pending claim; and the specific relief requested, including both time extension and additional cost compensation and the basis on which both were calculated. In the case of cost compensation, such basis for specific relief shall include the labor classifications, rates and additional time; the equipment descriptions, rates and additional time; material descriptions, unit prices and quantities; and appropriate supporting documentation as to materials, unit prices, labor rates, and equipment rates.

Claims presented that do not include the above information or are otherwise considered to be incomplete will be returned to the Contractor without review by the Owner's Representative. The Owner's Representative will render a decision as to the merit of a properly presented claim within sixty (60) days of its receipt. Any change in the Contract amount resulting from such claim will be subject to approval by the Owner through the execution of a Change Order.

Article 5.23 Time for Completion of Work

The Owner shall indicate in the Supplementary Conditions either a time period for completion of the Work or a completion date. Time is of the essence in the Contract. Therefore, the Work to be performed under the Contract shall be completed in its entirety within the time period specified or before the completion date.

The Contractor shall furnish all labor, materials, facilities, and equipment and shall work the required hours, including night shifts, overtime operations, and Saturdays, Sundays, and holidays (per the requirements in Article 5.4 – Unusual Working Hours, Holidays, Saturdays, and Sundays) as may be necessary to ensure the completion of the Work within the time specified.

Failure of the Contractor to comply with the requirements of this Article may be considered grounds for termination under the provisions of Article 5.29 - Termination of Contract by Owner.

Article 5.24 Delays and Extension of Time

If the Contractor is delayed, beyond his control and without fault or negligence on his part, at any time in the progress of the Work by any act or neglect of the Owner or by changes ordered in the Work or by labor disputes, fire, unusual delay in transportation, adverse weather conditions not reasonably anticipated, unavailability of materials for which orders were timely placed, or by unavoidable casualties, then the time period for completion or the completion date may be extended by a Change Order, for such reasonable time as

the Owner's Representative may determine, without invalidating any of the provisions of the Contract and without the consent of the Surety.

Any claim for extension of time shall be made in accordance with the procedures set forth in Article 5.22 - Claims for Additional Compensation. In the case of a continuing delay, only one claim is necessary. The Contractor shall provide an estimate of the probable impact of such delay on the progress of the Work.

Article 5.25 Suspension of Work

By executing a contract, the Contractor agrees that the Owner has the undisputed right to suspend the Work and that this right is a material condition of the contract. The Contractor shall immediately suspend the Work as directed in the written order. Failure of the Contractor to immediately suspend the Work as directed shall constitute a material and immediate breach of the contract by the Contractor. The Owner may terminate this contract for default without providing the ten (10) day notice specified in Article 5.29 – Termination of Contract by Owner, should the Contractor fail, refuse or otherwise not immediately suspend the Work as directed.

The Work may be suspended in whole or in part by order of the Owner's Representative for the convenience of the Owner. The Contractor shall take every precaution to prevent any damage or unreasonable deterioration of the Work during the time it is suspended. Suspension of the Work by the Owner's Representative for the convenience of the Owner may furnish grounds for a claim by the Contractor for additional compensation and/or a time extension, in which case the Contractor, when making a claim, shall comply with the provisions of Article 5.22 - Claims for Additional Compensation.

Upon the failure of the Contractor to carry out the orders of the Owner's Representative or to perform in accordance with the Contract Documents, the Owner's Representative may suspend the Work for such period as may be necessary. Time lost by reason of such suspension, or replacement of improper work or material, shall not furnish any grounds to the Contractor for claiming additional compensation and/or an extension of time and shall not release the Contractor from any liability for damages or for failure to complete the Work within the time prescribed.

In the event that a suspension of Work is ordered in writing by the Owner's Representative due to unsuitable weather or unforeseen conditions, and, in the opinion of the Owner's Representative, the Contractor has prosecuted the Work with due diligence prior to the time of suspension, the Contractor may be due an extension of time.

Where the Contract provides for a time period for completion and the Work is suspended for the convenience of the Owner or unsuitable weather or unforeseen conditions and the Contractor has prosecuted the Work with due diligence, the time period and liquidated damages provision of the Contract shall be tolled until a Notice to Resume Work is issued by the Owner's Representative.

Article 5.26 Final Trimming of Work

The Contractor shall be responsible for all repair to the Work as necessary to overcome deterioration or damage that may occur prior to final inspection. The Contractor at all times shall keep the premises free from accumulation of waste materials, rubbish, and debris. The Contractor shall grade all existing driveways on, and which have been affected by the project within the rights-of-way or easements as directed by the Owner's Representative. At the completion of the Work, all waste materials, rubbish, debris and temporary structures from and about the Project as well as all his tools, construction equipment, machinery, and surplus materials shall have been removed from the Project area. The Work shall be in a neatly trimmed and well-finished condition throughout the Project area at the time of Final Inspection. This Work shall be considered incidental to the contract unless there is a specific contract item for this Work.

At any time during the progress of construction that cleanup is not keeping pace with the rest of the Work in the opinion of the Owner's Representative, the Contractor shall at the direction of the Owner's Representative suspend all operations on the major items of work until the premises are cleaned up to the satisfaction of the Owner. Any additional expense involved will be the sole responsibility of the Contractor, and the Owner will not be held liable for this additional expense.

All street name signs, traffic control signs, mailboxes, newspaper boxes, property corner markers, survey markers, survey monuments, and utility markers removed to facilitate the Work or damaged by the Contractor's operations shall be restored by the Contractor unless otherwise directed. Items damaged by the Contractor during removal, storage, or restoration shall be repaired or replaced in kind by the Contractor. Repairing or replacing damaged items shall be considered incidental to the Contract, and no separate payment shall be made.

Article 5.27 Final Inspection

When the Contractor, by his own comprehensive inspection, has concluded that all Work is completed, all code compliance inspections are performed, and all other contract requirements are fulfilled, he shall notify the Owner's Representative in writing of completion and request a pre-final inspection of the Project. This inspection will be performed in the presence of a representative of the Owner, the Architect/Engineer, and the Contractor. The Contractor will make available copies of all required code compliance inspection reports at this inspection. All deficiencies indicated by this inspection will be listed and promptly furnished to the Contractor for remedial action. When all listed deficiencies have been corrected, the Contractor shall notify the Owner's Representative, and a Final Inspection will be performed. When the Final Inspection verifies correction of the listed deficiencies, the Owner's Representative will issue a Certificate of Completion.

When the Final Inspection reveals uncorrected listed deficiencies, the above outlined procedure shall be repeated and the cost of reinspection will be deducted from any money due the Contractor. This cost will include, but is not limited to, salaries, administrative, and transportation costs.

Article 5.28 Liquidated Damages

For each calendar day that the Substantial Completion and/or Final Acceptance date is delayed beyond the Contract Completion Date, the sum per day listed in the Supplementary Conditions shall be deducted from any monies due the Contractor. After Substantial Completion, the Owner shall deduct from any monies due the Contractor the sum per day listed in the Special Provisions for every calendar day that the Final Acceptance date is delayed beyond the Contract Completion Date. If no money is due the Contractor, the Owner shall have the right to recover said sums from the Contractor or the Surety, or both.

The Contractor acknowledges that the daily amount of the Liquidated Damages provision is not a penalty but rather is a reimbursement for damages that the Owner will sustain by reason of delayed completion. The Contractor further acknowledges that the daily amount of Liquidated Damages is a reasonable alternative to the complex calculations that would otherwise be necessary to determine such damages.

Permitting the Contractor to continue and finish the Work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the Owner of any of the Owner's rights under the Contract.

Article 5.29 Termination of Contract by Owner

If the Contractor should be adjudged bankrupt; if he should make a general assignment for the benefit of his creditors; if a receiver should be appointed on account of his insolvency; if he should persistently or repeatedly refuse or fail to supply enough properly skilled workmen or proper materials for the efficient prosecution of the Work; or if he should persistently disregard laws, ordinances, or the instructions of the Owner's Representative, or otherwise substantially violate any provisions of the Contract, then the Owner may without prejudice to any other right or remedy and after giving the Contractor and his Surety ten (10) days concurrent written notice, terminate the Contract and take possession of the premises and of all materials, tools, and appliances thereon. Notwithstanding the preceding, the Owner may immediately terminate this contract for default without providing a ten (10) day notice if the Contractor fails, refuses or otherwise does not comply with a written order by the Owner's Representative that may involve issues of safety or a suspension of work issued under Article 5.25 – Suspension of the Work. When the Contractor and Surety are notified of the termination of the Contract, the Owner may demand that the Surety fulfill its obligations under the Performance and Payment Bond. Should the Surety fail to perform its obligations under the Bond upon demand of the Owner, then the Owner may finish the Work by whatever method that the Owner determines expedient. The Contractor and his surety shall be responsible for compensating the owner for all excess costs, including applicable liquidated damages and all added procurement costs incurred in accomplishment of the Contract Work.

In the event that the Owner terminates the Contract, the Owner does not waive any other right or remedy under the Contract or any other right or remedy available at law or equity.

The Contractor may not be allowed to bid on any Owner's contracts for a period of two (2) years following the date of this termination by the Owner.

In the case of termination before completion for any cause whatsoever, the Contractor, if notified to do so by the Owner, shall promptly remove equipment and supplies from the premises of the Owner. Failure to do so will authorize the Owner to remove such equipment and supplies from the premises at the expense of the Contractor.

Article 5.30 Termination of Work for Owner's Convenience

At any time during the term of this contract, the Owner may terminate the Work, in whole or in part, for any reason that the Owner's Representative shall determine to be in the best interest of the Owner. Any such termination shall be effected by delivery of a Notice of Termination to the Contractor, specifying that the termination is for the convenience of the Owner; the extent to which performance of the Work under the Contract is terminated; and the date upon which such termination becomes effective.

After receipt of a Notice of Termination and except as otherwise directed by the Owner, the Contractor shall:

1. Stop work under the contract on the date and to the extent specified in the Notice of Termination;
2. Place no further orders or subcontracts for materials, services, or facilities except as may be necessary for completion of such portion of the Work under the contract as is not terminated;
3. Terminate all orders and subcontracts to the extent that they relate to the performance of Work terminated by the Notice of Termination;
4. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, the cost of which would be reimbursable, in whole, or in part, in accordance with the provisions of the contract;
5. Submit to the Owner's Representative a list, certified as to quantity and quality, of any or all termination inventory items, excluding items that the Owner's Representative directed or authorized disposition of;
6. Transfer to the Owner's Representative the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Owner;
7. Take such action as may be necessary or as the Owner's Representative may direct for the protection and preservation of the contract-related property that is in the possession of the Contractor and in which the Owner has or may acquire any interest.

The Contractor shall proceed immediately with the performance of the above obligations notwithstanding any delay in determining or adjusting the amount of any item of reimbursable cost under this clause.

When the Owner orders termination of Work, effective on a certain date, all completed Work will be paid for at the contract price. Payment for materials included in the material inventory described in item 5 listed above will be paid at actual cost delivered to the project or storage site, including transportation charges. Allowable total markup on the actual cost shall be fifteen percent (15%).

After receipt of a Notice of Termination, the Contractor shall submit to the Owner's Representative his claim for alleged additional damages or costs not covered above or elsewhere in these specifications as provided in Article 5.22 – Claims for Additional Compensation. In no event, however, will loss of anticipated profits be considered as part of any settlement.

Article 5.31 Use of Completed or Uncompleted Portions

The Owner shall have the right to take possession of and use any completed or partially completed portions of the Work, prior to the date specified for completion, and such action and use shall not be considered an acceptance of that Work. If such use by the Owner causes additional expense to the Contractor and/or delay in the Work, the Contractor may be entitled to additional compensation and/or an extension of time. Claims for additional compensation or a time extension shall follow the procedures set forth in Article 5.22 - Claims for Additional Compensation. The Owner shall be responsible for routine maintenance or damages caused by the Owner's use of such portions of the Work.

Article 5.32 Preconstruction Conference

Within five (5) days after delivery of the executed agreement by the Owner to Contractor, but before the Contractor begins the Work at the site, a Preconstruction Conference will be held to review the contractor's schedules and plans, to establish procedures for handling shop drawings and other submissions, to establish procedures for submitting and processing applications for payment, and to establish a working understanding between the parties as to the project. The Owner or his Representative, the Architect/Engineer, the Inspector, and the Contractor and his Superintendent and key Subcontractors' representatives will be present at the meeting. Construction Progress Meetings will be conducted each month on a scheduled basis to review work progress, schedules, and other matters requiring discussion and resolution. At a minimum, the Owner, Architect/Engineer, and Contractor's Project Manager, or their representatives,

will attend the Construction Progress Meetings, which will be conducted on the project site.

SECTION 00 72 13.06 LEGAL RELATIONS AND RESPONSIBILITIES

Article 6.1 Laws to Be Observed

The Contract shall be governed by the laws of the State of Alaska. The Contractor at all times shall observe and comply with all federal, state, and municipal laws, ordinances, and regulations in any manner affecting the conduct of the Work and all such orders or decrees existing or which may be enacted or promulgated by legislative bodies, boards, tribunals, or courts having any jurisdiction or authority over the Work. The Contractor shall defend, indemnify, and hold harmless the Municipality and the officers, employees, and agents of the Owner, including the Architect/Engineer, against any claim or liability arising from or based on the violation of any such laws, ordinances, regulations, orders, or decrees, whether such violations be by the Contractor, his Subcontractor, or his employees.

Article 6.2 Notice to Contractors

Any written notice to the Contractor by the Owner shall be served on said Contractor or his representative either personally or by mailing to the address given in the Contract.

Article 6.3 Notice by Contractors

Any notice to the Owner by the Contractor shall be made in writing and shall be delivered to the Owner's Representative or his representative in person or mailed to the office of the Owner's Representative at the address given in the official Notice to Proceed.

Article 6.4 Successors and Assigns

The Contractor binds himself, his partners, successors, assignees, and legal representatives to the Owner with respect to all covenants, conditions, and obligations contained in the Contract Documents.

Article 6.5 Assignments

The Contractor shall not assign the whole or any part of the Contract or any monies due or to become due the Contractor without written consent of the Owner. If the Contractor assigns all or any part of any monies due or to become due him, the instrument of assignment shall state that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior claims of all persons, firms, and corporations who performed Work or supplied materials under the Contract.

Article 6.6 Permits

All permits or licenses not required to be obtained by the Owner but which are required by any federal, state, or municipal governmental agency or any public utility shall be obtained and paid for by the Contractor when such permits or licenses are necessary for the prosecution of the Work. The Contractor shall be responsible for all stipulations of these permits and shall be responsible for all costs associated with these permits and their stipulations.

It will be the Contractor's responsibility to give all notices and comply with all laws, ordinances, rules, and regulations bearing on the conduct of the Work as specified herein. The Contractor shall also be responsible for requesting all code compliance inspections.

The Owner will obtain the required permits and authorizations for Work within the Alaska Railroad Corporation rights-of-way and permits from the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, and the Alaska Department of Fish and Game. Prior to the start of construction within the scope of such permits, the Contractor shall obtain the necessary approvals and permits relating to the method, plan, and exact schedule of construction for any Work within such rights-of-way, creeks, and wetlands. Failure on the part of the Contractor to comply with any of the stipulations of any of the applicable Owner- or Contractor-acquired permits shall be sufficient cause for the Owner to suspend that Work.

The payment of basic and special fees, established under Anchorage Municipal Code (AMC) Chapter 24.30, AMC 24.30.100.A, AMC 24.30.100.B, and AMC 24.30.100.F,

Permit Fees for Permanent Uses of Public Places (street use ordinance), and which are applicable to the Work, shall not be the responsibility of the Contractor. These fees shall not be considered a bid item, nor shall they be considered incidental to any bid item.

The Contractor shall be responsible for applying for permits and fulfilling all other requirements of the MASS, the Municipal Code, and the Director of the Municipality of Anchorage's Office of Planning, Development, and Public Works pertinent to the approval and issuance of the permits.

The Contractor shall obtain and pay for all permits, deposits and connection fees for tapping any required water and/or wastewater service connection permits for new and disrupted service connections.

Article 6.7 Copyrights and Patents

The Contractor shall defend, indemnify, and hold harmless the Municipality, its officers, its employees, and agents of the Owner, including the Architect/Engineer, from any and all claims, suits, or actions brought for the infringement of any copyright or patent claimed to be infringed by any material, devices, drawings, method, or process to be

incorporated in the Work and/or required to be used in connection with the Work, including all attorney's fees and costs.

Article 6.8 Safety

The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons (including employees, Owner's Representatives, and the public) and property during performance of the Work. This requirement shall apply continuously twenty-four (24) hours per day, seven (7) days per week and shall not be limited to normal working hours. Safety provisions shall conform to the rules and regulations established by the U.S. Department of Labor, the Occupational Safety and Health Administration (OSHA), the State of Alaska Occupational Safety and Health Section (OSH), as well as all other applicable federal, state, or municipal laws, ordinances, codes, the requirements set forth below, and any regulations that may be detailed on other parts of the Contract Documents. Where any of these are in conflict, the more stringent requirement shall be followed. The Contractor's failure to thoroughly familiarize himself with the aforementioned safety provisions shall not relieve him from compliance with the obligations and penalties set forth herein.

The Contractor shall develop and maintain, for the duration of this Contract, a safety program that will effectively incorporate and implement all required safety provisions. The Contractor shall appoint an employee who is qualified and authorized to supervise and enforce compliance with the safety program and shall notify the Owner's Representative of the name and contact phone number for this person prior to commencement of the Work.

The duty of the Owner's Representative to conduct construction review of the Work does not include review or approval of the adequacy of the Contractor's safety supervisor, the safety program, or any safety measures taken in, on, or near the construction site.

If death, serious injuries, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Architect/Engineer and the Owner. In addition, the Contractor must promptly report in writing to the Owner's Representative all accidents whatsoever arising out of, or in connection with, the performance of the Work, whether on, or adjacent to, the site, giving full details and statements of witnesses.

If a claim is made by anyone against the Contractor or any Subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Owner's Representative, giving full details of the claim.

Failure to comply with all applicable safety rules and regulations, notwithstanding any other provision of the Contract, is sufficient cause for termination under the provisions of the Contract.

Article 6.9 Insurance

Before signing the Contract or commencing the Work or allowing any Subcontractor to commence Work, the Contractor shall obtain all insurance required under this Article. The Contractor shall maintain this insurance until the Final Acceptance Date. The Contractor shall file with the Purchasing Officer as verification of insurance a certificate of insurance on the forms furnished, showing the type and amounts of insurance, the policy number, the expiration date, and the signature of an authorized representative of the insurance company. The insurance company must provide written notification to the MOA contract administrator of any material change, cancellation, or non-renewal of the insurance policies. If the insurer does not notify the MOA in these circumstances, it will be the contractor's responsibility to make that notification. All insurance policies required under this Article shall name the Municipality as an additional insured for the purposes of the Project and shall contain a waiver of subrogation against the Municipality.

The Contractor shall provide the following types of insurance:

Workers' Compensation

\$500,000 Employers Liability and Workers' Compensation as required by Alaska State Workers' Compensation Statutes

Minimum Limits

Statutory

Commercial General Liability

Bodily Injury and Property Damage Liability
Premises Operations including explosion, collapse and underground;
Products and Complete Operations;
Broad Form Property Damage;
Blanket Contractual;
Personal Injury;
Owner's/Contractor's Protection

Minimum Limits

\$1,000,000 Combined
Limit Each Occurrence
and \$2,000,000
Aggregate

Commercial Automobile Liability

Bodily Injury and Property Damage,
including all owned, hired, and non-owned
automobiles

Minimum Limits

\$1,000,000 Combined
Limit per Occurrence

When specified in the Supplementary Conditions, the Contractor shall provide the following additional coverages:

Coverages	Minimum Limits
Federal Longshoremen and Harbor Workers Compensation Act :	Statutory
Federal Maritime Liability Law (Jones Act:)	\$1,000,000
Builder's Risk:	Total Contract Amount

NOTICE TO "OUT OF STATE" CONTRACTORS:

A Certificate of Insurance for Alaska Worker's Compensation, or an "other states" endorsement on your home state Worker's Compensation policy, is required prior to execution of a Contract or commencement of any contract performance, if any in-state visits or Work is required or anticipated.

Article 6.10 Indemnification

To the fullest extent permitted by law, the Contractor shall indemnify, defend, and hold harmless the Municipality and the Architect/Engineer and their agents and employees from and against all claims, damages, losses, and expenses, including attorneys' fees, arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss, or expense (1) is attributable to bodily injury, sickness, disease, death, or personal injury or to injury to or destruction of tangible property including the loss of use resulting therefrom; and (2) is caused in whole or in part by any negligent act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by the Contractor or Subcontractors, or anyone for whose acts the Contractor or Subcontractors may be liable, regardless of whether or not the claim, damage, loss, or expense is caused in part by a party indemnified hereunder.

In any and all claims against the Municipality or the Architect/Engineer or their agents or employees by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation under this Article shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or any Subcontractor under Worker's Compensation acts, disability benefit acts, or other employee benefit acts.

Article 6.11 Claims by Workers, Suppliers, and Subcontractors

In the event the Contractor or any Subcontractor fails, neglects, or refuses to make prompt and full payment for labor, services, materials, supplies, or provisions furnished by any person in connection with the Work, then the Owner may withhold the amount due from the Contractor's progress payments provided that an affidavit of claim on the form furnished is filed with the Owner's Representative. The withholding by the Owner does not relieve the Contractor or his Surety from their obligations with respect to the payment

of such claims. Sums withheld from progress payments will be disbursed pursuant to Article 7.5 - Payment of Claimants.

Article 6.12 Certified Payroll

The Contractor shall file a certified payroll on Friday of each week that covers the preceding week; the payroll shall be filed with the State of Alaska Department of Labor, Labor Standards and Safety Division, Wage and Hour Administration.

Article 6.13 Lawsuits

If a lawsuit is filed by the Contractor or his Surety against the Municipality or by the Municipality against the Contractor or his Surety, the suit shall be commenced in the Superior Court, Third Judicial District, in Anchorage, Alaska.

If one of the questions at issue is the satisfactory performance of the Work by the Contractor, and should the appropriate Court decide that the Work of the Contractor was unsatisfactory, then the Contractor or his Surety shall reimburse the Owner for all legal and all other expenses incurred by the Owner because of the lawsuit as may be allowed and set by the Court. Further, it is agreed that the Owner may deduct such costs from any sum or sums then due or that may become due the Contractor under the Contract.

If any clause or condition of the Contract is held as a matter of law to be unenforceable or unconscionable, the remainder of the Contract shall be enforceable without such clause.

Article 6.14 Preference to Local Labor

The Contractor shall comply with the Provisions of Title 36, Chapter 10 of the Alaska Statutes requiring employment preference for Alaska residents.

Article 6.15 State of Alaska Prevailing Wage Scale

The Contractor shall comply with the Provisions of Title 36 of the Alaska Statutes for the payment of prevailing wages to their employees.

If the contract contains State of Alaska wage rates and a federal wage decision, the Contractor and all Subcontractors shall comply with both wage decisions. The Contractor and all Subcontractors shall be responsible for paying the higher pay rate between the state and federal wage decisions. Additionally, the Contractor and all Subcontractors shall be responsible for providing certified payrolls, to the State of Alaska Department of Labor, Wage and Hour Division on a weekly basis, using the appropriate agency's form(s) and, upon request to the Contract Administrator.

Article 6.16 Nondiscrimination

The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, national origin, ancestry, age, sex, or marital status or any employee or applicant who is a "qualified individual with a disability"

(As defined in the Americans with Disabilities Act of 1990). The Contractor shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, national origin, ancestry, age, sex, marital status, or mental or physical impairment/disability. Such action shall include, without limitation, the following: employment, upgrading, demotion, or transfer; recruitment or recruiting advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

The Contractor shall state in all solicitations or advertisements for employees for the Work that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, ancestry, age, sex, marital status, or mental or physical impairment/disability.

The Contractor shall include the provisions of the first two paragraphs of this section in every subcontract or purchase order under this contract, so as to be binding upon every such Subcontractor or vendor of the Contractor under this contract.

Article 6.17 Rights and Remedies

The duties and obligations of the Contractor imposed by the Contract Documents and the rights and remedies of the Owner available thereunder shall be in addition to and not a limitation of any duties, obligations, rights, and remedies otherwise imposed or available by law.

The failure of the Owner or the Architect/Engineer to insist in any one or more instances upon the strict performance of any one or more of the provisions of the Contract, or to exercise any right herein contained or provided by law, shall not be construed as a waiver or relinquishment of the performance of such provision or right(s) or of the right to subsequently demand such strict performance or exercise of such right(s), and the rights shall continue unchanged and remain in full force and effect.

Article 6.18 Payment of Taxes

As a condition of performance of this contract, the Contractor shall pay all municipal taxes incurred by the Contractor. Payment of such taxes is required before the Municipality will issue any payment to the Contractor for Work.

SECTION 00 72 13.07 MEASUREMENT AND PAYMENT

Article 7.1 Payment to Contractor

The contract amount shall be lump sum as stated in the contract and shall include any authorized adjustment(s). The contract amount represents the total amount payable to the Contractor by the Owner for performance of the Work as required by the Contract Documents.

Prior to the first application for payment, the Contractor shall submit a Schedule of Values (as described in Article 5.3 – Construction Progress Schedule and Schedule of Values), which outlines material and labor in categories that allocate portions of the Work in a detailed manner. The allocations, at a minimum, shall address the portions of the Work listed in the Table of Contents of the Specifications.

Article 7.2 Scope of Payment

The Contractor shall accept the compensation as herein provided in full payment for the Work. The Contractor shall do all things necessary to perform and to complete the Work according to the Contract Documents, including but not limited to furnishing all labor, tools, implements, machinery, supplies, materials, water, heat, utilities, transportation, and permits necessary to perform the Work. The Contractor shall be responsible for all loss, damage, or liability arising from the nature of the Work, from the action of the elements, or from any unforeseen difficulties that may be encountered. Work paid for under one item will not be paid for under another item.

The contract price shall constitute full compensation for furnishing all labor, equipment, and materials and performing all operations required to complete the Work as specified and as shown on the drawings or otherwise directed. Notwithstanding the omission or mention of any incident or incidental Work, the contract price and payment shall also constitute full compensation for all work incident or incidental to completion of the items, unless such Work is otherwise specifically mentioned for separate payment under another bid item. In the event any Work is required by the specifications or by the bidding schedule and is not directly incident or incidental to the completion of any such items, the contract price or prices for all enumerated items shall also constitute full compensation of such Work.

In this Section 00700.07, the terms "construct, furnish, install, erect, place, and prepare," shall be construed to mean that the bid item(s) is (are) complete, in place, and approved by the Owner's Representative.

Article 7.3 Advances on Materials

The Contractor may request advance payment for materials to be incorporated in the Work, provided such materials are delivered and stored at the site or, if approved by the Owner's Representative, at another site within the Municipality. The Contractor shall be solely responsible for the protection of these materials. Only the Contractor's costs of materials (including freight), as verified by invoices, will be considered for such advance payments by the Owner.

No payment for materials shall be made on any single class of material the value of which is not at least \$5,000. No advance shall be made for fuels, supplies, forms, lumber, falsework, or other materials or on temporary structures of any kind that will not become an integral part of the finished construction.

The Contractor shall make available to the Owner's Representative evidence of payment for the materials for which it is requesting advances and of insurance to ensure replacement if such material is lost, stolen, or damaged; and other information the Owner's Representative may request.

Article 7.4 Progress Payments

The Contractor shall submit to the Owner's Representative an Application for Payment, on the forms furnished, supported by such data as the Owner's Representative may require that substantiate the Contractor's right to payment for Work done during the preceding calendar month. The Owner's Representative will, within eight (8) days after receipt of the Application for Payment, either approve a Partial Payment Estimate and present it to the Contractor for signature or notify the Contractor in writing of his reasons for withholding approval. Approved Partial Payment Estimates shall be received by the Owner within two (2) days after execution by the Contractor.

The Owner will process Partial Payment Estimates and make payment to the Contractor within fifteen (15) days of receipt of the Partial Payment Estimate. If the Owner fails to make payment to the Contractor within thirty (30) days (twenty-one [21] days if the project is funded with State of Alaska grants) of receipt of the Application for Payment, the Contractor may, upon seven (7) days written notice to the Owner, suspend the Work. The Contractor shall take every precaution to prevent any damage or unreasonable deterioration of the Work during the time it is suspended.

Retainage: For projects where a Performance and Payment Bond is required, under Article 3.5 – Bonds and Insurance, progress payments at one hundred percent (100%) of the estimated value of the work accomplished, less all previous payments, shall be made to the Contractor, and no retainage shall be deducted, except as provided under the withholding provisions of this Article (Article 7.4).

For projects where a Performance and Payment Bond is not required under Article 3.5 – Bonds, Insurance. The Owner will retain ten percent (10%) of the total earnings to date until the Work is completed and accepted. However, if the Owner at any time after fifty percent (50%) of the Work has been completed determines that satisfactory progress is maintained, the Owner may continue to hold the retainage to date and authorize progress payments to the Contractor in full for Work performed beyond the fifty percent (50%) stage of completion. After ninety-five percent (95%) of the Work has been satisfactorily completed, the Owner may reduce the retention to two percent (2%) of the earnings to date. Interest on retainage shall accrue at the rate of eight percent (8%) per annum, simple interest, or, when the State of Alaska is to provide a grant for all or part of the

funding for the Work, the rate of interest will be equal to the amount set out in Alaska Statute (AS) 45.45.010(a).

No interest shall accrue and no interest shall be paid on sums that are withheld as provided for hereinafter.

Withholding: The Owner's Representative may withhold from a progress payment for any of the following reasons:

1. Defective Work;
2. Claims made directly against the Municipality alleging an act or omission on the part of the Contractor, Subcontractors, or their agents in connection with the Work;
3. Damage to the Municipality;
4. Reimbursements for Work done by the Owner because of any failure to carry out the Work in accordance with the Contract Documents;
5. Uncompleted incidental work, not earning direct payment, including but not limited to testing, cleanup, updating of progress schedules, and preparation of Record Documents and Operation and Maintenance Manuals;
6. Liquidated damages;
7. Claims by Subcontractors, suppliers, laborers, or the Alaska Department of Labor.

The amount of any withholding for items 1-5 listed above shall be the reasonable value of the Work or remedy to be accomplished as estimated by the Owner's Representative, without regard to bid amount or cost to the Contractor. The amount of withholding for items 6-8 shall be in accordance with the claimed amount or the applicable contract provisions.

Progress payments shall not be construed as an acceptance or approval of any part of the Work covered thereby, and they shall in no manner relieve the Contractor of responsibility for correcting defective workmanship or material.

The estimates upon which progress payments are based are not represented to be accurate estimates, and all quantities shown therein are subject to correction on any subsequent pay estimate. If the Contractor uses such estimates as a basis for making payment to Subcontractors, he does so at his own risk, and he shall bear all loss that may result.

The making of progress payment under the Contract, either before or after the date set for completion of the Work, shall not operate to invalidate any of the provisions of the Contract or to release the Surety.

Article 7.5 Payment of Claimants

Any claim received by the Owner's Representative against the Contractor or Subcontractors from any material men, laborer, supplier, Subcontractor, or the Alaska Department of Labor will be forwarded to the Contractor by certified mail as soon as practical following receipt by the Owner's Representative. Within twenty-one (21) days after the Contractor's receipt of the said notice, the Contractor shall notify the Owner's Representative in writing by Certified Mail that the said claim is contested or provide proof that the claim has been satisfied. If the Contractor contests the claim, the Contractor shall describe in detail how the Subcontractor was paid or why the Subcontractor should not be paid and furnish the 3-point statement described below. If the Contractor does not respond during the time allotted above, this lack of notice shall constitute consent by the Contractor to have the owner pay the claim from the earnings of the Contractor.

The Owner shall not be responsible to the Contractor if the Contractor subsequently contests the validity of the claim. Sums withheld pursuant to disputed claims will not be paid to the claimant except where compelled by legal authority. Such sums may be paid to the Contractor upon the filing of a 3-point statement by the Contractor and his Surety on the form furnished by the Owner's Representative stating that: (1) the Contractor contests the validity of the claim, (2) the Surety acknowledges responsibility for the payment of the claim in the event it is valid, and (3) that the Contractor and the Surety specifically agree to hold the Municipality harmless for making payment to the Contractor of the sums withheld.

In the event that the Contractor revokes consent to pay a claimant as provided herein and refuses to execute the said statement referenced above, the Municipality may institute an interpleader action in Superior Court, Third Judicial District, and all Court costs and attorney's fees incurred by the Municipality shall be paid by the Contractor or the Surety. Claimants are not intended beneficiaries of this Article and shall have no recourse against the Municipality for any failure to pay claims from sums withheld from the Contractor.

Article 7.6 Final Payment

Upon completion of the Work and issuance of a certificate of completion by the Owner's Representative, the Contractor shall submit a request to the Owner's Representative for the final payment. The retainage shall be held by the Owner for a period of not less than ninety (90) days following the Final Acceptance of the Work. No final payment shall be made until the Contractor has filed with the Owner's Representative, prior to acceptance of the Work, a notarized Certificate of Compliance as follows:

I (we) hereby certify that all Work has been performed and materials supplied in accordance with the Contract Documents for the above Work; that not less than the prevailing rates of wages as required by the State of Alaska statute have been paid to laborers, workers, and mechanics; that all payroll taxes have been paid; and that all claims for material and labor and other services performed in connection with these Contract Documents have been satisfied.

There shall be deducted from the final payment any sums withheld pursuant to Article 7.5 - Payment of Claimants.

Article 7.7 Correction of Work After Final Payment

Neither the final payment nor any progress payment shall relieve the Contractor of his responsibility for paying all costs resulting from defects in materials or workmanship supplied under the terms of this contract, and for correction of those defects, for a period of one (1) year following the Final Acceptance Date. The Owner shall give notice of observed defects with reasonable promptness. The Contractor shall initiate corrective action within five (5) days after written notification from the Owner, or the Owner will make other provisions to complete the Work, and all costs shall be paid by the Contractor.

END OF SECTION

MAINTENANCE AND OPERATIONS
FIRE STATION 11 STORAGE BUILDING
SUPPLEMENTARY CONDITIONS

SECTION 00 72 13.02 BIDDING REQUIREMENTS AND CONDITIONS

Article 2.2 Interpretation or Correction of Bidding Documents

Add the following definition:

The following supplements, modifies, changes, deletes from or adds to the Section 00 72 13 of the Municipality of Anchorage - Standard Specifications-Building (MASSB). Where any Article, Paragraph, Subparagraph, or Clause is modified, or added by these Supplementary Conditions, the unaltered provisions of the Article, Paragraph, Subparagraph, or Clause shall remain in effect. If the Supplementary Conditions conflict with any general condition it shall supersede the conflicting item.

SECTION 00 72 13.03 AWARD AND EXECUTION OF CONTRACT

Article 3.4 Action on Bids

Paragraph seven (7) Modify the following:

The Purchasing Officer will give a written, signed Notice of Award or rejection within sixty (60) days of Bid opening when the Bid amount exceeds \$500,000 or more.

Article 3.6 Execution of Contract

Paragraph four (4) Modify the following:

The Municipality will supply the Contractor with the Contract Documents, which includes the ITB (Invitation to Bid) Book and Drawing Set; the Contractor may request additional copies which the Municipality will supply, up to (4) sets.

Article 3.7 Contractor's Warranty

At the end of Paragraph one (1) Add the following:

The Contractor shall extend to the Municipality such other bond, warranty of manufacturer or any other guarantee given on any material, goods, equipment, or workmanship included in the work.

SECTION 00 72 13.05 CONTROL OF WORK

Article 5.7 Submittal List

Remove this Article completely.

Article 5.23 Time for Completion of Work

Add the following at the end of paragraph one:

All work shall be completed within 360 calendar days after receipt of Notice to Proceed.

Article 5.28 Liquidated Damages

Add the following at the end of paragraph one:

Liquidated damages under this contract will be \$250.00 per day.

SECTION 00 72 13.06 LEGAL RELATIONS AND RESPONSIBILITIES

Article 6.6 Permits

Add the following after paragraph three:

The plans have been reviewed for code compliance by Building Safety the permit number is **C21-2035**. The Contractor shall use this permit number to identify this project to Building Safety. The Contractor shall provide a Type 2 SWPPP to Building Safety plan review for approval. The Contractor shall Provide a written statement with information to include Haul route, hours of operation, type of material, source of fill, disposition of excavation to Building Safety plan review for approval. inspections required to obtain the Certificate of Occupancy shall be the responsibility of the contractor. The Contractor shall obtain certificates of inspection from the appropriate municipal, state, or federal inspector and submit them to the Contract Administrator. The Contractor shall provide the Contract Administrator with a copy of the issued permits and invoice for the first progress payment. The Contractor shall provide the Contract Administrator a copy of the Certificate of Occupancy with the final invoice for the project.

Special Inspections:

Special Inspections will be paid for by the Municipality of Anchorage. The Contractor shall be responsible for scheduling special inspections sufficiently in advance of when needed and assuring that the work is ready to be inspected when the inspector is scheduled to visit. The Municipality of Anchorage will not pay for re-inspections caused by the Contractor's failure to be prepared for an inspection scheduled by the Contractor.

Article 6.9 Insurance

The insurance requirements in Section 00 62 16 superseded the requirements in the General Conditions 00 72 13 Article 6.9.

Article 6.14 Preference to Local Labor

Delete this Article in its entirety:

EQUAL EMPLOYMENT OPPORTUNITY SPECIAL PROVISIONS CONTRACT COMPLIANCE SPECIFICATIONS

Every municipal contract shall include language substantially the same as the following: The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, ancestry, age, sex, sexual orientation, gender identity, marital status, or physical or mental disability. The contract will comply with all laws concerning the prohibition of discrimination including, but not limited to, Title 5 and Title 7 of the Anchorage Municipal Code.

Every municipal contract shall state, in all solicitations or advertisements for employees to work under the contract, that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, ancestry, age, sex, sexual orientation, gender identity, marital status, or physical or mental disability.

Laborers' & Mechanics' Minimum Rates of Pay

Title 36. Public Contracts AS 36.05 & AS 36.10 Wage & Hour Administration Pamphlet No. 600 (Pamphlet 600) is hereby incorporated in its entirety. Pamphlet 600 is available for free download at <http://www.labor.state.ak.us/lss/forms/pam600.pdf>

The Municipality of Anchorage will include a paper copy of the wage rates in the signed Contract.

Exhibit "E"

FEDERAL PROVISIONS

I. DEFINITIONS

- A. **Government** means the United States of America and any executive department or agency thereof.
- B. **The FEMA** means the Federal Agency Management Agency.
- C. **Third Party Subcontract** means a subcontract at any tier entered into by Contractor or subcontractor, financed in whole or in part with Federal assistance.
- D. **“MOA”** means Municipality of Anchorage.
- E. **M.A.S.S.-Municipality of Anchorage Standard Specification.** A copy of M.A.S.S. may be obtained by contacting the MOA Purchasing Office or by visiting the MOA Purchasing Website
http://www.muni.org/Departments/project_management/Pages/MASS.aspx

II. INCORPORATION OF UNIFORM ADMINISTRATIVE REQUIREMENTS

The preceding provisions include, in part, certain standard terms and conditions required by the FEMA, whether or not expressly set forth in the preceding contract provisions. All contractual provisions required by the FEMA are hereby incorporated by reference. Anything to the contrary herein notwithstanding, the FEMA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Agreement. Contractor shall not perform any act, fail to perform any act, or refuse to comply with any MOA requests that would cause MOA to be in violation of the FEMA terms and conditions.

III. TERMINATION FOR CONVENIENCE (applicable to all contracts in excess of \$10,000)

In accordance with M.A.S.S. Division 10, Section 10.05, Article 5.29-Termination of Work for Owners Convenience.

IV. TERMINATION FOR DEFAULT (applicable to all contracts in excess of \$10,000)

In accordance with M.A.S.S. Division 10, Section 10.05, Article 5.28-Termination of Contract by Owner.

V. SUSPENSION OF WORK

In accordance with M.A.S.S. Division 10, Section 10.05, Article 5.24-Suspension of Work.

VI. CHANGES TO THE CONTRACT

In accordance with M.A.S.S. Division 10, Section 10.05, Article 5.20-Changes in the Work.

VII. FEDERAL CHANGES

- A. Contractor shall at all times comply with all applicable regulations, policies, procedures, and the FEMA Directives as they may be amended or promulgated from time to time during the term of this Agreement, including but not limited to those requirements of 2 CFR 200.318 through 200.326 and more fully set forth in Appendix II to Part 200—Contract Provisions for non-FEMA Contracts Under Federal Awards, which is included herein by reference. Contractor's failure to so comply shall constitute a material breach of this contract.

B. The Contractor agrees to include the above clause in each third-party subcontract financed in whole or in part with Federal assistance. It is further agreed the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

VIII. EQUAL EMPLOYMENT OPPORUNITY (applicable to all construction contracts awarded meeting the definition of “federally assisted construction contract” under 41 CFR 61-1.3)

During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants’ employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

(4) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(5) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(6) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled,

terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(8) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: Provided, That if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

IX. COMPLIANCE WITH DAVIS-BACON ACT (applicable to construction contracts in excess of \$2,000 awarded by grantees and subgrantees when required by Federal grant program legislation)

- A. All transactions regarding this contract shall be done in compliance with the Davis-Bacon Act (40 U.S.C. 3141- 3144, and 3146-3148) and the requirements of 29C.F.R. pt. 5 as may be applicable. The contractor shall comply with 40 U.S.C. 3141-3144, and 3146-3148 and the requirements of 29 C.F.R. pt. 5 as applicable.
- B. Contractors are required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor.
- C. Additionally, contractors are required to pay wages not less than once a week.

X. COMPLIANCE WITH COPELAND “ANTI-KICKBACK” ACT (required for all construction or repair work above \$2,000 where the Davis-Bacon Act also applies (It DOES NOT apply to the FEMA Public Assistance Program))

- A. Contractor. The contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract.
- B. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clause above and such other clauses as FEMA may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.
- C. Breach. A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a contractor and subcontractor as provided in 29 C.F.R. § 5.12.”

XI. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT (applicable to all contracts, grants, and cooperative agreements in excess of \$100,000 that involve the employment of mechanics or laborers, but not to purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence)

- (1) ***Overtime requirements.*** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) ***Violation;*** liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of

forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

- (3) ***Withholding for unpaid wages and liquidated damages.*** The MOA shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.
- (4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section.

XII. CLEAN AIR ACT AND THE FEDERAL POLLUTION CONTROL ACT

Clean Air Act

1. The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq.
2. The contractor agrees to report each violation to the MOA and understands and agrees the MOA will, in turn, report each violation as required to assure notification to the FEMA and the appropriate Environmental Protection Agency Regional Office.
3. The contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance provided by the FEMA.

Federal Water Pollution Control Act

1. The contractor agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq.
2. The contractor agrees to report each violation to the MOA and understands and agrees that the MOA will, in turn, report each violation as required to assure notification to the FEMA and the appropriate Environmental Protection Agency Regional Office.
3. The contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance provided by the Federal Agency.

XIII. DEBARMENT AND SUSPENSION

Regulations restrict awards, subawards, and contracts with certain parties that are debarred, suspended, or otherwise excluded from or ineligible for participation in Federal assistance programs and activities. See 2 C.F.R. Part 200, Appendix II(H); and 2 C.F.R. § 200.213. A contract award must not be made to parties listed in the SAM Exclusions. SAM Exclusions is

the list maintained by the General Services Administration that contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549. SAM exclusions can be accessed at www.sam.gov. See 2 C.F.R. § 180.530.

- A. This contract is a covered transaction for purposes of 2 C.F.R. pt. 180 and 2 C.F.R. pt. 3000. As such, the contractor is required to verify that none of the contractor, its principals (defined at 2 C.F.R. § 180.995), or its affiliates (defined at 2 C.F.R. § 180.905) are excluded (defined at 2 C.F.R. § 180.940) or disqualified (defined at 2 C.F.R. § 180.935).
- B. The contractor must comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.
- C. This certification is a material representation of fact relied upon by the MOA. If it is later determined that the contractor did not comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, in addition to remedies available to the MOA, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.
- D. The bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

XIV. BYRD ANTI-LOBBYING AMENDMENT, 31 U.S.C. § 1352 (AS AMENDED)

Contractors who apply or bid for an award of \$100,000 or more shall file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification(s) to the awarding agency.

XV. PROCUREMENT OF RECOVERED MATERIALS

In the performance of this contract, the Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired:

- 1. Competitively within a timeframe providing for compliance with the contract performance schedule;
- 2. Meeting contract performance requirements; or
- 3. At a reasonable price.

Information about this requirement, along with the list of EPA designated items, is available at EPA's Comprehensive Procurement Guidelines web site,

<https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>.

The Contractor also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.”

XVI. ACCESS TO RECORDS

1. The Contractor agrees to provide the MOA, the FEMA Administrator, the Comptroller General of the United States, or any of their authorized representatives access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.
2. The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.
3. The Contractor agrees to provide the FEMA Administrator or his authorized representatives access to construction or other work sites pertaining to the work being completed under the contract.
4. In compliance with the Disaster Recovery Act of 2018, the MOA and the Contractor acknowledge and agree that no language in this contract is intended to prohibit audits or internal reviews by the FEMA Administrator or the Comptroller General of the United States.

XVII. USE OF SEAL, LOGO, AND FLAGS

The contractor shall not use any Federal Agency seals, logos, or flags without specific written pre-approval from the Federal Agency.

The contractor shall not use any MOA seals, logos, or flags without specific written pre-approval from the MOA.

XVIII. COMPLIANCE WITH FEDERAL LAW, REGULATIONS AND EXECUTIVE ORDERS

This is an acknowledgement that Federal Agency financial assistance will be used to fund all or a portion of the contract. The contractor will comply with all applicable Federal law, regulations, executive orders, Federal Agency policies, procedures, and directives.

XIX. NO FEDERAL GOVERNMENT OBLIGATIONS TO CONTRACTOR

- A. The MOA and Contractor acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Government, the Government is not a party to this contract and shall not be subject to any obligations or liabilities to the MOA, Contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.
- B. The Contractor agrees to include the above clause in each third-party subcontract financed in whole or in part with Federal assistance provided by the Federal Entity. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

XX. NOTICE OF REPORTING REQUIREMENTS

- A. Contractor acknowledges that it has read and understands the reporting requirements of Part III of Chapter 11 of the United States Department of Justice’s Office of Justice Programs Financial Guide and agrees to comply with any such applicable requirements.

- B. The Contractor agrees to include the above clause in each third-party subcontract financed in whole or in part with Federal assistance provided by the Federal Entity. It is further agreed the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

XXI. NOTICE OF REQUIREMENTS PERTAINING TO COPYRIGHTS

- A. Contractor agrees the Federal Entity shall have a royalty-free, nonexclusive, and irrevocable license to reproduce, publish or otherwise use, and to authorize others to use, for government purposes:
 - 1) The copyright in any work developed with the assistance of funds provided under this Agreement;
 - 2) Any rights of copyright to which Contractor purchases ownership with the assistance of funds provided under this Agreement.
- B. The Contractor agrees to include paragraph A above in each third-party subcontract financed in whole or in part with Federal assistance. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

XXII. PATENT RIGHTS (applicable to contracts for experimental, research, or development projects financed the Federal Entity; 44 CFR §13.36(i)(8))

- A. General. If any invention, improvement, or discovery is conceived or first actually reduced to practice in the course of or under this Agreement, and that invention, improvement, or discovery is patentable under the laws of the United States of America or any foreign country, the MOA and Contractor agree to take actions necessary to provide immediate notice and a detailed report to the Federal Entity.
- B. Unless the Government later makes a contrary determination in writing, irrespective of Contractor's status (a large business, small business, state government or state instrumentality, local government, nonprofit organization, institution of higher education, individual), the MOA and Contractor agree to take the necessary actions to provide, through the Federal Entity, those rights in that invention due the Federal Government as described in U.S. Department of Commerce regulations, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," 37 CFR, Part 401.
- C. The Contractor agrees to include paragraphs A and B above in each third-party subcontract for experimental, developmental, or research work financed in whole or in part with Federal assistance provided by the Federal Entity.

XXIII. ENERGY CONSERVATION REQUIREMENTS

- A. The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 USC 6201).
- B. The Contractor agrees to include paragraph A above in each third-party subcontract financed in whole or in part with Federal assistance provided the Federal Entity. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

XXIV. MBE / WBE REQUIREMENTS

The MOA intends to seek reimbursement of its costs incurred in connection with this project from the Federal Entity. Accordingly, the CONTRACTOR shall make every effort to procure Minority and Women's Business Enterprises ("DBEs") through the "Good Faith Effort" process as required in 2 CFR 200.321. Failure to perform the "Good Faith Effort" process and submit the forms listed below with the bid shall be cause for a bid to be rejected as non-responsive and/or be considered as a material breach of the contract.

PRIME CONTRACTOR RESPONSIBILITIES

All recipients of this grant funding, as well as their prime contractors and subcontractors, must take all affirmative steps to assure that minority firms, women's business enterprises, and labor surplus area firms are used when possible make every effort to solicit bids from eligible DBEs. This information must be documented and reported.

"GOOD FAITH" EFFORT PROCESS

Any public or private entity receiving federal funds must demonstrate that efforts were made to attract MBE/WBEs. The process to attract MBE/WBEs is referred to as the "Good Faith" effort. This effort requires the recipient, prime contractor and any subcontractors to take the steps listed below to assure that MBE/WBEs are used whenever possible as sources of supplies, construction, equipment, or services. If a CONTRACTOR fails to take the steps outlined below shall cause the bid to be rejected as non-responsive and/or be deemed a material breach of the contract.

- A. Place qualified small and minority businesses and women's business enterprises on solicitation lists;
- B. Assure that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
- C. Divide total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority business, and women's business enterprises;
- D. Establish delivery schedules, where the requirement permits, which encourage participation by small and minority business, and women's business enterprises; and
- E. Use the services and assistance of the Small Business Administration, and the Minority Business Development Agency of the Department of Commerce.
- F. If subcontracts are to be let, Contractor shall take the affirmative steps listed in 2 CFR 200.321.

XXV. PROGRAM FRAUD AND FALSE OR FRAUDULENT STATEMENT AND RELATED ACTS.

The Contract acknowledges that 31 U.S.C Chapter 38 (Administrative Remedies for False Claims and Statements) applies to the Contractor's actions pertaining to this contract.

Attachment D1

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION – LOWER TIER COVERED TRANSACTIONS

(Lower Tier refers to the agency or contractor receiving Federal funds, as well as any subcontractors that the agency or contractor enters into contract with using those funds)

As required by Executive Order 12549 Debarment and Suspension (1986), and Executive Order 12689, Debarment and Suspension (1989), Debarment and Suspension, as defined at 2 CFR Part 180 and the Department of Homeland Security's regulations at 2 CFR Part 3000 (Non-Procurement Debarment and Suspension), MOA may not enter into contract with any entity that is debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by the Federal Government from participating in transactions involving Federal funds. Contractor is required to sign the certification below which specifies that neither Contractor nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by the Federal agency. It also certifies that Contractor will not use, directly or indirectly, any of these funds to employ, award contracts to, engage the services of, or fund any contractor that is debarred, suspended, or ineligible under 2 CFR Parts 180 and 3000.

Instruction for Certification

1. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
3. The prospective lower tier participant shall provide immediate written notice to the person to whom this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or had become erroneous by reason of changed circumstances.
4. The terms covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded, as used in this clause, have the meaning set out in the Definition and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.
5. The prospective lower tier participant agrees by submitting this agreement that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is proposed for debarment under 48 CFR Part 9, subpart 9.4, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

6. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not proposed for debarment under 48 CFR part 9, subpart 9.4, debarred, suspended, ineligible, or voluntarily excluded from covered transactions, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the List of Parties Excluded from Federal Procurement and Non-procurement Programs.
8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction originated may pursue available remedies, including suspension and/or debarment.

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Covered Transactions

1. The prospective lower tier participant certifies, by submission of its proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Signature of Contractor's Authorized Official

Printed Name and Title of Contractor's Authorized Official

Date

Attachment D2

CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loan, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The Contractor, _____, certifies or affirms that truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees the provisions of 31 U.S.C Chapter 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

Signature of Contractor's Authorized Officer

Printed Name and Title of Contractor's Authorized Official

Date

DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE¹ subcontractors² and the estimated dollar amount of each subcontract.

Prime Contractor Name		Project Name
Bid/Proposal No.	Assistance Agreement ID No. (If known)	Point of Contact
Address		
Telephone No.	Email Address	
Issuing/Funding Entity:		

I have identified potential DBE certified subcontractors	<input type="radio"/> YES	<input type="radio"/> NO	
Subcontractor Name/ Company Name	Company Address/Phone/Email	Est. Dollar Amt	Currently DBE Certified?

¹ A DBE is a Disadvantaged, Minority, Small or Woman Business Enterprise that has been certified as described in 40 CFR 33.204-33.205.

² Subcontractor is defined as a company, firm, joint venture or individual who enters into an agreement with a contractor to provide services.

DBE Subcontractor Performance

I certify under penalty of perjury that the foregoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. In the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CRF Part 33 Section 33.302(c).

Prime Contractor Signature	Print Name
Title	Date

DBE Subcontractor Performance

This form is intended to capture the DBE³ subcontractors'⁴ description of work to be performed and the price of the work submitted to the prime contractor. Prime contractor is required to have its DBE subcontractors complete this form and include all completed forms in the prime contractors bid or proposal package unless subcontractors will not be used.

Subcontractor Name		Project Name
Bid/Proposal No.	Assistance Agreement ID No. (If known)	Point of Contact
Address		
Telephone No.		Email Address
Prime Contractor Name		Issuing/Funding Entity:

Contract Item Number	Description of Work Submitted to the Prime Contractor Involving construction, Services, Equipment or Supplies	Price of Work Submitted to the Prime Contractor
BDE Certified by <input type="radio"/> DOT <input type="radio"/> SBA		Meets/ exceeds the Federal Entity certification standards:
O Other: _____		<input type="checkbox"/> YES <input type="radio"/> NO <input type="radio"/> Unknown

³ A DBE is a Disadvantaged, Minority, Small or Woman Business Enterprise that has been certified as described in 40 CFR 33.204-33.205

⁴ Subcontractor is defined as a company, firm, joint venture or individual who enters into an agreement with a contractor to provide services pursuant to an EPA award of financial assistance.

DBE Subcontractor Performance

I certify under penalty of perjury that the foregoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware of that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CRF Part 33 Section 33.302(c).

Prime Contractor Signature	Print Name
Title	Date

Subcontractor Signature	Print Name
Title	Date

"General Decision Number: AK20230001 01/06/2023

Superseded General Decision Number: AK20220001

State: Alaska

Construction Types: Building and Heavy

Counties: Alaska Statewide.

BUILDING AND HEAVY CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

<p>If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
<p>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

ASBE0097-001 06/01/2021

	Rates	Fringes
Asbestos Workers/Insulator (includes application of all insulating materials protective coverings, coatings and finishings to all types of mechanical systems).....	\$ 38.68	21.57
HAZARDOUS MATERIAL HANDLER (includes preparation, wetting, stripping, removal scrapping, vacuming, bagging, and disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....	\$ 37.38	19.55

BOIL0502-002 01/01/2021

	Rates	Fringes
BOILERMAKER.....	\$ 47.03	30.59

BRAK0001-002 07/01/2020

	Rates	Fringes
Bricklayer, Blocklayer, Stonemason, Marble Mason, Tile Setter, Terrazzo Worker.....	\$ 42.16	19.67
Tile & Terrazzo Finisher.....	\$ 35.99	19.67

CARP1281-001 09/01/2022

	Rates	Fringes
CARPENTER Including Lather and Drywall Hanging.....	\$ 43.34	28.86

CARP1501-001 09/01/2019

	Rates	Fringes
MILLWRIGHT.....	\$ 37.64	23.46

CARP2520-003 09/01/2022

	Rates	Fringes
Diver		
Stand-by.....	\$ 47.65	28.32
Tender.....	\$ 46.65	28.32
Working.....	\$ 87.45	28.32
Piledriver		
Piledriver; Skiff Operator and Rigger.....	\$ 38.34	26.51
Sheet Stabber.....	\$ 38.34	26.51
Welder.....	\$ 43.90	26.51

DEPTH PAY PREMIUM FOR DIVERS BELOW WATER SURFACE:

50-100 feet \$1.00 per foot
 101 feet and deeper \$2.00 per foot

ENCLOSURE PAY PREMIUM WITH NO VERTICAL ASCENT:

5-50 FEET \$1.00 PER FOOT/DAY
 51-100 FEET \$2.00 PER FOOT/DAY
 101 FEET AND ABOVE \$3.00 PER FOOT/DAY

SATURATION DIVING:

The standby rate applies until saturation starts. The saturation diving rate applies when divers are under pressure continuously until work task and decompression are complete. the diver rate shall be paid for all saturation hours.

WORK IN COMBINATION OF CLASSIFICATIONS:

Employees working in any combination of classifications within the diving crew (except dive supervisor) in a shift are paid in the classification with the highest rate for that shift.

 ELEC1547-004 04/01/2022

	Rates	Fringes
CABLE SPLICER.....	\$ 42.77	3% + 27.97
ELECTRICIAN.....	\$ 42.44	3% + 28.22

 ELEC1547-005 04/01/2022

Line Construction

	Rates	Fringes
CABLE SPLICER.....	\$ 62.29	3%+32.37
Linemen (Including Equipment Operators, Technician).....	\$ 61.29	3%+30.98
Powderman.....	\$ 59.29	3%+32.37
TREE TRIMMER.....	\$ 38.05	3%+27.01

 ELEV0019-002 01/01/2022

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 63.16	36.885+a+b

FOOTNOTE: a. Employer contributes 8% of the basic hourly rate for over 5 year's service and 6% of the basic hourly rate for 6 months to 5 years' of service as vacation paid credit. b. Eight paid holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Veteran's Day; Thanksgiving Day; Friday after Thanksgiving, and Christmas Day

 ENGI0302-002 01/01/2022

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	\$ 43.53	25.95
GROUP 1A.....	\$ 45.29	25.95
GROUP 2.....	\$ 42.76	25.95
GROUP 3.....	\$ 42.76	25.95

GROUP 4.....	\$ 35.83	25.95
TUNNEL WORK		
GROUP 1.....	\$ 47.88	25.95
GROUP 1A.....	\$ 49.82	25.95
GROUP 2.....	\$ 47.04	25.95
GROUP 3.....	\$ 46.24	25.95
GROUP 4.....	\$ 39.41	25.95

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Asphalt Roller: Breakdown, Intermediate, and Finish; Back Filler; Barrier Machine (Zipper); Beltcrete with power pack and similar conveyors; Bending Machine; Boat Coxwains; Bulldozers; Cableways, Highlines and Cablecars; Cleaning Machine; Coating Machine; Concrete Hydro Blaster; Cranes-45 tons and under or 150 foot boom and under (including jib and attachments): (a) Hydralifts or Transporters, all track or truck type,(b) Derricks; Crushers; Deck Winches-Double Drum; Ditching or Trenching Machine (16 inch or over); Drilling Machines, core, cable, rotary and exploration; Finishing Machine Operator, Concrete Paving, Laser Screed, Sidewalk, Curb and Gutter Machine; Helicopters; Hover Craft, Flex Craft, Loadmaster, Air Cushion, All Terrain Vehicle, Rollagon, Bargecable, Nodwell, and Snow Cat; Hydro Ax: Feller Buncher and similar; Loaders (2 1/2 yards through 5 yards, including all attachments): Forklifts with telescopic boom and swing attachment, Overhead and front end, 2 1/2 yards through 5 yards, Loaders with forks or pipe clamps; Loaders, elevating belt type, Euclid and similar types; Mechanics, Bodyman; Micro Tunneling Machine; Mixers: Mobile type w/hoist combination; Motor Patrol Grader; Mucking Machines: Mole, Tunnel Drill, Horizontal/Directional Drill Operator, and/or Shield; Operator on Dredges; Piledriver Engineers, L. B. Foster, Puller or similar Paving Breaker; Power Plant, Turbine Operator, 200 k.w. and over (power plants or combination of power units over 300 k.w.); Scrapers-through 40 yards; Service Oiler/Service Engineer; Sidebooms-under 45 tons; Shot Blast Machine; Shovels, Backhoes, Excavators with all attachments, and Gradealls (3 yards and under), Spreaders, Blaw Knox, Cedarapids, Barber Greene, Slurry Machine; Sub-grader (Gurries, Reclaimer, and similar types); Tack tractor; Truck mounted Concrete Pumps, Conveyor, Creter; Water Kote Machine; Unlicensed off road hauler

GROUP 1A: Camera/Tool/Video Operator (Slipline), Cranes-over 45 tons or 150 foot (including jib and attachments): (a) Clamshells and Draglines (over 3 yards), (b) Tower cranes; Licensed Water/Waste Water Treatment Operator; Loaders over 5 yds.; Certified Welder, Electrical Mechanic, Camp Maintenance Engineer, Mechanic (over 10,000 hours); Motor Patrol Grader, Dozer, Grade Tractor, Roto-mill/Profiler (finish: when finishing to final grade and/or to hubs, or for asphalt); Power Plants: 1000 k.w. and over; Quad; Screed; Shovels, Backhoes, Excavators with all attachments (over 3 yards), Sidebooms over 45 tons; Slip Form Paver, C.M.I. and similar types; Scrapers over 40 yards;

GROUP 2: Boiler-fireman; Cement Hog and Concrete Pump Operator; Conveyors (except as listed in group 1); Hoist on steel erection; Towermobiles and Air Tuggers; Horizontal/Directional Drill Locator; Licensed Grade Technician; Loaders, (i.e., Elevating Grader and Material

Transfer Vehicle); Locomotives: rod and geared engines; Mixers; Screening, Washing Plant; Sideboom (cradling rock drill regardless of size); Skidder; Trenching Machine under 16 inches; Waste/ Waste Water Treatment Operator.

GROUP 3: "A" Frame Trucks, Deck Winches: single power drum; Bombardier (tack or tow rig); Boring Machine; Brooms-power; Bump Cutter; Compressor; Farm tractor; Forklift, industrial type; Gin Truck or Winch Truck with poles when used for hoisting; Grade Checker and Stake Hopper; Hoist, Air Tuggers, Elevators; Loaders: (a) Elevating-Athey, Barber Green and similar types (b) Forklifts or Lumber Carrier (on construction job site) (c) Forklifts with Tower (d) Overhead and Front-end, under 2 1/2 yds. Locomotives: Dinkey (air, steam, gas and electric) Speeders; Mechanics (light duty); Oil, Blower Distribution; Post Hole Diggers, mechanical; Pot Fireman (power agitated); Power Plant, Turbine Operator, under 200 k.w.; Pumps-water; Roller-other than Plantmix; Saws, concrete; Skid Steer with all attachments; Straightening Machine; Tow Tractor

GROUP 4: Rig Oiler/Crane Assistant Engineer; Parts and Equipment Coordinator; Swamper (on trenching machines or shovel type equipment); Spotter; Steam Cleaner; Drill Helper.

FOOTNOTE: Groups 1-4 receive 10% premium while performing tunnel or underground work. Rig Oiler/Crane Assistant Engineer shall be required on cranes over 85 tons or over 100 feet of boom.

IRON0751-003 07/01/2022

	Rates	Fringes
IRONWORKER		
BENDER OPERATOR.....	\$ 41.49	34.86
BRIDGE, STRUCTURAL, ORNAMENTAL, REINFORCING MACHINERY MOVER, RIGGER, SHEETER, STAGE RIGGER,		
BENDER OPERATOR.....	\$ 41.49	34.86
BRIDGE, STRUCTURAL, ORNAMENTAL, REINFORCING MACHINERY MOVER, RIGGER, SHEETER, STAGE RIGGER,		
BENDER OPERATOR.....	\$ 38.75	32.63
FENCE, BARRIER INSTALLER....	\$ 37.99	34.86
GUARDRAIL INSTALLERS.....	\$ 38.99	34.86
GUARDRAIL LAYOUT MAN.....	\$ 38.72	34.86
HELICOPTER, TOWER.....	\$ 42.49	34.86

LAB00341-001 04/01/2021

	Rates	Fringes
LABORER (South of the 63rd		

Parallel & West of Longitude
138 Degrees)

GROUP 1.....	\$ 32.00	31.11
GROUP 2.....	\$ 33.00	31.11
GROUP 3.....	\$ 33.90	31.11
GROUP 3A.....	\$ 37.18	31.11
GROUP 3B.....	\$ 40.97	28.40
GROUP 4.....	\$ 21.57	31.11
TUNNELS, SHAFTS, AND RAISES		
GROUP 1.....	\$ 35.20	31.11
GROUP 2.....	\$ 36.30	31.11
GROUP 3.....	\$ 37.29	31.11
GROUP 3A.....	\$ 40.90	31.11
GROUP 3B.....	\$ 45.07	28.40

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Workers (shovelman, plant crew); Brush Cutters; Camp Maintenance Laborer; Carpenter Tenders; Choke Setters, Hook Tender, Rigger, Signalman; Concrete Laborer (curb and gutter, chute handler, grouting, curing, screeding); Crusher Plant Laborer; Demolition Laborer; Ditch Diggers; Dump Man; Environmental Laborer (asbestos (limited to nonmechanical systems), hazardous and toxic waste, oil spill); Fence Installer; Fire Watch Laborer; Flagman; Form Strippers; General Laborer; Guardrail Laborer, Bridge Rail Installers; Hydro-Seeder Nozzleman; Laborers (building); Landscape or Planter; Laying of Decorative Block (retaining walls, flowered decorative block 4 feet and below); Material Handlers; Pneumatic or Power Tools; Portable or Chemical Toilet Serviceman; Pump Man or Mixer Man; Railroad Track Laborer; Sandblast, Pot Tender; Saw Tenders; Scaffold Building and Erecting; Slurry Work; Stake Hopper; Steam Point or Water Jet Operator; Steam Cleaner Operator; Tank Cleaning; Utiliwalk, Utilidor Laborer and Conduit Installer; Watchman (construction projects); Window Cleaner

GROUP 2: Burning and Cutting Torch; Cement or Lime Dumper or Handler (sack or bulk); Choker Splicer; Chucktender (wagon, airtrack and hydraulic drills); Concrete Laborers (power buggy, concrete saws, pumpcrete nozzleman, vibratorman); Culvert Pipe Laborer; Cured in place Pipelayer; Environmental Laborer (marine work, oil spill skimmer operator, small boat operator); Foam Gun or Foam Machine Operator; Green Cutter (dam work); Gunnite Operator; Hod Carriers; Jackhammer or Pavement Breakers (more than 45 pounds); Laying of Decorative Block (retaining walls, flowered decorative block above 4 feet); Mason Tender and Mud Mixer (sewer work); Pilot Car; Plasterer, Bricklayer and Cement Finisher Tenders; Power Saw Operator; Railroad Switch Layout Laborer; Sandblaster; Sewer Caulkers; Sewer Plant Maintenance Man; Thermal Plastic Applicator; Timber Faller, chain saw operator, filer; Timberman

GROUP 3: Alarm Installer; Bit Grinder; Guardrail Machine Operator; High Rigger and tree topper; High Scaler; Multiplate; Slurry Seal Squeegee Man

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers

GROUP 3B: Grade checker (setting or transferring of grade marks, line and grade)

GROUP 4: Final Building Cleanup

TUNNELS, SHAFTS, AND RAISES CLASSIFICATIONS

GROUP 1: Brakeman; Muckers; Nippers; Topman and Bull Gang; Tunnel Track Laborer

GROUP 2: Burning and Cutting Torch; Concrete Laborers; Jackhammers; Nozzleman, Pumpcrete or Shotcrete.

GROUP 3: Miner; Retimberman

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers.

GROUP 3B: Grade checker (setting or transferring of grade marks, line and grade)

Tunnel shaft and raise rates only apply to workers regularly employed inside a tunnel portal or shaft collar.

LAB00942-001 04/01/2022

	Rates	Fringes
Laborers: North of the 63rd Parallel & East of Longitude 138 Degrees		
GROUP 1.....	\$ 33.00	31.37
GROUP 2.....	\$ 34.00	31.37
GROUP 3.....	\$ 34.90	31.37
GROUP 3A.....	\$ 38.18	31.37
GROUP 3B.....	\$ 41.97	29.00
GROUP 4.....	\$ 22.57	31.37
TUNNELS, SHAFTS, AND RAISES		
GROUP 1.....	\$ 36.20	31.37
GROUP 2.....	\$ 37.40	31.37
GROUP 3.....	\$ 38.39	31.37
GROUP 3A.....	\$ 42.00	31.37
GROUP 3B.....	\$ 46.17	29.00

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Workers (shovelman, plant crew); Brush Cutters; Camp Maintenance Laborer; Carpenter Tenders; Choke Setters, Hook Tender, Rigger, Signalman; Concrete Laborer (curb and gutter, chute handler, grouting, curing, screeding); Crusher Plant Laborer; Demolition Laborer; Ditch Diggers; Dump Man; Environmental Laborer (asbestos (limited to nonmechanical systems), hazardous and toxic waste, oil spill); Fence Installer; Fire Watch Laborer; Flagman; Form Strippers; General Laborer; Guardrail Laborer, Bridge Rail Installers; Hydro-Seeder Nozzleman; Laborers (building); Landscape or Planter; Laying of Decorative Block (retaining walls, flowered decorative block 4 feet and below); Material Handlers; Pneumatic or Power Tools; Portable or Chemical Toilet Serviceman; Pump Man or Mixer Man; Railroad Track Laborer; Sandblast, Pot

Tender; Saw Tenders; Scaffold Building and Erecting; Slurry Work; Stake Hopper; Steam Point or Water Jet Operator; Steam Cleaner Operator; Tank Cleaning; Utiliwalk, Utilidor Laborer and Conduit Installer; Watchman (construction projects); Window Cleaner

GROUP 2: Burning and Cutting Torch; Cement or Lime Dumper or Handler (sack or bulk); Choker Splicer; Chucktender (wagon, airtrack and hydraulic drills); Concrete Laborers (power buggy, concrete saws, pumpcrete nozzleman, vibratorman); Culvert Pipe Laborer; Cured in place Pipelayer; Environmental Laborer (marine work, oil spill skimmer operator, small boat operator); Foam Gun or Foam Machine Operator; Green Cutter (dam work); Gunnite Operator; Hod Carriers; Jackhammer or Pavement Breakers (more than 45 pounds); Laying of Decorative Block (retaining walls, flowered decorative block above 4 feet); Mason Tender and Mud Mixer (sewer work); Pilot Car; Plasterer, Bricklayer and Cement Finisher Tenders; Power Saw Operator; Railroad Switch Layout Laborer; Sandblaster; Sewer Caulkers; Sewer Plant Maintenance Man; Thermal Plastic Applicator; Timber Faller, chain saw operator, filer; Timberman

GROUP 3: Alarm Installer; Bit Grinder; Guardrail Machine Operator; High Rigger and tree topper; High Scaler; Multiplate; Slurry Seal Squeegee Man

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers

GROUP 3B: Grade checker (setting or transferring of grade marks, line and grade)

GROUP 4: Final Building Cleanup

TUNNELS, SHAFTS, AND RAISES CLASSIFICATIONS

GROUP 1: Brakeman; Muckers; Nippers; Topman and Bull Gang; Tunnel Track Laborer

GROUP 2: Burning and Cutting Torch; Concrete Laborers; Jackhammers; Nozzleman, Pumpcrete or Shotcrete.

GROUP 3: Miner; Retimberman

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers.

GROUP 3B: Grade checker (setting or transferring of grade marks, line and grade)

Tunnel shaft and raise rates only apply to workers regularly employed inside a tunnel portal or shaft collar.

PAIN1959-001 07/01/2022

NORTH OF THE 63RD PARALLEL

	Rates	Fringes
PAINTER		
BRUSH/ROLLER PAINT OR WALL COVERER.....	\$ 36.08	25.45
TAPING, TEXTURING, STRUCTURAL PAINTING, SANDBLASTING, POT TENDER, FINISH METAL, SPRAY, BUFFER OPERATOR, RADON MITIGATION, LEAD BASED PAINT ABATEMENT, HAZARDOUS MATERIAL HANDLER.....	\$ 36.60	25.45

PAIN1959-002 12/01/2021

SOUTH OF THE 63RD PARALLEL

	Rates	Fringes
PAINTER		
General Painter.....	\$ 32.64	25.95
Industrial Painter.....	\$ 32.74	25.95
Taper / Paper & Vinyl Hanger.....	\$ 32.64	25.95

PAIN1959-003 12/01/2021

NORTH OF THE 63RD PARALLEL

	Rates	Fringes
GLAZIER.....	\$ 41.16	28.16

PAIN1959-004 07/01/2019

	Rates	Fringes
FLOOR LAYER: Carpet.....	\$ 28.75	14.44

PAIN1959-006 12/01/2021

SOUTH OF THE 63RD PARALLEL

	Rates	Fringes
GLAZIER.....	\$ 41.37	27.25

PLUM0262-002 07/01/2022

East of the 141st Meridian

	Rates	Fringes
Plumber; Steamfitter.....	\$ 41.32	27.62

PLUM0367-002 07/01/2021

South of the 63rd Parallel

	Rates	Fringes
Plumber; Steamfitter.....	\$ 41.00	27.95

PLUM0375-002 07/01/2021

North of the 63rd Parallel

	Rates	Fringes
Plumber; Steamfitter.....	\$ 42.91	31.25

PLUM0669-002 04/01/2019		

	Rates	Fringes
SPRINKLER FITTER.....	\$ 47.25	26.49

ROOF0189-006 04/01/2021		

	Rates	Fringes
ROOFER.....	\$ 44.62	17.63

SHEE0023-003 08/01/2022		

South of the 63rd Parallel

	Rates	Fringes
SHEET METAL WORKER.....	\$ 45.35	29.19

SHEE0023-004 07/01/2022		

North of the 63rd Parallel

	Rates	Fringes
SHEET METAL WORKER.....	\$ 50.83	29.03

TEAM0959-003 04/01/2021		

	Rates	Fringes
TRUCK DRIVER		
GROUP 1.....	\$ 41.94	26.12
GROUP 1A.....	\$ 43.21	26.12
GROUP 2.....	\$ 40.68	26.12
GROUP 3.....	\$ 39.86	26.12
GROUP 4.....	\$ 39.28	26.12
GROUP 5.....	\$ 38.52	26.12

GROUP 1: Semi with Double Box Mixer; Dump Trucks (including rockbuggy and trucks with pups) over 40 yards up to and including 60 yards; Deltas, Commanders, Rollogans and similar equipment when pulling sleds, trailers or similar equipment; Boat Coxswain; Lowboys including attached trailers and jeeps, up to and including 12 axles; Ready-mix over 12 yards up to and including 15 yards); Water Wagon (250 Bbls and above); Tireman, Heavy Duty/Fueler

GROUP 1A: Dump Trucks (including Rockbuggy and Trucks with pups) over 60 yards up to and including 100 yards; Jeeps (driver under load)

GROUP 2: Turn-O-Wagon or DW-10 not self-loading; All Deltas, Commanders, Rollogans, and similar equipment; Mechanics; Dump Trucks (including Rockbuggy and Trucks with pups) over 20 yards up to and including 40 yards; Lowboys including attached trailers and jeeps up to and including 8 axles;

Super vac truck/cacasco truck/heat stress truck; Ready-mix over 7 yards up to and including 12 yards; Partsman; Stringing Truck

GROUP 3: Dump Trucks (including Rockbuggy and Trucks with pups) over 10 yards up to and including 20 yards; batch trucks 8 yards and up; Oil distributor drivers; Oil Distributor Drivers; Trucks/Jeeps (push or pull); Traffic Control Technician

GROUP 4: Buggymobile; Semi or Truck and trailer; Dumpster; Tireman (light duty); Dump Trucks (including Rockbuggy and Truck with pups) up to and including 10 yards; Track Truck Equipment; Grease Truck; Flat Beds, dual rear axle; Hyster Operators (handling bulk aggregate); Lumber Carrier; Water Wagon, semi; Water Truck, dual axle; Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted "A" Frame manufactured rating over 5 tons; Bull Lifts and Fork Lifts with Power Boom and Swing attachments, over 5 tons; Front End Loader with Forks; Bus Operator over 30 passengers; All Terrain Vehicles; Boom Truck/Knuckle Truck over 5 tons; Foam Distributor Truck/dual axle; Hydro-seeders, dual axle; Vacuum Trucks, Truck Vacuum Sweepers; Loadmaster (air and water); Air Cushion or similar type vehicle; Fire Truck/Ambulance Driver; Combination Truck-fuel and grease; Compactor (when pulled by rubber tired equipment); Rigger (air/water/oilfield); Ready Mix, up to and including 7 yards;

GROUP 5: Gravel Spreader Box Operator on Truck; Flat Beds, single rear axle; Boom Truck/Knuckle Truck up to and including 5 tons; Pickups (Pilot Cars and all light duty vehicles); Water Wagon (Below 250 Bbls); Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted "A" Frame, manufactured rating 5 tons and under; Bull Lifts and Fork Lifts (fork lifts with power broom and swing attachments up to and including 5 tons); Buffer Truck; Tack Truck; Farm type Rubber Tired Tractor (when material handling or pulling wagons on a construction project); Foam Distributor, single axle; Hydro-Seeders, single axle; Team Drivers (horses, mules and similar equipment); Fuel Handler (station/bulk attendant); Batch Truck, up to and including 7 yards; Gear/Supply Truck; Bus Operator, Up to 30 Passengers; Rigger/Swamper

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is

like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative

Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

SECTION 01 10 00 – SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications – Buildings (MASSB), apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Access to site.
 - 4. Coordination with occupants.
 - 5. Work restrictions.
 - 6. Specification and drawing conventions.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. Divisions 02 through 31 Sections for specific requirements and scheduling of installation.

1.4 DEFINITIONS

- A. Contractor: The individual, firm, corporation, partnership, or joint venture executing the Contract and performing the Work under the terms of the Contract Documents.

1.5 PROJECT INFORMATION

- A. Project Identification: **MOA – FIRE STATION 11 STORAGE BUILDING**
 - 1. Project Location: Eagle River, Alaska
- B. Owner: Municipality of Anchorage.
 - 1. Owner's Representative: Stanford Longan – MOA Project Manager for Capital Projects

-
- C. Architect: Burkhart Croft Architects, LLC.

1.6 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work of this project includes demolition of the Old Fire Station 11 Building damaged during the 2018 earthquake and construction of a new PEMB in Eagle River for the Municipality of Anchorage – Anchorage Fire Department.
- B. Preservation of the existing on-site potable water source for the community during construction.
- C. Before commencing Work, submit Contractor's overall construction schedule showing the sequence, commencement and completion dates, and move-out and move-in dates of Owner's personnel for all aspects of the Work.

1.7 WORK UNDER SEPARATE CONTRACTS

- A. The Owner reserves the right to issue additional separate contracts for work in the project area. If separate contracts are executed, Contractor shall cooperate fully with separate contractors so work of those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Contractor shall coordinate the work of this Contract with work performed under separate contracts.

1.8 ACCESS TO SITE

- A. General: Contractor shall have unlimited use of Project site for construction operations throughout the course of this contract.
- B. Contract Limits: Contractor shall work only in areas designated in Drawings.
- C. Use of Site: Limit use of Project site to areas indicated in Drawings. Do not disturb portions of Project site beyond areas shown, or where actual Work is to be performed.
1. Driveways, Walkways and Entrances: Keep driveways and loading areas clear and available to Owner, station personnel, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

1.9 COORDINATION WITH OCCUPANTS

- A. Owner Occupancy: Personnel will need access to the uncovered storage during the entire contract period. Cooperate with Owner and personnel during construction operations to minimize conflicts and facilitate use. Perform the Work so as not to interfere with day-to-day operations.

1.10 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
- B. Controlled Substances: Use controlled substances on the Project site is not permitted.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI "MasterFormat 2010" numbering system.
 - 1. Section Identification: The specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are directed to the Contractor unless specifically stated otherwise. Contractor is responsible to coordinate with sub-contractors to ensure requirements are met.
 - 3. The following definitions apply to all specification sections:
 - a. Furnish: Supply and deliver to the project, including the cost to supply and deliver.
 - b. Install: Build into the work, ready to use in complete, finished and operable system, including the cost to install.
 - c. Provide: Furnish and Install for a complete, finished and operable system.
- C. Contract Documents: Drawings and specifications are complementary and inter-dependent. What is required by one shall be as required by all. Work identified in Drawings and specifications is not separated by trade, material group or sub-contractor scope, or directed to any party other than the Contractor. Contractor, Sub-Contractors, and Sub-sub-contractors shall familiarize themselves with all Drawings, Specifications and other Contract Documents to identify all Work requirements.
- D. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

MUNICIPALITY OF ANCHORAGE
FIRE STATION 11 STORAGE BUILDING

DIVISION 01
GENERAL REQUIREMENTS

Section 01 10 00 - Page 4
SUMMARY

- E. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PRODUCTS (Not Used)

EXECUTION (Not Used)

END OF SECTION 01 00 00

SECTION 02 41 16 – STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Removal of existing paving and other site improvements.
 - 2. Demolition and removal of existing building.
 - 3. Demolition and removal of in-place foundations and other below-grade construction.
 - 4. Disconnecting, capping or sealing, and abandoning in-place site utilities.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 01 10 00 – SUMMARY, for summary of work and work restrictions.

1.4 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

1.5 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.6 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
1. Inspect and discuss condition of construction to be demolished.
 2. Review structural load limitations of existing structures.
 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review and finalize protection requirements.
 5. Review procedures for noise control and dust control.
 6. Review procedures for protection of adjacent buildings.
 7. Review items to be salvaged and returned to Owner.

1.7 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit informational report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.
1. Adjacent building and landscaping: Detail special measures proposed to ensure no accidental damage to adjacent building and landscaping.
 2. Existing utility service connections: Detail special measures proposed to ensure no accidental damage to adjacent utility connections or meters.
- B. Schedule of Building Demolition Activities: Indicate the following:
1. Detailed sequence of demolition work, with starting and ending dates for each activity.
 2. Temporary interruption of utility services.
 3. Shutoff and capping or re-routing of utility services.
- C. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations.
1. Before commencement of excavation or demolition, or starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Owner's Representative.
 2. Flag construction limits before taking construction photographs.
 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
 4. Submit image files, in format indicated below, within three days of taking photographs.
 - a. Digital Camera: Minimum sensor resolution of 8 megapixels.

- b. Format: Unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file where necessary.
 - c. Provide color images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.
- D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings and structures immediately adjacent to demolition area will remain in use. Conduct building demolition so operations of adjacent facilities will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for buildings and structures to be demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. On-site storage or sale of removed items or materials is not permitted.

1.9 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

- A. Pre-demolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review and finalize building abatement and demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review and finalize protection requirements.
 - 4. Review procedures for noise control and dust control.
 - 5. Review procedures for protection of adjacent buildings.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 - 1. Arrange to shut off utilities with utility companies.

2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

3.4 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, utility boxes, signage, landscaping, fences, and adjacent building facilities during demolition operations.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 1. Strengthen or add new supports when required during progress of demolition.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

- A. General: Demolish indicated building and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 2. Maintain adequate ventilation when using cutting torches.
 3. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

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- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- C. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Below-Grade Construction: Demolish foundation walls and other below-grade construction according to the following.
1. Remove below-grade construction, including concrete slabs, basements, foundation walls, and footings, complete.
- C. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.
1. Fill abandoned utility structures with satisfactory soil materials according to MASS backfill requirements.
 2. Piping: Disconnect piping at unions, flanges, valves, or fittings.
 3. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.7 SITE RESTORATION

- A. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades. Provide additional classified fill as necessary to complete uniform rough grading.

3.8 REPAIRS

- A. Promptly repair damage to adjacent buildings and site improvements caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.10 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - 1. Clean roadways of debris caused by debris transport.

END OF SECTION 02 41 16

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Cook Inlet Native Head Start 6901 East Tudor Road, Anchorage, AK 99507.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, curing procedures, construction contraction and isolation joints, and joint-filler strips, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Engineer.
- E. Samples: For slab finish.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Waterstops.
 - 5. Curing compounds.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Adhesives.
 - 9. Vapor retarders.
 - 10. Joint-filler strips.
 - 11. Repair materials.
 - 12. Joint sealants.
- C. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates.
 - 2. Concrete mix design.
 - 3. Compressive strength test.
 - 4. Air content.

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5. Slump test.
 6. Water.
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
 - E. Field quality-control reports.
 - F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS**2.1 CONCRETE, GENERAL**

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301.
 2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

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- c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
- 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
- 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, Grade 60, deformed.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
1. Portland Cement: ASTM C 150/C 150M, Type IA, Type IIA or Type IIIA.
 2. Fly Ash: ASTM C 618, Class F.
 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
 4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag or Type IP, portland-pozzolan cement.
 5. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
- G. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
- H. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

- A. Flexible Bentonite Waterstops: with factory-installed adhesive strip, for embedding in concrete to prevent passage of fluids through joints.
 - 1. Profile: Rectangular.
 - 2. Dimensions: 1 inch by 3/4 inch thick.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, 15 mil thickness, except with maximum water-vapor permeance of 0.04 perms per ASTM E96. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork. Type I or Type II. Material must be ½ inch thick unless otherwise indicated.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.022-inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4500 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Foundations: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4500 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
- B. Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4500 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Minimum Cementitious Materials Content: 520 lb/cu. yd..
 - 4. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding water-reducing admixture, plus or minus 1 inch.
 - 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
 - 6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION**3.1 FORMWORK INSTALLATION**

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.

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- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
 - F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
 - G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
 - H. Chamfer exterior corners and edges of permanently exposed concrete.
 - I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
 - J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
 - K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
 - L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50

deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOP INSTALLATION

- A. Bentonite Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces to receive concrete floor toppings.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

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2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish. While concrete is still plastic, slightly scarify surface with a fine broom. Apply to interior exposed concrete surfaces (i.e. utility spaces and restrooms serving exterior), and to surfaces where ceramic or quarry tile is to be installed by either thinset or thickset method.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 3. Minimum Compressive Strength: 4500 psi at 28 days.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch max centers around the full perimeter of concrete base.
 5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

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6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

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3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENT APPLICATION

- A. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions, where indicated.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

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- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and

loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Headed bolts and studs.
 - 3. Verification of use of required design mixture.
 - 4. Concrete placement, including conveying and depositing.
 - 5. Curing procedures and maintenance of curing temperature.
 - 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

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5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

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CAST-IN-PLACE CONCRETE

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 30 00

SECTION 05 50 00 - METAL FABRICATIONS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 13 34 19 METAL BUILDING SYSTEMS.

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel shear lug plates.
 - 2. Metal building anchor bolts.
 - 3. Catch basin grating and frames.
 - 4. Slotted channel framing system.
 - 5. Steel framing and supports for mechanical and electrical equipment.
 - 6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 7. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements:
 - 1. Section 13 34 19 "Metal Building Systems" for installing loose angles, anchor bolts, and structural building framing.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

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- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Fasteners.
 2. Shop primers.
 3. Shrinkage-resisting grout.
 4. Prefabricated building columns.
 5. Slotted channel framing.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for overhead door track and operators.
 2. Steel framing and supports for mechanical and electrical equipment.
 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 4. Steel frames and grating for interior catch basins.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS**2.1 METALS**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Zinc-Coated Steel Wire Rope: ASTM A741.
 - 1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- H. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
 - 1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- I. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches or as indicated.
 - 2. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.
- J. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- K. Steel Grating: Welded bar grating per ANSI/NAAMM MBG 53, with serrated top edges, banded, and hot-dip galvanized after fabrication. Heavy traffic rated.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- F. Post-Installed Anchors: Torque-controlled expansion anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- G. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.3 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

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- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
 - E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
 - F. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 - G. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 4500 psi.

2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

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- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
 - I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - J. Where units are indicated to be cast into concrete, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.6 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime.

2.7 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe 1/4-inch wall-thickness.
 - 1. Cap bollards with 1/4-inch-thick, steel plate with domed top.
 - 2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
- B. Prime steel bollards with zinc-rich primer.

2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.
- C. Prime plates with zinc-rich primer.

2.9 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

PART 3 - EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete inserts, toggle bolts, through bolts, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLATION OF ANCHOR BOLTS AND SHEAR LUG PLATES FOR PREFABRICATED BUILDING COLUMNS

- A. Install anchor bolts and shear lug plates for prefabricated building columns as shown in the structural drawings.

3.4 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

3.5 INSTALLATION OF BEARING AND LEVELING PLATES

- A. Clean concrete bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.6 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications – Buildings (MASSB), apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Wood blocking, cants, and nailers.
 - 2. Preservative-treated wood.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NHLA: National Hardwood Lumber Association.
 - 3. NLGA: National Lumber Grades Authority.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WRCLA: Western Red Cedar Lumber Association.
 - 7. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

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3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 1. Preservative-treated wood.
 2. Fire-retardant-treated wood.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - a. Do not use preservative-treated materials in roof assemblies.
 - b. User only stainless steel fasteners for attachment of preservative-treated materials.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Cants.
 - 4. Furring.
 - 5. Grounds.
- B. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
 - 1. Hem-Fir, Construction or No. 2 Common grade; NLGA, WCLIB, or WWP A.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

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1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
 - D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
 - E. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. NES NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - G. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

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MISCELLANEOUS ROUGH CARPENTRY

END OF SECTION 06 10 53

SECTION 06 64 00 - PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Prefinished polyester glass reinforced plastic sheets and adhered trim.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 07 92 00 – JOINT SEALANTS, for sealant joints applied at plastic panel perimeter and where terminating at different materials.
 - 2. SECTION 09 29 00 – GYPSUM BOARD, for gypsum board substrates to receive plastic panel finishes.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For FRP paneling and trim accessories.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS**2.1 PLASTIC SHEET PANELING (DRAWING DESIGNATION FRP-1)**

- A. General: Prefinished, glass-fiber reinforced plastic panels.
1. Basis-of-Design Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:
 - a. "Sequentia" FRP wall panels, by Crane Composites
- B. Materials: Provide products complying with the following:
1. Nominal Thickness: 0.09-inch.
 2. Panel Size: 4-feet x 8-feet.
 3. Surface Finish: Embossed.
 4. Color: Pearl Gray.
 5. Fire Rating: Class C.
- C. Trim Accessories: Manufacturer's standard one-piece PVC extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
1. Color: Match FRP panel.
- D. Adhesive: As recommended by plastic paneling manufacturer.
- E. Sealant: Sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels so that trimmed panels at corners are not less than 12 inches wide.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive.
- D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.4 CLEANING

- A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

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- B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION 06 64 00

SECTION 071113 - BITUMINOUS DAMPPROOFING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Cold-applied, cut-back-asphalt dampproofing.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 033000 - CAST-IN-PLACE CONCRETE, for concrete footings and foundations to receive dampproofing specified in this Section.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Product Data for Credit IEQ 4.2: For dampproofing, documentation including printed statement of VOC content.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

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- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course and auxiliary materials recommended in writing by manufacturer of primary materials.
- B. VOC Content: Products shall comply with VOC content limits of this Section, and of authorities having jurisdiction unless otherwise required.

2.2 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. 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:
1. Henry Company.
- B. Trowel Coats: ASTM D 4586, Type I, Class 1, fibered.
- C. Brush and Spray Coats: ASTM D 4479, Type I, fibered or nonfibered.
- D. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D 41.
- C. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- D. Patching Compound: Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.
- E. Protection Course: Smooth-surfaced roll roofing complying with ASTM D 6380, Class S, Type III.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
 - 1. Test for surface moisture according to ASTM D 4263.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
 - 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an

8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

3.4 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Concrete Foundations: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat.

3.5 INSTALLATION OF PROTECTION COURSE

- A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
 - 2. Install protection course on same day of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.6 CLEANING

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071113

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber blanket insulation.
 - 2. Spray polyurethane foam insulation.

1.3 RELATED SECTIONS

- 1. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES, for door frames to receive spray foam insulation as part of installation.
- 2. Section 09 29 16-GYPSUM BOARD, for gypsum board sheathing as part of assemblies incorporating products of this Section.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- C. Research/Evaluation Reports: For foam-plastic insulation.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS**2.1 GLASS-FIBER BLANKET INSULATION**

- A. 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:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville.
 - 3. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
 - 1. 5-1/2 inches thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Acoustical Sealant: As specified in Section 07 92 00 – Joint Sealants.

2.2 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
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. Dow Chemical Company (The).
 - b. Gaco Western Inc.
 - c. Henry Company.
 2. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
 3. Provide in pre-mixed cans for simplified application at window and door frame rough openings.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions.
- B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of doors and windows, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 INSTALLATION OF INSULATION FOR SOUND ATTENUATION

- A. Provide glass-fiber blankets at walls as indicated on the Drawings and above gypsum wallboard ceilings for all toilet rooms.
- B. Thickness: 3-1/2-inches.

3.5 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 07 26 00 – VAPOR RETARDERS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SECTION INCLUDES

- A. Section includes:
 - 1. Polyethylene sheet vapor retarder and related accessories.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 06 10 00 – ROUGH CARPENTRY, for wood framing requiring vapor retarder tabs specified in this Section as part of the framing sequence.
 - 2. SECTION 07 21 00 – THERMAL INSULATION, for building insulation.
 - 3. SECTION 07 25 00 – WEATHER BARRIERS, for air and weather barriers for exterior wall and floor repair areas where indicated or required.
 - 4. SECTION 09 29 16 – GYPSUM BOARD, for metal stud framing at exterior walls requiring vapor retarder tabs specified in this Section as part of the framing sequence.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions including details of anchors, hardware and fasteners.
- B. Submit documentation from an approved independent testing laboratory certifying vapor permeance rates of vapor retarder products, in accordance with ASTM E 2178.

1.5 QUALITY ASSURANCE

- A. Source Limitations: For each type of vapor retarder specified, obtain materials through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original containers with seals unbroken, wrapped in a polythene sleeve, labeled with manufacturer's name, and product brand name.

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- B. Store rolls under cover, on a clean, level surface, either flat or upright.

PART 2 - PRODUCTS

2.1 POLYETHYLENE SHEET VAPOR RETARDER

- A. Vapor Retarder: ASTM D 2103, 10-mil thick polyethylene sheeting.
1. Water Vapor Transmission: Maximum of 0.02 Perms (US) per ASTM E96
- B. Adhesive: A spray-on adhesive, "3M High Tack Adhesive no. 76 or equivalent product with respect to shear strength, maximum recommended temperature and adhesion to polyethylene.
- C. Sealing Film: A transfer tape, "3M Adhesive Transfer System Y-926" or equivalent with respect to adhesion to steel, adhesion to polyethylene, shear strength, and high temperature operating resistance.
- D. Tape: A press-on tape, "3M No. 396 Super Bond Film Tape" or equivalent with respect to tensile strength, adhesion to steel, adhesion to polyethylene and range of use temperature. Use opaque color tape 2 inches wide.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Coordinate installation of vapor retarder with installation of insulation. Protect insulation at all times against migration of moisture vapor.
- B. Coordinate installation of wall, roof and floor assembly vapor retarder to create a continuous barrier to vapor migration. Overlap wall vapor retarder a minimum of 24 inches over roof or floor vapor retarder wherever possible. Where construction configuration will not permit overlap of wall and roof vapor retarder, seal sheet to adjacent construction with sealant.
- C. Install vapor retarder on the interior or warm side of all insulated exterior walls, roof, and floor, and other areas indicated on the Drawings. Apply the vapor retarder material with all joints lapped a minimum of 12 inches. Apply this minimum lap to all areas where the vapor retarder material unites other materials or surfaces such as at corners, floors, ceilings, and wall openings. Extend the wall material loosely 24 inches above the top of exterior wall for eventual meshing with roof vapor retarder.
- D. Make all joints and laps over solid framing or substrate panels. Set-in and seal joints and laps with tape. The vapor retarder material may be attached with compression-type automatic staplers; however, staplers must be pressure adjusted to avoid rupturing or tearing the vapor retarder materials. Make spacing of staples or nails ample to hold the vapor retarder materials in position until application of finish material. Apply vapor retarder tape over all staples.

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- E. Avoid pipe, conduit, fixture, wiring, outlet box or other penetrations along the exterior wall assemblies wherever possible. Where pipes, conduits, fixtures, wiring, outlet boxes, or other openings penetrate the vapor retarder, the penetration and retarder shall be sealed vapor tight with a rubberized asphalt membrane patch on the back side of the penetration, sealing to the vapor retarder.
 - F. At larger openings, such as exterior windows and doors, completely seal wall openings at all junctions, corners, edges, and penetrations. After the vapor retarder is installed and sealed with the specified tape, and prior to applying any wall or ceiling finish, cover the vapor retarder with a 2 inch wide band of sealing film with the vapor retarder mastic specified herein, over all furring, framing, blocking or other bearing surfaces to form a seal where the vapor retarder has been or may be penetrated by nailing, staples, or other fasteners during installation of the vapor retarder and other finish materials. The completed installation, sealing and coating shall be such as to eliminate the possibility of moisture vapor flow into the insulation from the building interior.
 - G. After installation and prior to installing any wall finish, the vapor retarder installation shall be thoroughly inspected prior to concealment; any break, rupture, tear or failure to provide a positive vapor retarder seal shall be brought to the attention of the Architect and Owner.

3.2 VAPOR RETARDER TABS

- A. Contractor shall coordinate work required at the exterior envelope to provide vapor retarder “tabs” to be installed under components that would later prohibit continuity of the vapor retarder installation. Vapor retarder tabs shall be installed simultaneously with rough carpentry framing or other materials that might otherwise interrupt vapor retarder continuity.
 - 1. Tabs shall be sized to allow a minimum 24-inch overlap with primary vapor retarder sheet, on both sides of the obstruction.

END OF SECTION 07 26 00

SECTION 07 43 00 – INSULATED METAL ROOF AND WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Factory-assembled panels, with insulated foam cores, for exterior roofs and walls.
 - 2. Trim, accessories, and sealants installed with insulated roof and wall panels.
- B. Related Sections:
 - 1. Section 07 62 00-SHEET METAL FLASHING AND TRIM, for flashing and trim not provided with insulated roof and wall panels.
 - 2. Section 07 92 00-JOINT SEALANTS, for sealants not provided with insulated roof and wall panels.
 - 3. Section 08 36 13-SECTIONAL OVERHEAD DOORS, for overhead doors to be installed in metal wall panel systems.
 - 4. Section 13 34 19-METAL BUILDING SYSTEMS, for structural frame and secondary framing members supporting metal roof and wall panels specified in this Section.

1.3 DEFINITIONS

- A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal roof and wall panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

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- B. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: When tested per ASTM E-283 at a uniform static pressure of 20.0 psf, air infiltration shall not exceed .01 cfm per sq. ft. of roof or wall area.
- D. Water Penetration: When tested per ASTM E-331 at a uniform static pressure of 20.0 psf there shall be no uncontrolled water penetration through the panel joints.
- E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for minimum UL 90 wind-uplift-resistance class. In addition, provide metal roof panel assemblies design to resist wind uplift for the following:
1. Wind Speed: 130 mph.
 2. Exposure Rating: B
- G. Structural Performance: Provide metal roof and wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
1. Wind Loads: Determine loads based on 130 mph wind speed, Exposure B.
 2. Snow Loads: As required in the 2006 International Building Code, or as indicated on Drawings.
 3. Deflection Limits: Metal roof panel assemblies shall withstand wind and snow loads with vertical deflections no greater than $L/240$ of the span. Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than $L/180$ of the span.
 4. Fatigue Test: There shall be no evidence of metal/insulation interface delamination when the panel is tested by simulated wind loads of 20 psf (positive and negative loads), when applied for two million alternate cycles.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- I. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.
1. When tested per ASTM C-236 or C-1363 panels shall provide a minimum R-value of 8.0 per inch at 40° F mean temperature.
- J. Code Compliance: Panels shall be in compliance with the 2006 International Building Code as evidenced by a current ICC-ES evaluation report. The urethane composite panel shall be qualified by the following fire tests and approvals:

1. ICC-ES Approval Report #ESR-1143.
 2. UL 263 Fire Resistance Rating.
 3. FMRC Standard 4880 "50' Full Scale Corner Test".
- K. Surface-Burning Characteristics: Provide metal roof and wall panels having insulation core material with the following surface-burning characteristics as determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal roof and wall panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
- C. Samples for Initial Selection: For each type of metal roof and wall panel indicated with factory-applied color finishes.
1. Color to be selected by Architect from manufacturer's standard color options.
- D. Coordination Drawings: Roof plans and building elevations, drawn to scale, on which the following are shown and coordinated with each other, based on input from installers of the items involved:
1. Roof panels and attachments.
 2. Roof-mounted and wall-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.
 3. Indicate coordination with roof purlin and wall girt requirements of the metal building supplier, indicating spacing of secondary framing members to support roof and wall panels at loads indicated.

- E. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with energy performance requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.
- F. Qualification Data: For qualified Installer and professional engineer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- H. Maintenance Data: For metal roof and wall panels to include in maintenance manuals.
- I. Warranties: Samples of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Owner's Representative, Owner's insurer if applicable, metal roof and wall panel Installer, and installers whose work interfaces with or affects metal roof and wall panels including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal roof and wall panel installation, including manufacturer's written instructions.
 - 4. Examine conditions for compliance with requirements, including flatness and attachment to structural members.
 - 5. Review flashings, special details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof and wall panels.
 - 6. Review temporary protection requirements during and after installation.
 - 7. Review repair procedures after metal roof and wall panel installation.
 - 8. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal roof and wall panels, and other manufactured items so as not to be damaged or deformed. Package metal roof and wall panels for protection during transportation and handling.

- B. Unload, store, and erect metal roof and wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal roof and wall panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof and wall panels to ensure dryness. Do not store metal roof and wall panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect strippable protective covering on metal roof and wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof and wall panel installation.
- E. Protect foam-plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof and wall panel work to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof and panels by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate sizes and locations of wall openings, roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal roof and wall panels with flashing, trim, and construction of decks, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof and wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof and wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof and panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
1. Weathertight Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Provide the following products, or subject to compliance with requirements of this Section, comparable products of alternate manufacturers:
1. Metal Roof Panels: **(DRAWING DESIGNATION MRP-1)** CFR Insulated Metal Roof Panel, by MBCI, a Division of the Cornerstone Building Brands family; Lewisville, Texas Tel: 972.221.6656; Email: info@mbci.com; Web: mbci.com.
 - a. Thickness: 6-inches.
 - b. Panel Width: 42-inches
 - c. Profile: High Rib configuration.
 - d. Fastener Type: Exposed fasteners and saddle clips.
 - e. R-Value: R-45 Min
 - f. Color: Charcoal Gray.

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2. Metal Roof Panels: **(DRAWING DESIGNATION MWP-1)** CF Flute Insulated Metal Wall Panel, by MBCI, a Division of the Cornerstone Building Brands family; Lewisville, Texas Tel: 972.221.6656; Email: info@mbcicom; Web: mbcicom.
 - a. Thickness: 4-inches.
 - b. Panel Width: 42-inches
 - c. Configuration: Vertical
 - d. Fastener Type: Concealed
 - e. R-Value: R-30 Min
 - f. Color: Charcoal Gray

 3. Metal Roof Panels: **(DRAWING DESIGNATION MWP-2)** CF Architectural Insulated Metal Wall Panel, by MBCI, a Division of the Cornerstone Building Brands family; Lewisville, Texas Tel: 972.221.6656; Email: info@mbcicom; Web: mbcicom.
 - a. Thickness: 4-inches.
 - b. Panel Width: 42-inches
 - c. Configuration: Vertical
 - d. Fastener Type: Concealed
 - e. R-Value: R-30 Min
 - f. Color: Rustic Red

- B. Factory fabricated panel units shall consist of roll-formed exterior and interior sheets bonded by foaming in place the urethane insulation core.
- C. The longitudinal tongue and groove panel edges shall be formed to allow anchor clips and fasteners to be used as shown on the contract drawings.

2.2 MATERIALS

- A. Exterior metal face sheet shall be minimum 24 gauge galvanized steel conforming to ASTM A-653 Grade C or better, hot dipped commercial quality galvanized coating, designation G-90.
- B. Interior Metal liner sheet shall be 26 gauge G-90galvanized steel.
- C. Insulating Core: Polyurethane with zero ozone depletion potential blowing agent Density.
 1. Closed Cell Content: 90% or more as determined by ASTM D 6226
 2. Compressive Strength: As required to meet structural performance requirements and with a minimum of 15 psi as determined by ASTM D 1621
 3. Minimum Density: 2.0 pcf as determined by ASTM D 1622

2.3 PANEL FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
- B. Exterior Face Sheet Coil-Coated Finish System
 - 1. Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat, [meeting solar reflectance index requirements].
 - a. Basis of Design: MBCI, Silicone Polyester.
 - 2. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621, [meeting solar reflectance index requirements].
 - a. Basis of Design: MBCI, Fluoropolymer.
- C. Interior Face Sheet Coil-Coated Finish System
 - 1. Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat
 - a. Basis of Design: MBCI, Igloo White

2.4 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide EPDM, PVC, or neoprene sealing washers.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Fabricate and finish metal roof and wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal roof and wall panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

- D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. End Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 5. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof and wall panel supports, and other conditions affecting performance of the Work.
- B. Examine primary and secondary framing to verify that rafters, purlins, girts, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
- C. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

- B. **Miscellaneous Framing:** Install subpurlins, eave angles, furring, and other miscellaneous panel support members and anchorage according to metal roof and wall panel manufacturer's written instructions.

3.3 METAL ROOF PANEL INSTALLATION

- A. Provide metal roof panels of full length from eave to ridge unless otherwise approved by Architect prior to fabrication.
- B. Install metal roof panels as follows:
 - 1. Field cutting of metal panels by torch is not permitted.
 - 2. Install panels perpendicular to purlins.
 - 3. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 4. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
 - 5. Install ridge caps as metal roof panel work proceeds.
 - 6. Install metal flashing to allow moisture to run over and off metal roof panels.
- C. Fasteners:
 - 1. Steel Roof Panels: Use stainless-steel fasteners .
- D. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- E. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
 - 1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.
- F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
 - 1. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.4 METAL WALL PANEL INSTALLATION

- A. Install panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weathertight installation.

- B. Provide metal wall panels of full length from roof to foundation wall unless otherwise approved by Architect prior to fabrication.
- C. Provide a dry wipe-down cleaning of panels as they are erected.

3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal roof and wall panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- D. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal roof and wall panel units within installed tolerance of 1/4 inch in 20 feet and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 FIELD QUALITY CONTROL

- A. Remove and replace applications of metal roof and wall panels where inspections indicate that they do not comply with specified requirements.
- B. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal roof and wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof and wall panel installation, clean finished surfaces as recommended by metal roof and wall panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal roof and wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 43 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section includes the following:
1. Formed wall sheet metal flashings and soffit trim.
 2. Miscellaneous sheet metal flashing, as required.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
1. SECTION 07 43 00- INSULATED METAL ROOF AND WALL PANELS, for insulated metal panels to receive sheet metal fabrications specified in this Section.
 2. SECTION 07 92 00 – JOINT SEALANTS, for joint sealants.
 3. SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES, for door frames to receive sheet metal fabrications specified in the Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

- A. **Product Data:** For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. **Shop Drawings:** Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 - 6. Details of special conditions.
 - 7. Details of connections to adjoining work.
 - 8. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.
- C. **Samples for Verification:** For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. **Sheet Metal Flashing:** 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. **Trim, Metal Closures, Joint Intersections, and Miscellaneous Fabrications:** 12 inches long and in required profile. Include fasteners and other exposed accessories.
- D. **Warranty:** Sample of Special warranty.

1.6 QUALITY ASSURANCE

- A. **Fabricator Qualifications:** Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. **Sheet Metal Flashing and Trim Standard:** Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. **Preinstallation Conference:** Conduct conference at Project site.
 - 1. Meet with Owner's Representative, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including

installers of roofing materials, roof accessories, roof-mounted equipment, exterior cladding, windows and doors.

2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.8 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

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1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
 2. Surface: Smooth, flat.
- C. Finish: Factory applied, 70% baked-on Kynar 500 or Hylar 5000 PVDF fluoropolymer resin coating system, conforming to the following:
1. Metal preparation: All metal shall have the surfaces carefully prepared for painting on a continuous coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with an acid rinse, and thorough drying.
 2. Prime coating: A base coat specifically formulated to interact with the top coat, shall be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 mils (+/- 0.05 mils). This prime coat shall be oven cured prior to application of finish coat.
 3. Exterior coating: A finish coating shall be applied over a primer by roll coating to a dry film thickness of 0.80 mils (+/- 0.05 mils) for a total dry film thickness of 1.00 mils (+/- 0.10 mils). This finish coating shall be oven cured.
 4. Interior coating: a wash coat shall be applied on the reverse side over the primer by roll coating to a dry film thickness of 0.30 mils (+/- .05 mils) for a total dry film thickness of 0.050 mils (+/- .10 mils). The wash coat shall be oven cured.
 5. Physical properties: The coating shall conform to the manufacturer's standard performance criteria as listed by certified test reports for fade, chalk, abrasion, humidity, adhesion, pollution resistance and others as required and standard with the industry.
 - a. Color: To match adjacent finish.
 6. Concealed Face: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Where concealed fasteners are unavoidable, provide exposed heads matching color of sheet metal using factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

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2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
 - C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 - D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
 - E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

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- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
 - H. Do not use graphite pencils to mark metal surfaces.

2.4 WALL SHEET METAL FABRICATIONS

- A. Opening Flashings in Frame Construction: To the greatest extent possible, fabricate head, sill, jamb, and similar flashings to extend 4-inches beyond wall openings. Form head and sill flashing with integral drip edge. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.024 inch thick (24-gauge).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

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4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks. Provide continuous flashing lengths at openings to the greatest extent possible.
 5. Install sealant tape where indicated.
 6. Torch cutting of sheet metal flashing and trim is not permitted.
 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.3 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: To the greatest extent possible, install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. DIVISION 22, 23 and 26, for mechanical and electrical piping penetrating fire-resistive assemblies.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
- C. Deferred Submittals: Provide copy of all submittals to Authority Having Jurisdiction for review and approval as a deferred plan review submittal.
- D. Qualification Data: For qualified Installer.
- E. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to Authorities Having Jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) FM Global in its "Building Materials Approval Guide."
- C. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. 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:
1. Hilti, Inc.
 2. 3M Fire Protection Products.
 3. Tremco, Inc.; Tremco Fire Protection Systems Group.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Fire-resistance-rated walls include fire walls, fire barrier walls, smoke-barrier walls, and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Horizontal assemblies include floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

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- E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.3 **FILL MATERIALS**

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- F. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

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- G. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
 - H. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 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 the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

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- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner may engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

- A. Firestopping with No Penetrating Items:
 - 1. F-Rating: Same as wall or membrane rating, but minimum of 1-hour.
 - 2. T-Rating: Same as wall or membrane rating, but minimum of 1-hour..
 - 3. L-Rating at Ambient: Less than 5.0 cfm/sq. ft.
 - 4. L-Rating at 400 deg F: Less than 5.0 cfm/sq. ft..
 - 5. W-Rating: No leakage of water at completion of water leakage testing.
 - 6. Type of Fill Materials: As required to achieve rating.
- B. Firestopping for Metallic Pipes, Conduit, or Tubing:
 - 1. F-Rating: Same as wall or membrane rating, but minimum of 1-hour.
 - 2. T-Rating: Same as wall or membrane rating, but minimum of 1-hour..
 - 3. L-Rating at Ambient: Less than 5.0 cfm/sq. ft.
 - 4. L-Rating at 400 deg F: Less than 5.0 cfm/sq. ft..
 - 5. W-Rating: No leakage of water at completion of water leakage testing.
 - 6. Type of Fill Materials: As required to achieve rating.
- C. Firestopping for Nonmetallic Pipe, Conduit, or Tubing:
 - 1. F-Rating: Same as wall or membrane rating, but minimum of 1-hour.

2. T-Rating: Same as wall or membrane rating, but minimum of 1-hour..
3. L-Rating at Ambient: Less than 5.0 cfm/sq. ft.
4. L-Rating at 400 deg F: Less than 5.0 cfm/sq. ft..
5. W-Rating: No leakage of water at completion of water leakage testing.
6. Type of Fill Materials: As required to achieve rating.

D. Firestopping for Electrical Cables:

1. F-Rating: Same as wall or membrane rating, but minimum of 1-hour.
2. T-Rating: Same as wall or membrane rating, but minimum of 1-hour..
3. L-Rating at Ambient: Less than 5.0 cfm/sq. ft.
4. L-Rating at 400 deg F: Less than 5.0 cfm/sq. ft..
5. W-Rating: No leakage of water at completion of water leakage testing.
6. Type of Fill Materials: As required to achieve rating.

E. Firestopping for Insulated Pipes:

1. F-Rating: Same as wall or membrane rating, but minimum of 1-hour.
2. T-Rating: Same as wall or membrane rating, but minimum of 1-hour..
3. L-Rating at Ambient: Less than 5.0 cfm/sq. ft.
4. L-Rating at 400 deg F: Less than 5.0 cfm/sq. ft..
5. W-Rating: No leakage of water at completion of water leakage testing.
6. Type of Fill Materials: As required to achieve rating.

F. Firestopping for Miscellaneous Electrical Penetrants:

1. F-Rating: Same as wall or membrane rating, but minimum of 1-hour.
2. T-Rating: Same as wall or membrane rating, but minimum of 1-hour..
3. L-Rating at Ambient: Less than 5.0 cfm/sq. ft.
4. L-Rating at 400 deg F: Less than 5.0 cfm/sq. ft..
5. W-Rating: No leakage of water at completion of water leakage testing.
6. Type of Fill Materials: As required to achieve rating.

G. Firestopping for Miscellaneous Mechanical Penetrants:

1. F-Rating: Same as wall or membrane rating, but minimum of 1-hour.
2. T-Rating: Same as wall or membrane rating, but minimum of 1-hour..
3. L-Rating at Ambient: Less than 5.0 cfm/sq. ft.
4. L-Rating at 400 deg F: Less than 5.0 cfm/sq. ft..
5. W-Rating: No leakage of water at completion of water leakage testing.
6. Type of Fill Materials: As required to achieve rating.

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H. Firestopping for Groupings of Penetrants:

1. F-Rating: Same as wall or membrane rating, but minimum of 1-hour.
2. T-Rating: Same as wall or membrane rating, but minimum of 1-hour.
3. L-Rating at Ambient: Less than 5.0 cfm/sq. ft.
4. L-Rating at 400 deg F: Less than 5.0 cfm/sq. ft..
5. W-Rating: No leakage of water at completion of water leakage testing.
6. Type of Fill Materials: As required to achieve rating.

END OF SECTION 07 84 13

SECTION 07 84 43 – JOINT FIRESTOPPING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Joints in or between fire-resistance-rated constructions.
 - 2. Joints at exterior curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 07 84 13 – PENETRATION FIRESTOPPING, for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
 - 2. SECTION 09 29 16 – GYPSUM BOARD, for sealing perimeter joints at rated wall assemblies.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
- C. Deferred Submittals: Provide copy of all submittals to Authority Having Jurisdiction for review and approval as a deferred plan review submittal.
- D. Qualification Data: For qualified Installer.
- E. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

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- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
- C. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

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- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. 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:
1. Fire Trak Corp.
 2. Grace Construction Products.
 3. Hilti, Inc.
 4. 3M Fire Protection Products.
 5. Tremco, Inc.; Tremco Fire Protection Systems Group.
 6. USG Corporation.
- C. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
1. Joints include those installed in or between fire-resistance-rated walls and floor or floor/ceiling assemblies.
 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.
- E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

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- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner may engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If

damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Wall-to-Wall, Fire-Resistive Joint Systems:

1. Assembly Rating: Equal to assembly rating, but 1 hour minimum.
2. Nominal Joint Width: As indicated.
3. Movement Capabilities: Class I – 100 percent compression or extension.
4. L-Rating at Ambient: Less than 5.0 cfm/ft.
5. L-Rating at 400 deg F: Less than 5.0 cfm/ft.

B. Floor-to-Wall, Fire-Resistive Joint Systems:

1. Assembly Rating: Equal to assembly rating, but 1 hour minimum.
2. Nominal Joint Width: 2-inch maximum, or as indicated.
3. Movement Capabilities: Class I – 100 percent compression or extension.
4. L-Rating at Ambient: Less than 5.0 cfm/ft.
5. L-Rating at 400 deg F: Less than 5.0 cfm/ft.

C. Head-of-Wall, Fire-Resistive Joint Systems:

1. Assembly Rating: Equal to assembly rating, but 1 hour minimum.
2. Nominal Joint Width: 2-inch maximum, or as indicated.
3. Movement Capabilities: Class I – 100 percent compression or extension.
4. L-Rating at Ambient: Less than 5.0 cfm/ft.
5. L-Rating at 400 deg F: Less than 5.0 cfm/ft.

D. Bottom-of-Wall, Fire-Resistive Joint Systems:

1. Assembly Rating: Equal to assembly rating, but 1 hour minimum.
2. Nominal Joint Width: 2-inch maximum, or as indicated.
3. Movement Capabilities: Class I – 100 percent compression or extension.
4. L-Rating at Ambient: Less than 5.0 cfm/ft.
5. L-Rating at 400 deg F: Less than 5.0 cfm/ft.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. This Section Includes the following:
 - 1. Joint sealants.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 07 43 00- INSULATED METAL ROOF AND WALL PANELS, for exterior wall panels.
 - 2. SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM, for shop- and field-fabricated metal flashing and counterflashing, and miscellaneous sheet metal trim and accessories.
 - 3. SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES, for hollow metal door frames.
 - 4. SECTION 09 29 16 – GYPSUM BOARD ASSEMBLIES, for sealing perimeter joints.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

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- D. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
 - E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
 - F. Warranties: Sample of special warranties

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

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- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Single-Component Polyurethane Sealant: For use at exterior siding, roofing, and flashing installations.
1. Products:
 - a. Permathane SM7100/7108, by Schnee-Morehead, or equal.
 2. Type and Grade: S (single component) and NS (non-sag).
 3. Class: 25.
 4. Use Related to Exposure: NT (non-traffic).
 5. Uses Related to Joint Substrates: M, G, A, and O.
- D. Single-Component Neutral-Curing Silicone Sealant: For interior applications
1. Products:
 - a. Dow Corning Corporation; 790.
 - b. GE Silicones; SilPruf LM SCS2700.
 - c. GE Silicones; SilPruf SCS2000.
 - d. Sonneborn, Division of ChemRex Inc.; Omniseal.
 - e. Or equal.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 100/50.
 4. Use Related to Exposure: NT (non-traffic).
 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 6. Stain-Test-Response Characteristics: Non-staining to porous substrates per ASTM C 1248.
- E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant: For interior applications subject to exposure to moisture.
1. Products:

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- a. Pecora Corporation; 898, or equal.
 2. Type and Grade: S (single component) and NS (non-sag).
 3. Class: 25.
 4. Use Related to Exposure: NT (non-traffic).
 5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

2.3 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, type, size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Non-porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

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- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. This Section includes the following:
 - 1. Maximum-Duty hollow metal doors and frames, as indicated on Drawings.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 08 71 00 – DOOR HARDWARE, for door hardware for hollow metal doors.
 - 2. SECTION 08 80 00 – GLAZING, for glass view panels in new hollow metal doors and frames.
 - 3. SECTION 09 91 23 – INTERIOR PAINTING, for painting hollow metal doors and frames.

1.4 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.5 SUBMITTALS

- A. Field Verification Report: Provide schedule of field-verified door and frame components, organized by door numbers indicated in Drawings. Confirm suitable condition and function of existing doors and frames scheduled for re-use.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

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- C. Shop Drawings: Include the following:
1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of anchorages, joints, field splices, and connections.
 7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of conduit and preparations for power, signal, and control systems.
- D. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UBC Standard 7-2.
- C. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.8 COORDINATION

- A. Electric Functions: Coordinate requirements of other sections and trades related to security and access control system.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. 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:
1. Amweld Building Products, LLC.
 2. Ceco Door Products; an Assa Abloy Group company.
 3. Curries Company; an Assa Abloy Group company.

2.2 DOORS AND FRAMES

- A. Construct doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: SDI A250.8, Performance Level 4.
1. Physical Performance: Level A according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Polyurethane.
 - 1) Fire Door Core: As required to provide fire-protection ratings indicated.
 - 2) Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 10 deg F x h x sq. ft./Btu when tested according to ASTM C518 or 2.9 deg F x h x sq. ft./Btu when tested according to ASTM C1363.
 - a) Locations: Vestibule doors, and interior doors where indicated.
 3. Frames: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A40 coating.
 - a. Construction: Full profile welded.
 - b. Exposed Finish: Prime.

2.3 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.067 inch thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.067 inch.

2.4 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.5 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding.

2.6 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
 - 1. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- B. Hollow Metal Doors:
 - 1. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 - 2. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 3. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 4. Glazed Lites: Factory cut openings in doors.

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5. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- C. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Four anchors per jamb from 60 to 90 inches high.
 5. Head Anchors: Two anchors, minimum per head for frames.
 6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08 7 10 - Door Hardware.
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
- F. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.7 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

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1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

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- a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Section 08 80 00 –Glazing and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

SECTION 08 31 13 - ACCESS DOORS AND FRAMES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 07 84 13 – JOINT FIRE STOPPING, for sealants at fire rated access doors.
 - 2. SECTION 06 10 53 – MISCELLANEOUS ROUGH CARPENTRY, for wood framing and furring.
 - 3. SECTION 09 29 16 – GYPSUM BOARD ASSEMBLIES, for interior partition framing and gypsum finishes.
 - 4. SECTION 09 91 23 – INTERIOR PAINTING, for interior paint applications.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1. Include key floor plans, ceiling plans, sections and interior elevations indicating location, size, mounting height and type of each door and frame.

1.5 QUALITY ASSURANCE

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR FLOORS, WALLS AND CEILINGS

- A. General: Provide access doors and frames for all locations requiring access to otherwise concealed valves, switches, equipment, or other components requiring routine maintenance, adjustment or reset. Provide doors and frames of suitable size to access components served.
- B. Basis-of-Design: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
- C. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- D. Flush Access Doors with Exposed Flanges:
 1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Floor, wall and ceiling.
 3. Door Size: 30"x30" at floor locations. As required for access to components served at wall and ceiling locations.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.

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- a. Finish: Factory prime.
 - b. Application: Interior wall and ceiling locations as required.
5. Galvanized Steel Sheet for Door: Nominal 0.064 inch, 16 gage.
 - a. Finish: G60 galvanized and suitable for exterior conditions.
 - b. Application: Exterior wall locations as required.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Hinges: Manufacturer's standard.
 8. Hardware: Lock.
- E. Fire-Rated, Flush Access Doors with Exposed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 2. Locations: Wall and ceiling.
 3. Fire-Resistance Rating: Not less than that of adjacent construction.
 4. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
 - a. Finish: Factory prime.
 5. Frame Material: Same material, thickness, and finish as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: Latch.
- F. Hardware:
1. Latch: Cam latch operated.
 2. Lock: Cylinder.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

- E. Frame Anchors: Same type as door face.
- F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 - 1. For cylinder locks, furnish two keys per lock and key all locks alike.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

SECTION 08 36 13 - SECTIONAL DOORS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section includes electrically operated sectional doors.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 03 30 00 – CAST-IN-PLACE CONCRETE, for placement of anchors in concrete wall construction.
 - 2. SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM, for metal flashing at sectional door openings.
 - 3. SECTION 09 91 13 - EXTERIOR PAINTING, for paint schedule at sectional doors.
 - 4. DIVISION 26 and DIVISION 28 SECTIONS, for electrical service and connections for powered operators and accessories.

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance: Exterior sectional doors shall withstand the effects of gravity loads and wind loads indicated in Drawings.
 - 1. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components. Deflection of door in horizontal position (open) shall not exceed 1/120 of the door width.
- C. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283.
 - 1. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph.

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- D. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 2. Seismic Component Importance Factor: 1.5.
- E. Operation Cycles: Provide sectional door components and operators capable of operating for not less than 25,000 cycles. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory. Include the following:
1. Construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
1. Include similar Samples of accessories involving color selection.
- D. Delegated-Design Submittal: For sectional doors 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. Detail fabrication and assembly of seismic restraints.
 2. Summary of forces and loads on walls and jambs.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - d. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 STEEL DOOR SECTIONS

- A. Basis-of-Design: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Overhead Door Company; 'Thermacore' Model 599.

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- a. Door Thickness: 2-inch thick, flush panels.
 - b. Face Thickness: 0.016-inch.
 - c. Thermal Performance: R-17.5
 - d. Face Surface Treatment: Smooth skin.
 - e. Exterior Color: Field painted to match MWP-2 metal siding.
 - f. Interior Color: Manufacturer's standard white.
- B. Exterior Section Faces and Frames: Fabricate from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
1. Fabricate section faces from single sheets to provide sections not more than 24 inches high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.
 2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- C. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch- nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch- thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
- D. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal.
- E. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
- F. Provide reinforcement for hardware attachment.
- G. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84.
- H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

2.2 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings, and

complying with ASTM A 653/A 653M for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.

1. Track: 3-inch wide rolled steel track, continuous.
 2. Exterior Installation Configuration: Standard lift track, as indicated in Drawings.
- B. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
1. Assembly: Provide vertical track components with wall jamb brackets attached to track and attached to wall. Provide horizontal track components with continuous reinforcing angle attached to track and supported at points from curve in track to end of track by laterally braced attachments to overhead structural members.
- C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible EPDM, fitted to bottom and top of sectional door unless otherwise indicated.

2.3 WINDOW PANEL SECTIONS

- A. Material: 2-inch thick, 6036-T6 aluminum alloy stiles and rails joined together with 5/16-inch galvanized through-bolts. Fill spaces between stiles and rails with 0.050-inch aluminum panels, completely encased in soft vinyl channels and held in place with snap-in extruded aluminum retainer. Combined dimension of two adjoining intermediate meeting rails shall be 3-3/4 inches. End stiles 6-1/4 inches wide as determined by overall door width. Center stiles 3-5/8 inches wide. Bottom rail height 5-1/8 inches.
1. Windows: Provide window sizes and configurations as indicated in Drawings.
 2. Color: Clear anodized aluminum.
- B. Section Mounting in Door Opening: Mount sections in door opening using Lap Jamb Angle Mounting. Section shall overlap door jambs by 1 inch on each side of door opening.
- C. Seals: Flexible U-shaped vinyl seal retained in bottom aluminum rail of door.
- D. Glass Glazing: Provide glazing in window panel sections with 7/16-inch insulated clear glass, consisting of two panes of 1/8-inch DSB non-insulated glass.

2.4 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors over 16 feet wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch-wide.
- D. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.

2.5 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Weight Counterbalance: Counterbalance mechanism consisting of filled pipe weights that move vertically in a galvanized-steel weight pipe. Connect pipe weights with cable to weight-cable drums mounted on torsion shaft made of steel tube or solid steel.
- C. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.
- D. Cables: Galvanized-steel lifting cables with cable safety factor of at least 7 to 1.
- E. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- F. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

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- G. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
1. Comply with NFPA 70.
- B. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
1. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall above door and connected to torsion shaft with an adjustable coupling or drive chain.
 - a. Overhead Door Company Model RHX Commercial Operator.
- C. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.
1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115 V.
 - c. Hertz: 60.
 2. Motor Size: 1/2 HP.
 3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- D. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- E. Obstruction Detection Device: Equip motorized door with external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

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- F. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
 - G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 35 lbf.
 - H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
 - 1. Provide full height steel mounting and backing plates or angles at track / jamb conditions, full height to torsion spring and drum elevation. Provide intermediate steel backing plates for drum and operator support as required by manufacturer. Provide steel angle, channel or other shapes as required to brace section door, track and operator components.

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- a. Provide steel support components as specified in Section 05 50 00, "Metal Fabrications".
 - b. Provide solid backing in wall construction for steel backing and bracing components, or attach to steel girt framing.
 - c. Exposed wood mounting and backing material for section door, track or operator components is not permitted.
- B. Examine locations of electrical connections.
 - C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
 - 3. Repair galvanized coating on tracks according to ASTM A 780.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

- C. Adjust doors and seals to provide weathertight fit around entire perimeter.
- D. Align and adjust motors, pulleys, belts, sprockets, chains, and controls according to manufacturer's written instructions.
- E. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 36 13

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section includes:
 - 1. Door hardware for swinging doors.
- B. Quantities: Quantities listed are for the Contractor's convenience only and are not guaranteed. Items not specifically mentioned, but necessary to complete the work shall be furnished, matching the items specified in quality and finish.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES, for hollow metal doors and frames to receive door hardware specified in this Section.

1.4 REFERENCES

- A. Applicable Codes and Standards: Comply with the following codes and standards, current edition at date of bid:
 - 1. ADAAG - Americans with Disabilities Act, “Accessibility Guidelines for Buildings and Facilities”
 - 2. ANSI/BHMA A156.18 - Materials and Finishes
 - 3. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities
 - 4. NFPA 80 - Standard for Fire Doors and Windows
 - 5. NFPA 252 - Standard of Fire Tests of Door Assemblies
 - 6. Underwriters Laboratories - Building Materials Directory
 - 7. Underwriters Laboratories Test Standard UL 10C - Positive Pressure Fire Tests of Door Assemblies

1.5 ACTION SUBMITTALS

- A. **Product Data:** For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. **Color Samples:** Submit color charts and physical samples of each product requiring color selection.
- C. **Hardware Schedule:** Provide a Finish Hardware Schedule indicating the complete designation of every item required for each door or opening.
1. List each opening individually, under separate heading, in same order as the door schedule. Do not group like or similar doors under a single heading. Do not continue headings on separate pages.
 2. Each heading shall indicate opening location, handing, degree of opening, door size, type, fire rating, and Door and Frame material.
 3. Indicate product Manufacturer and incorporate cross-reference to symbols used in "Hardware Groups" article.
 4. The submittal shall include an index indicating door, heading, page numbers, and locking function of each opening.
 5. Include locations for all miscellaneous items.
 6. Include cross-reference for abbreviations or symbols used.
 7. Schedules in coded or horizontal format are unacceptable.
 8. Submittals not conforming to these requirements will be returned without review, for re-submittal. Following is an example of the required format:

SET #12

6 Hinges	FBB191 4 1/2 X 4 1/2 NRP	US32D	ST
1 Flush Bolt (Top Only)	3917-12	626	TR
1 Lockset	45H-7D14M STD 7/8"LTC	630	BE
2 Wall Bumper	1270WX	630	TR
1 Astragal	139 A 84"		NA
2 Door Silencers	1229A	BLACK	TR

- D. **Modifications:** Maintain Finish Hardware current throughout the project duration. All revisions incorporated shall be submitted in accordance with the above requirements. Submit only cover sheet and revised pages. All revisions shall clearly identify changes from previous submittal content.
- E. **Key Schedule:** Upon completion of the Keying Conference indicated "Quality Assurance" article, submit six copies of a key schedule indicating the complete project key system for approval. Obtain approval prior to proceeding with lock portion of the project.

1.6 INFORMATIONAL SUBMITTALS

- A. **Qualification Data:** For Supplier and Installer.

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- B. Product Certificates: For electrified door hardware, from the manufacturer.
 - 1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
 - D. Warranty: Special warranty specified in this Section.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.8 QUALITY ASSURANCE

- A. Supplier Qualifications: Finish hardware shall be supplied by a recognized builders' hardware supplier who has furnished hardware in the same area as the project for a period of not less than five years. Supplier must be a factory authorized, direct, and stocking distributor of the Locksets and Door Closers. The supplier's organization shall include an Architectural Hardware Consultant, certified by the Door and Hardware Institute, to remain available during the course of the work to consult with the Owner's Representative, Architect or Contractor for project hardware requirements and coordination.
- B. Installer Qualifications: Installer of products and an employer of workers trained and approved by product manufacturers.
- C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

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- F. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- G. Regulatory Requirements: All finish hardware shall comply with applicable local and/or state current building codes. All finish hardware shall meet the requirements of ADAAG-1992, and ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
- H. Product Compliance: Provide only hardware which has been tested and listed by a recognized testing agency for the types and sizes of doors required, and which complies with the requirements of the door and door frame labels. Provide door closers, automatic self-latching bolts, coordinators, gasketing, astragals, or other components if required to conform to label requirements.
- I. Keying Conference: Prior to preparation of submittals, conduct conference at Project site, In addition to Owner's Representative, Contractor, and Architect, conference participants shall also include Installer's representative and Owner's contract hardware and security vendor. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Preliminary key system schematic diagram.
 2. Requirements for key control system.
 3. Requirements for access control.
 4. Address for delivery of keys.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site. Store hardware components in a securely locked location on the project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.10 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware failing in materials or workmanship within specified warranty period.
1. Closers: Thirty years
 2. Exit Devices: Five Years
 3. Locksets & Cylinders: Life of Building
 4. All other Hardware: Two years.

1.12 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Products may be furnished by the manufacturers listed under "Basis of Design" below, or equivalent products of type, grade, design, and function, from manufacturers listed under "Acceptable Substitutions".

<u>Product</u>	<u>Basis-of-Design</u>	<u>Acceptable Substitutions</u>
Hinges	Stanley (ST)	Bommer, McKinney
Continuous Hinges	Stanley (ST)	Select, ABH
Cypher Locksets	Trilogy (TRI)	No Substitutions Permitted
Locksets	Schlage (SCH)	No Substitutions Permitted
Cylinders	BEST (BE)	No Substitutions Permitted
Exit Devices	Von Duprin (VO)	No Substitutions Permitted
Closers	LCN (LCN)	No Substitutions Permitted
Push/Pull Plates	Trimco (TR)	Hager, Rockwood
Protection Plates	Trimco (TR)	Hager, Rockwood
Overhead Stops	ABH (ABH)	Rixson, Glynn Johnson
Door Stops	Trimco (TR)	Hager, Rockwood
Flush Bolts	Trimco (TR)	ABH, Rockwood
Coordinator & Brackets	Trimco (TR)	ABH, Rockwood

Threshold & Gasketing Pemko (PE) National Guard, Reese, Zero

2.2 MATERIALS AND FABRICATION

A. Hinges: Shall be Five Knuckle Ball bearing hinges

1. Template screw hole locations
2. Bearings are to be fully hardened.
3. Bearing shell is to be consistent shape with barrel.
4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
5. Equip with easily seated, non-rising pins.
6. Non Removable Pin screws shall be slotted stainless steel screws.
7. Hinges shall be full polished, front, back and barrel.
8. Hinge pin is to be fully plated.
9. Bearing assembly is to be installed after plating.
10. Sufficient size to allow 180-degree swing of door
11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
15. UL10C listed for Fire rated doors.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3 hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

C. Mortise Type Locks and Latches:

1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C.
2. Furnish UL or recognized independent laboratory certified mechanical operational testing to 4 million cycles minimum.
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Fit ANSI A115.1 door preparation
5. Functions and design as indicated in the hardware groups

6. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
7. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
8. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
9. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
10. Provide sufficient curved strike lip to protect door trim
11. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
12. Lock shall have self-aligning, thru-bolted trim
13. Levers to operate a roller bearing spindle hub mechanism
14. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
15. Spindle to be designed to prevent forced entry from attacking of lever
16. Provide locksets with 7-pin removable and interchangeable core cylinders
17. Each lever to have independent spring mechanism controlling it
18. Core face must be the same finish as the lockset.

D. Exit Devices:

1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
2. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
3. Exit devices chassis to be investment cast steel, zinc dichromate.
4. Exit devices to have stainless steel deadlocking 3/4" through latch bolt.
5. Exit devices to be equipped with sound dampening on touchbar.
6. Non-fire rated exit devices to have cylinder dogging.
7. Non-fire rated exit devices to have 1/4" minimum turn hex key dogging.
8. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
9. Touchbar assembly on wide style exit devices to have a 1/4" clearance to allow for vision frames.
10. All exposed exit device components to be of architectural metals and "true" architectural finishes.
11. Provide strikes as required by application.
12. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
13. The strike is to be black powder coated finish.
14. Exit devices to have field reversible handing.
15. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
16. Provide 9001-Quality Management and 14001-Environmental Management.
17. Vertical Latch Assemblies to have gravity operation, no springs.

E. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Closer shall have extra-duty arms and knuckles
5. Conform to ANSI 117.1
6. Maximum 2 7/16 inch case projection with non-ferrous cover
7. Separate adjusting valves for closing and latching speed, and backcheck
8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
9. Full rack and pinion type closer with 1½" minimum bore
10. Mount closers on non-public side of door, unless otherwise noted in specification
11. Closers shall be non-handed, non-sized and multi-sized.

F. Low Energy Operators shall:

1. Conform to ANSI/BHMA A156.19 as a low energy power opening device.
2. Be listed under UL228, UL325, UL10B, UL10C, UBC 7.2 and FCC listed.
3. Shall be non-handed.
4. Be rated for door panels weighing up to 350 lbs (160 kg).
5. The manual door closer within the Low Energy Operator shall be adjusted to meet Americans with Disabilities Act (ADA) 5 lbs opening force [Push-Side applications only]
6. Operator shall be isolated from mounting plate with rubber mounts to mitigate the transmission of forces between the door and the operator.
7. Shall have a position encoder to communicate with microprocessor.
8. Incorporate a resettable powered operation counter that tracks both powered and non-powered cycling of the Operator.
9. Incorporate the following adjustable settings:
 - i. Hold Open Timer, to 28 seconds
 - ii. Open Speed
 - iii. Backcheck Speed
 - iv. Vestibule Sequence Timer
10. Include DIP switch controls for:
 - i. On board diagnostics
 - ii. Power close
 - iii. Push and Go operation
 - iv. Time delay logic for electrified hardware components
11. Include terminals for auxiliary controls including:
 - i. Activation devices; provide two discrete inputs
 - ii. Vestibule sequencing
12. Control switches including:
 - i. Day/Night open (illuminated)
 - ii. Power On-Off
13. Includes adhesive Low Energy Operator mounting templates.
14. R-14 Aluminum Allow Materials

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15. For non-powered operation, the unit shall function as a standard door closer with adjustable spring force size 1 thru 6.
- G. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
 2. Provide fastener suitable for wall construction.
 3. Coordinate reinforcement of walls where wall stop is specified.
 4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
- H. Over Head Stops: Provide a concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
- I. as indicated in hardware set. Furnish oval-head countersunk screws to match finish.
- J. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plate s with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.
- K. Push Pull Bars: Provide ANSI J504, .1" Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.
- L. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- M. Door Bolts: Flush bolts for wood or metal doors.
1. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
 2. Provide Dust Proof Strike, Certified ANSI/BHMA 156.16 at doors with flush bolts without thresholds.
- N. Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.
1. Coordinator, Certified ANSI/BHMA A1156.3 Type 21A for full width of the opening.
 2. Provide mounting brackets for soffit applied hardware.
 3. Provide hardware preparation (cutouts) for latches as necessary.
- O. Magnetic Door Holders: Provide magnetic door holders with Tri-Voltage that can be wired 12VDC, 24V AC/DC or 120V AC
1. Wall magnetic door holders shall be surface mounted.
 2. Armature shall be thru-bolted and can be provided with any projection required.
 3. Models will be available in US28, sprayed finishes and US32D.

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- 4 Floor mounted shall be provided for a single door or double door hold open application.
- P. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- Q. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.
- R. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.
- S. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.
- T. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.3 FINISH:

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

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- B. Cylinders, removable and interchangeable core system: Best 7-pin.
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
1. 1 each Grand Masterkeys
 2. 4 each Masterkeys
 3. 2 each Change keys each keyed core
 4. 15 each Construction masterkeys
 5. 1 each Control keys
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

2.5 DOOR HARDWARE GROUPS

Finish List

<u>Code</u>	<u>Description</u>
AL	Aluminum
626	Satin Chromium Plated
628	Satin Aluminum, Clear Anodized
630	Satin Stainless Steel
689	Aluminum Painted
BLACK	Black
US32D	Stainless Steel, Dull

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DOOR HARDWARE

Hardware Groups

HW-1

EXTERIOR OVERHEAD DOOR 100C, 100D, 100E & 100F

ALL HARDWARE BY DOOR MANUFACTURER

HW-2

EXTERIOR DOOR 100A & 100B

1	CONTINUOUS HINGE	ST	661HD UL 83" AL
1	EXIT DEVICE	VO	99 L-NL
1	CYPHER LOCKSET	TRI	ETDL1S/26DV99
1	PANIC EXIT DEVICE TRIM	TRI	ETDLS1Q/26DV99
1	CYPHER ADAPTER COLLAR	TRI	ET-BIC
1	IC MORTISE CYLINDER	BE	1E74-626
1	LOCK GUARD	TR	5000-T
1	DOOR CLOSER W/ SPRING STOP	LCN	4041-EDA
1	THRESHOLD	PE	254 X 4 AFG MSES10
1	DOOR SWEEP	PE	18061 CNB
1	WEATHERSTRIP	PE	2891 APK @ HEAD
1	WEATHERSTRIP	PE	290 APK @ JAMBS
1	KICK PLATE	TR	K1250 X 630 - 12" X 34" RO

HW-3

INTERIOR DOOR 101

3	HINGES	ST	FBB179 4 1/2 X 4 1/2 US26D
1	PRIVACY LOCKSET	SCH	ND40S 630
1	DOOR CLOSER	LCN	4041-EDA
1	WALL BUMPER	TR	1270CX 626
1	SMOKE SEAL	PE	S88D HEAD AND JAMBS
1	KICK PLATE	TR	K1250 X 630 - 12" X 34" RO
1	MOP PLATE	TR	KM650 X 630 - 6" X 34" RO

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DOOR HARDWARE

HW-4
INTERIOR DOOR 102

3	HINGES	ST	FBB179 4 1/2 X 4 1/2	US26D
1	CLASSROOM LOCKSET	SCH	ND70PD SFIC	630
1	CORE	BE	1E74-626	
1	DOOR CLOSER	LCN	4041-EDA	
1	WALL BUMPER	TR	1270CX	626
1	SMOKE SEAL	PE	S88D HEAD AND JAMBS	
1	KICK PLATE	TR	K1250 X 630 - 12" X 34"	RO

HW-5
EXTERIOR DOOR 104

2	HINGES	ST	FBB179 4 1/2 X 4 1/2	US26D
1	CLASSROOM LOCKSET	SCH	ND70PD SFIC	630
1	CORE	BE	1E74-626	
1	DOOR CLOSER	LCN	4041-EDA	
1	OVERHEAD STOP		1020 SERIES	

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Blocking: Provide solid blocking for wall mounted components.
- C. Fasteners: Check all conditions and use fastening devices as needed to securely anchor all hardware as per manufacturer's published templates. Self-tapping sheet metal screws are not acceptable. Door Closers, Exit Devices, and Surface Overhead Stops shall be mounted with Sex Bolts.
- D. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Mounting Heights: Mounting Heights: Mount units at heights as recommended in "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames (2001)" by Doors and Hardware Institute, except as indicated below. Products not specifically covered shall be installed in accordance with the manufacturer templates and instructions.
1. Hinges:
 - a. Top Hinge: 7-1/4", Top of frame rabbet to centerline of hinge.
 - b. Bottom Hinge: 12-1/4", Bottom of Frame to centerline of hinge
 - c. Intermediate Hinges: Centered, equal spacing between top and bottom hinges.
 2. Mortise Lock Strikes: 40", bottom of frame to centerline of Strike.
 3. Wall Stops: Locate Wall Stops intended for use with Lever Handle Locksets and Exit Devices at the Centerline of the Spindle or Pull.
 4. Push/Pulls Sets: 42", bottom of frame to center of Push Bar.
- B. Installation: Install each hardware item in compliance with manufacturer's instructions.
1. Cutting and Fitting: Wherever cutting and fitting are required to install hardware surfaces which will be painted or finished at a later time, install each item completely and then remove and store in a secure place. After completion of the finishes, re-install each item.
 2. Door and Frame Finishes: Do not install surface-mounted items until finishes have been completed on the substrate.
 3. Fire Rated Openings: Comply with NFPA 80.
 4. Door Closers: Located to provide the maximum degree of opening that project conditions will allow. Door Closers shall not be used to stop the door, except for models equipped with an integral stop-on-the-arm feature.
 5. Overhead Stops: Locate Overhead Stop and Holders to provide the maximum degree of opening that project conditions will allow.
 6. Floor Stops: Locate Floors Stops at maximum degree of opening that project conditions will allow. Do not locate Floor Stops where they create a hazardous condition. Stops should be located no more than 1/3 Door width from the latch edge of the Door.
 7. Thresholds: Set exterior Thresholds in a bed of butyl rubber sealant in conformance with Division 07 requirements. Remove excess sealant. Caulk edges and joints to exclude moisture.
 8. Weatherstrip: Mount and adjust Rigid Jamb Weatherstrip prior to mounting Parallel Arm Door Closers. Weatherstrip shall be installed to provide a continuous seal at head and jambs. Do not notch Weatherstrip for Door Closer shoe. Lower Door Closer Cylinder Assembly 1/4" to allow for mounting of Soffit Shoe on top of the Weatherstrip. Provide Parallel Arm 5th hole spacer of increased thickness to allow for revised location.
- C. Adjustment: Adjust and check each operating item of hardware and each door to insure proper operation or function of every unit. Replace units, which cannot be adjusted to operate freely and smoothly.

3.3 FINAL ADJUSTMENT

- A. Final Adjustment: Wherever hardware installation is made more than one (1) month prior to acceptance or occupancy, make a final check and adjustment of all hardware items during the week prior to acceptance or occupancy. Clean and lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Door Closer Adjustment: After mechanical systems have been balanced, adjust Door Closers to comply with following ICC/ANSI A117.1 requirements.
 - 1. Closing Speed: With the door open 70 degrees; the door closer shall be adjusted so that the door will take at least three (3) seconds to move to a point where the leading edge of the door is inches three from latching.
 - 2. Opening Force: The maximum force for pushing or pulling a door open shall be as follows: (these forces do not apply to the force required to retract latch bolts or disengage other devices securing the door)
 - a. Fire Doors: The minimum opening force allowable by the appropriate administrative authority.
 - b. Exterior Doors: 10.0 lbf.
 - c. Interior Doors: 5.0 lbf.
- C. Adjust backcheck to prevent damage to the closer, hardware, door and frame, and wall.
- D. Instruction: Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes

3.4 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 07 92 00 – JOINT SEALANTS, for joint sealants.
 - 2. SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES, for metal frames to receive glazing products specified in this Section.

1.4 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Design glazing units to meet design loads indicated on Drawings.

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1. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 - D. Safety Glazing: Provide safety glazing at all locations required by the International Building Code for protection from human impact.

1.6 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers; manufacturers of insulating-glass units with sputter-coated, low-e coatings; spandrel glazing; glass testing agency.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, and spandrel glass.
- D. Warranties: Sample of special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Source Limitations for Glass: Obtain glass from single source from single manufacturer for each glass type.

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- E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- G. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction.
- H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- I. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review temporary protection requirements for glazing during and after installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.11 WARRANTY

- A. **Manufacturer's Special Warranty for Coated-Glass Products:** Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
1. Warranty Period: 10 years from date of Substantial Completion.
- B. **Manufacturer's Special Warranty on Insulating Glass:** Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 INSULATING GLASS**

- A. **Basis of Design:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Cardinal Glass Industries Company; Cardinal IG
 - a. Cardinal LoE 270.
- B. **Insulating-Glass Units:** Provide insulated glazing units at all exterior conditions. Provide units as follows:
1. Thickness: 1-inch.
 2. Shading Coefficient: 0.41
 3. Solar Heat Gain Coefficient: 0.36
 4. Center of Glass U-Factor: 0.25
 5. Interspace: Argon gas.
- C. **Factory-assemble units** consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
 2. Spacer: Manufacturer's standard spacer material and construction.

2.2 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. Neoprene complying with ASTM C 864.
 2. EPDM complying with ASTM C 864.
 3. Silicone complying with ASTM C 1115.
 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.3 GLAZING SEALANTS

- A. General:
1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 790.
- C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.4 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.5 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

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- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
 - C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
 - D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
 - E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
 - F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
 - G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
 - I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
 - J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.

-
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
 - H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

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- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 07 21 00 – THERMAL INSULATION, for sound attenuation batt insulation in acoustic partitions and ceilings.
 - 2. SECTION 07 84 46 – FIRE-RESISTIVE JOINT SYSTEMS, for head-of-wall joint systems installed with non-load-bearing steel framing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATION SUBMITTALS

- A. Evaluation Reports: For steel studs and runners, and firestop tracks, from ICC-ES.

PART 2 - PRODUCTS**2.1 DESCRIPTION**

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.
- C. Basis-of-Design: Subject to compliance with requirements, products and systems that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Scafco Steel Stud Manufacturing Company; Supreme Framing System (SFS)
- D. Studs and Runners: ASTM C 645. Modified light gauge stud profile, fabricated with increased yield strength material, to provide performance properties of traditional 30-mil metal stud products.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 24-mil / 0.0235-inches.
 - b. Base-Metal Yield Strength: 57 ksi.
 - c. Depth: As indicated on Drawings.
 - d. Flange Width: 1-7/16 inches.
 - e. Provide accessory bridging and bracing, or increased base metal thickness, as required for un-supported heights, stud spacing, and stud depth indicated in Drawings.
- E. Slip-Type Head Joints: Provide at all full-height partitions, except where firestop tracks are provided:

1. Deflection Track: Steel sheet top slotted track runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- F. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Provide firestop tracks as an option to other head-of-wall fire-resistive joint systems specified in Section 07 84 46, "Fire-Resistive Joint Systems".
- G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: 0.027 inch minimum, with thicker material as required for application.
- H. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
1. Depth: 1-1/2 inches.
- I. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.018 inch.
 2. Depth: 7/8 inch.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, expansion anchor.

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2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
 - C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
 - D. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install studs so flanges within framing system point in same direction.
 - 1. Space studs as follows:
 - a. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - b. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

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- a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- C. Direct Furring:
1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Interior gypsum board, and accessories.
 - 2. Repairs to existing gypsum board where existing finishes are scheduled for removal.
 - 3. Abuse-resistant gypsum board, and accessories, for use as corridor and gym wainscot.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 07 21 00 – BUILDING INSULATION, for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
 - 2. SECTION 09 91 23 – INTERIOR PAINTING, for primers applied to gypsum board surfaces.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
 - 1. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.
- C. Shop Drawings: Provide shop drawings indicating location and detail for all control joints in gypsum board installation. Provide interior elevations of wall areas to receive control joints.

1.5 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.6 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS**2.1 PANELS, GENERAL**

- A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36 or ASTM C 1396, as applicable to type of gypsum board indicated and whichever is more stringent.

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1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum Co.
 - b. National Gypsum Company.
 - c. USG Corporation.
 2. Core: Type X.
 3. Thickness: 5/8 inch.
 4. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

- A. Typical Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.

2.4 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 1. Interior Gypsum Wallboard: Paper.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
- D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

2.6 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered

edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless 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. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- G. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: All uses.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 CONTROL JOINTS

- A. Form control and expansion joints with space between edges of adjoining gypsum panels. Locate joints at doors, cased openings, or similar vertical separation, from corner of door or cased opening to ceiling and as indicated below.
 - 1. Partitions and Wainscot:
 - a. Install control joints in partitions and wall furring exceeding 30 feet in length.
 - b. Space control joints not more than 30 linear feet o.c.
 - c. Install control joints in new wainscot assemblies and in existing gypsum board finish above.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840, and at locations indicated on Drawings, every 50 lineal feet of wall area (minimum), and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 4: At new panel surfaces that will be exposed to view.

- a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.7 FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 91 13 - EXTERIOR PAINTING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section includes surface preparation and the application of paint systems on the following miscellaneous exterior substrates:
 - 1. Steel.
 - 2. Cementitious Siding.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 09920 – INTERIOR PAINTING, for surface preparation and the application of paint systems on interior substrates.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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:
 1. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

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2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Colors: As indicated in Drawings.

2.3 EXTERIOR STEEL PAINT SYSTEM

- A. Latex System: Gloss Finish.
- B. 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5.0 mils wet, 2.0 mils dry).
- C. 2nd Coat: S-W A-100 Exterior Latex Gloss, A8 Series.
- D. 3rd Coat: S-W A-100 Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat).
- E. Gloss: Level 3-4.

2.4 EXTERIOR CEMENTITIOUS SIDING PAINT SYSTEM

- A. Latex System: Gloss Finish.
- B. 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5.0 mils wet, 2.0 mils dry).
- C. 2nd Coat: S-W A-100 Exterior Latex Gloss, A8 Series.
- D. 3rd Coat: S-W A-100 Exterior Latex Gloss, A8 Series (4 mils wet, 1.3 mils dry per coat).
- E. Gloss: Level 3-4.

2.5 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from

previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints per manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

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- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section includes surface preparation and the application of paint and transparent finish systems on the following interior substrates:
 - 1. Steel.
 - 2. Masonry.
 - 3. Gypsum Wallboard.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. SECTION 09910 – EXTERIOR PAINTING, for surface preparation and the application of paint systems on exterior substrates.

1.4 SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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:
 1. Sherwin-Williams Company (The): General paint and varnish coatings.
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.

A. Colors: Colors: Colors: Match existing colors for like substrates, as indicated in Drawings.**2.3 GYPSUM DRYWALL PAINT SYSTEM**

- A. Latex System: Eggshell / Satin Finish
- B. 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
- C. 2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
- D. 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series (4 mils wet, 1.7 mils dry per coat).

2.5 MASONRY PAINT SYSTEM

- A. Latex System: Eggshell / Satin Finish
- B. 1st Coat: S-W PrepRite Block Filler, B25W25 (75-125 sq ft/gal).
- C. 2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series.
- D. 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series (4 mils wet, 1.7 mils dry per coat).

2.6 STEEL PAINT SYSTEM

- A. Latex System: Semi-Gloss Finish
- B. 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5.0 mils wet, 2.0 mils dry).
- C. 2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series.
- D. 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series (4.0 mils wet, 1.6 mils dry per coat).

2.7 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints per manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

-
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 - D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 23

SECTION 10 14 00 - SIGNAGE**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section Includes:
 - 1. Panel Signs.
 - 2. Exterior graphic lettering.

1.3 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. DIVISION 22 & 23 SECTIONS, for labels, tags and nameplates for mechanical equipment.
 - 2. DIVISION 26 SECTIONS, for labels, tags, and nameplates for electrical equipment.

1.4 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 2. Provide message list, typestyles, graphic elements and layout for each sign.
- C. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
 - 1. Panel Signs: 6 inches square.
 - 2. Exterior graphic lettering: 24 inches square.

- D. Sign Schedule: Use same designations indicated on Drawings.
- E. Qualification Data: For fabricator.
- F. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- C. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Manufacturers of Panel Signs:
 - a. Mohawk Sign Systems. (Basis-of-Design)
 - b. Andco Industries Corp.
 - c. APCO Graphics, Inc.

2.2 PANEL SIGNS

- A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.
- B. Plastic Laminate: Provide high-pressure laminate engraving stock with face and core plies in contrasting colors as selected by Architect from manufacturer's full range.
- C. Laminated Panels: Permanently laminate face panels to backing sheets of material; use manufacturer's standard process.
- D. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Sign Schedule approved by the Architect and Owner for size, style, spacing, content, mounting height, and location material, finishes, and colors of signage.
- E. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
1. Panel Material: Manufacturer's standard for sign type indicated.
 2. Raised-Copy Thickness: Not less than 1/32-inch.
- F. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.
1. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.
 2. Provide text in English and local Inupiat dialect, to be provided by Owner.
- G. Sign Schedule: Provide panel signs at door entries into each interior room. Verify signage text and room numbering. Each sign shall have a room number, bilingual text, and raised Braille letters. Panel Type B will also have universal graphic images.
1. Panel Type: A
 - a. Plaque Size: 8-inch x 8-inch.
 - b. Character Size: 1-1/2-inch for room number; 3/4-inch for room name.
 - c. Character Finish/Color: To be selected from manufacturer's standard.
 - d. Background Finish/Color: To be selected from Manufacturer's standard.
 - e. Text/Message: Room number and room name as indicated on Drawings.
 - f. Location: Toilet Room and Mechanical Room.
 - g. Fastening: Stainless steel screw fastener at each corner, with countersunk finishing washer.

2. Panel Type: B
 - a. Plaque Size: 12-inch x 24-inch.
 - b. Character Size: 1-1/2-inch.
 - c. Character Finish/Color: To be selected from manufacturer's standard.
 - d. Background Finish/Color: To be selected from Manufacturer's standard.
 - e. Text/Message: TBD, plaque to be mounted at the exterior of the building at the water fill station. Message will inform the general public on instructions for use and protection.
 - f. Location: Water fill.
 - g. Fastening: Stainless steel screw fastener at each corner, with countersunk finishing washer.

2.3 EXTERIOR GRAPHIC LETTERING

- A. Cut Characters: Form individual letters and numbers by cutting vinyl.
 1. Location: Building Exterior
 2. Size: As indicated in Drawings
 3. Thickness: 3 mil
 4. Text Copy: As indicated in Drawings
 5. Font: As indicated in Drawings
 6. Color: To be selected from manufacturer's standard color options.

2.4 ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items are sized and located to accommodate signs.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
- B. Mount dimensional lettering using standard fastening methods to comply with manufacturer's written instructions for type of wall surface indicated.
 - 1. Concealed Mounting: Mount dimensional characters by inserting threaded studs into tapped lugs on back of character. Set in predrilled holes filled with quick-setting cement.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 28 00 – TOILET, BATH & LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Underlavatory guards.
 - 3. Custodial accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 TOILET ACCESSORIES

- A. Basis-of-Design Product: Bobrick Washroom Equipment, Inc. Model numbers indicated are based on specific manufacturers to establish a basis of design. Other manufacturers are acceptable, provided products meet or exceed the physical characteristics, performance, and finish of the following:
1. All toilet and bath accessories shall be 304 stainless steel, having a smooth, No. 4 satin finish, unless otherwise noted.
- B. Toilet Tissue Dispenser (TTD): B-4288
- C. Paper Towel Dispenser (PTD): B-262
- D. Trash Receptacle: B-2260
- E. Liquid-Soap Dispenser (SD): B-2111
- F. Grab Bars:
1. GB-1: Bobrick B-5806-18
 2. GB-2: Bobrick B-5806-42
 3. GB-3: Bobrick B-5806-36
- G. Mirror Units (M-1): Bobrick B-165 (2436)

2.3 UNDERLAVATORY GUARDS

- A. 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:
1. Plumberex Specialty Products, Inc.
- B. Underlavatory Guard:
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 2. Material and Finish: Antimicrobial, molded plastic, white.
 3. Location: Provide at all supply and drain piping assemblies that are regularly exposed to direct contact with human contact.

2.4 CUSTODIAL ACCESSORIES

- A. Basis-of-Design Product: Model numbers indicated are based on specific manufacturers to establish a basis of design. Other manufacturers are acceptable, provided products meet or exceed the physical characteristics, performance, and finish of the following:
 - 1. All toilet and bath accessories shall be 304 stainless steel, having a smooth, No. 4 satin finish, unless otherwise noted.
- B. Shelf with Mop and Broom Holders and Rag Hooks (MR): Bobrick B-239x34

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

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SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SECTION INCLUDES

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.7 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire extinguisher cabinets specified in Section 10 44 13, "Fire Extinguisher Cabinets" to ensure fit and function.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire extinguisher cabinet and mounting bracket indicated.
 1. Basis-of-Design Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Larsen's Manufacturing Company; Model MP5.
 2. Valves: Manufacturer's standard.
 3. Handles and Levers: Manufacturer's standard.
 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
 - B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated.
 1. Provide at all fire extinguisher locations designated "FE" in Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 13 34 19 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Municipality of Anchorage Standard Specifications (MASS), General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural-steel framing.
 - 2. Miscellaneous support framing and accessories.
- B. Related Sections:
 - 1. Section 074300-INSULATED METAL ROOF AND WALL PANELS, for insulated core metal roof and exterior wall panels.
 - 2. Section 076200-SHEET METAL FLASHING AND TRIM, for sheet metal flashing.
 - 3. Section 083613-SECTIONAL DOORS, for overhead doors.
 - 4. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES, for insulated hollow metal exterior doors.

1.3 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - 1. Structural-steel-framing system.
 - 2. Miscellaneous support framing and accessories.

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- B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.
1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
- C. Design Submittal: Submit compliance with performance requirements and design criteria, including analysis data and structural calculations signed and sealed by the qualified professional engineer, licensed in the State of Alaska and responsible for their preparation.
- D. Qualification Data: For qualified erector, manufacturer, and professional engineer.
- E. Welding certificates.
- F. Metal Building System Certificates: For each type of metal building system, from manufacturer.
1. Letter of Design Certification: Signed and sealed by a qualified professional engineer, licensed in the State of Alaska. Include the following:
 - a. Name and location of Project.
 - b. Order number.
 - c. Name of manufacturer.
 - d. Name of Contractor.
 - e. Building dimensions including width, length, height, and roof slope.
 - f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - g. Governing building code and year of edition.
 - h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
 - k. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.
- G. Finish: Submit all applicable procedures, specifications, suppliers, and contractors used for applying the finish and galvanizing for secondary structural framing and accessory components.
- H. Erector Certificates: For each product, from manufacturer.

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- I. Material Test Reports: For each of the following products:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Primers, paint, and other coatings.
 - J. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
 - K. Source quality-control reports.
 - L. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.
 - 1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer, licensed in the state of Alaska.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- D. Source Limitations: Obtain metal building system components, including primary and secondary framing, from single source from single manufacturer.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- F. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- G. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when weather conditions permit metal building systems to be installed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements:
 - 1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
 - 2. Established Dimensions for Metal Panels: Coordinate framing and opening dimensions with approved metal wall and roof panel shop drawings. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of equipment supports, and roof penetrations.
- C. Coordinate installation of Running Track structure, stairs, and other equipment.

1.9 WARRANTY

- A. Provide manufacturer's standard warranty for metal building components.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. 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:
1. Butler Manufacturing Company; a BlueScope Steel company.
 2. Garco Building Systems; Division of NCI Building Systems, L.P.
 3. Star Building Systems; an NCI company.
 4. VP Buildings; a United Dominion company.

2.2 METAL BUILDING SYSTEMS

- A. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building framing system capable of withstanding structural and other loads, and thermally induced movement without failure or infiltration of water into building interior.
1. Provide metal building system of size and with bay spacings, roof slopes, and spans indicated.
- B. Base Bid Primary-Frame Type:
1. Rigid Modular: Solid-member, structural-framing system with interior columns.
 2. End-Wall Framing: Manufacturer's standard, consisting of primary frame, capable of supporting full bay design load, and overhead and man door framing.
- C. Secondary-Frame Type: Manufacturer's standard purlins, joists and exterior-framed (bypass) girts.
- D. Eave Height: As indicated on Drawings, with minimum 18'-0" at the primary frame "haunch".
- E. Bay Spacing: As indicated on Drawings.
- F. Roof Slope: As indicated on Drawings.
- G. Roof System: Insulated metal panels, specified in Division 7.
- H. Exterior Wall System: Insulated metal panels, specified in Division 7.

2.3 METAL BUILDING SYSTEM PERFORMANCE

- A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, licensed in the State of Alaska, using performance requirements and design criteria indicated.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Structural Drawings.
 - 2. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/180 of the span.
 - b. Girts: Horizontal deflection of 1/180 of the span.
 - c. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - 3. Drift Limits: Engineer building structure to withstand wind loads with drift limits no greater than the following:
 - a. Lateral Drift: Maximum of 1/200 of the building height.
- C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 100 deg F, ambient; 120 deg F, material surfaces.

2.4 STRUCTURAL-STEEL FRAMING

- A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements.
- B. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - 1. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.

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2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are permitted only where indicated.
 3. Frame Configuration: Mono-slope shed.
 4. Exterior Column Type: Tapered.
 5. Rafter Type: Tapered.
- C. End-Wall Framing: Rigid clear span frame with steel framing for overhead and man doors.
- D. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, pre-coated or post fabrication applied hot-dip galvanizing G-90, to comply with the following:
1. Purlins: Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.
 - a. Depth: As needed to comply with system performance requirements.
 - b. Spacing: As needed to comply system performance requirements, and span limitations of metal roof panels.
 2. Girts: Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- wide flanges.
 - a. Depth: 8-inches, or as needed to comply with system performance requirements. Depth greater than 8-inches shall require matching increase to concrete stem wall thickness.
 - b. Spacing: As needed to comply system performance requirements, and span limitations of metal wall panels.
 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 4. Flange Bracing: Not permitted at columns. Manufacturer's standard members may be used for roof framing.
 5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
 6. Base Channels: Minimum 2-by-8-inch steel sheet.
 7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet.
 8. Secondary End-Wall Framing: Manufacturer's standard sections.
 9. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; designed to withstand required loads.

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- E. Bracing: Provide adjustable wind bracing as follows:
1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50; or ASTM A 529/A 529M, Grade 50; minimum 1/2-inch- diameter steel; threaded full length or threaded a minimum of 6 inches at each end. Hot-dip galvanized finish.
 2. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads. Hot-dip galvanized finish.
- F. Bolts: Provide bolts finished with mechanically applied zinc or Dacromet coating for structural-framing components that are primed or finish painted. Provide hot-dip galvanized bolts for structural-framing components that are galvanized.
- G. Materials:
1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
 2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
 3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
 4. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
 6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70.
 7. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80, or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80; with G90 coating designation.
 8. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 steel washers.
 - a. Finish: Dacromet coating, Hot-dip zinc coating, ASTM A 153/A 153M, Class C or Mechanically deposited zinc coating, ASTM B 695, Class 50.
 9. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - a. Finish: Dacromet coating, Hot-dip zinc coating, ASTM A 153/A 153M, Class C or Mechanically deposited zinc coating, ASTM B 695, Class 50.

10. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with spline ends.
 - a. Finish: Dacromet coating, Hot-dip zinc coating, ASTM A 153/A 153M, Class C or Mechanically deposited zinc coating, ASTM B 695, Class 50.
11. Headed Anchor Rods: ASTM F 1554.
 - a. Configuration: Straight.
 - b. Nuts: ASTM A 563 hex carbon steel.
 - c. Plate Washers: ASTM A 36/A 36M carbon steel.
 - d. Washers: ASTM F 436 hardened carbon steel.
 - e. Finish: Dacromet coating, Hot-dip zinc coating, ASTM A 153/A 153M, Class C or Mechanically deposited zinc coating, ASTM B 695, Class 50.
12. Threaded Rods: ASTM A 193/A 193M or ASTM A 572/A 572M, Grade 50 or ASTM A 36/A 36M or ASTM A 307, Grade A.
 - a. Nuts: ASTM A 563 hex carbon steel.
 - b. Washers: ASTM A 36/A 36M carbon steel.
 - c. Finish: Dacromet coating, Hot-dip zinc coating, ASTM A 153/A 153M, Class C or Mechanically deposited zinc coating, ASTM B 695, Class 50.

H. Finish:

1. Primary & Secondary framing members:
 - a. Factory primed. Apply specified primer immediately after cleaning and pretreating.
 - b. Clean and prepare in accordance with SSPC-SP2.
 - c. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.

2.5 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

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- B. Roof Panel Accessories: Provide secondary framing components required to complete metal roof panel assembly.
 - C. Wall Panel Accessories: Provide secondary framing components required to complete metal wall panel assembly.
 - D. Materials:
 - 1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - 2. Corrosion-Resistance: Hot-dip galvanized or stainless steel.
 - 3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 SOURCE QUALITY CONTROL

- A. Testing: Inspect shop connections for metal buildings according to the following:
 - 1. Bolted Connections: Shop-bolted connections shall be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

2.7 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
1. Make shop connections by welding or by using high-strength bolts.
 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 3. Design primary framing, girts and purlins to eliminate the need for flange bracing.
 4. Weld clips to frames for attaching secondary framing.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
1. Make shop connections by welding or by using non-high-strength bolts.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

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- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned.

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- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
1. Tighten rod and cable bracing to avoid sag.
 2. Locate interior end-bay bracing only where indicated.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections required by building codes or local authorities having jurisdiction.
- B. Tests and Inspections:
1. High-Strength, Field-Bolted Connections: Connections shall be inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.

- C. Product will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Doors: After completing installation, test doors, windows and other openings to ensure proper operation. Correct secondary framing as required.

3.7 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - 1. Use same finish method as required for the material supplied.

END OF SECTION 13 34 19

SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Steel ball valves.

1.2 DEFINITIONS

- A. CWP: Cold working pressure.
- B. RPTFE: Reinforced polytetrafluoroethylene.
- C. WOG: Water, oil, gas.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and soldered ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS**2.1 SOURCE LIMITATIONS**

- A. Obtain each type of valve from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Standards:
1. Domestic water valves intended to convey or dispense water for human consumption must comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or must be certified to be in compliance with NSF 61 and NSF 372 (by an ANSI-accredited third-party certification body) that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
 2. ASME B16.5 for flanges on steel valves.
 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 4. ASME B16.18 for cast copper solder-joint connections.
 5. ASME B16.22 for wrought copper and copper alloy solder-joint connections.
 6. ASME B16.34 for flanged and threaded end connections
 7. ASME B31.9 for building services piping valves.
- C. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream piping unless otherwise indicated.
- F. Valve Actuator Type:
1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
 2. Hand Lever: For quarter-turn valves smaller than NPS 4.
- G. Valves in Insulated Piping:
1. Provide 2-inch extended neck stems.
 2. Extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 3. Memory stops that are fully adjustable after insulation is applied.

2.3 BRONZE BALL VALVES

- A. Bronze Ball Valves, One Piece with Stainless Steel Trim, Threaded Ends:
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. NIBCO INC.
 - b. WATTS.
 2. Standard: MSS SP-110; MSS SP-145.
 3. CWP Rating: 600 psig.
 4. Body Design: One piece.
 5. Body Material: Bronze.
 6. Ends: Threaded.
 7. Seats: PTFE.
 8. Stem: Stainless steel.
 9. Ball: Stainless steel, vented.
 10. Port: Reduced.
- B. Bronze Ball Valves, Two Piece with Full Port and Stainless Steel Trim, Threaded or Soldered Ends:
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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. NIBCO INC.
 - c. Red-White Valve Corp.
 - d. Viega LLC.
 - e. WATTS.
 2. Standard: MSS SP-110; MSS SP-145.
 3. CWP Rating: 600 psig.
 4. Body Design: Two piece.
 5. Body Material: Bronze.
 6. Ends: Threaded or soldered.
 7. Seats: PTFE.
 8. Stem: Stainless steel.
 9. Ball: Stainless steel, vented.
 10. Port: Full.

C. Bronze Ball Valves, Three Piece with Full Port and Stainless Steel Trim, Threaded Ends:

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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. NIBCO INC.
2. Standard: MSS SP-110; MSS SP-145.
3. CWP Rating: 600 psig.
4. Body Design: Three piece.
5. Body Material: Bronze.
6. Ends: Threaded.
7. Seats: PTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel, vented.
10. Port: Full.

D. Bronze Ball Valves, Three Piece with Regular Port and Stainless Steel Trim, Threaded or Soldered Ends:

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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. NIBCO INC.
2. Standard: MSS SP-110; MSS SP-145.
3. CWP Rating: 600 psig.
4. Body Design: Three piece.
5. Body Material: Bronze.
6. Ends: Threaded or soldered.
7. Seats: PTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel, vented.
10. Port: Regular.

2.4 STEEL BALL VALVES

A. Steel Ball Valves with Full Port, Class 150, Flanged or Threaded Ends:

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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. NIBCO INC.
 - c. Viega LLC.
 - d. WATTS.
2. Standard: MSS SP-72; MSS SP-110.
 3. CWP Rating: 285 psig.
 4. Body Design: Split body.
 5. Body Material: Carbon steel, ASTM A216/A216M, Type WCB.
 6. Ends: Flanged or threaded.
 7. Seats: PTFE.
 8. Stem: Stainless steel.
 9. Ball: Stainless steel, vented.
 10. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

- A. Install valves with unions or flanges at each piece of equipment arranged to allow space for service, maintenance, and equipment removal without system shutdown.
- B. Provide support to piping adjacent to valves such that no force is imposed upon valves.
- C. Locate valves for easy access.
- D. For valves in horizontal piping, install valves with stem at or above center of pipe.

-
- E. Install valves in position to allow full valve actuation movement.
 - F. Valve Tags: Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - G. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves exhibiting leakage.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, provide the same types of valves with higher CWP ratings.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze ball valve, one piece with stainless steel trim. Provide with threaded, solder or press-connection-joint ends.
 - 2. Bronze ball valves, two piece with full port, and stainless steel trim. Provide with threaded, solder or press-connection-joint ends.
 - 3. Bronze ball valves, three piece with full port, and stainless steel trim.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Steel ball valves, Class 150 with full port.

END OF SECTION 22 05 23.12

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Fastener systems.
 - 5. Pipe-positioning systems.
 - 6. Equipment supports.
- B. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 22 05 16 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
 - 3. Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.
 - 4. Pipe stands.
 - 5. Equipment supports.

- C. Delegated-Design Submittal: For trapeze hangers 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. Detail fabrication and assembly of trapeze hangers.
 - 2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.

3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:

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. Cooper B-line; brand of Eaton, Electrical Sector.
 - b. Unistrut; Atkore International.
2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Paint Coating: Match surrounding architectural features and finishes.

- B. Non-MFMA Manufacturer Metal Framing Systems:

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. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Select for applicable load criteria.

6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Paint Coating: Match surrounding architectural features and finishes.

2.5 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 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. Cooper B-line; brand of Eaton, Electrical Sector.
 - b. Hilti, Inc.
 2. Indoor Applications: Zinc-coated steel.
 3. Outdoor Applications: Stainless steel.

2.6 PIPE-POSITIONING SYSTEMS

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.8 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.

- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Stand Installation:
 - 1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

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2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.
- F. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

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3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal may be required. See architectural specifications.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal hanger-shield inserts for insulated piping and tubing.

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.

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21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

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- O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

SECTION 22 05 48 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Delegated design – deferred submittal
- B. Related Requirements:
 - 1. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.3 DEFINITIONS

- A. Designated Seismic System: A plumbing component that requires design in accordance with ASCE/SEI 7, Ch. 13 and for which the Component Importance Factor is greater than 1.0.
- B. IBC: International Building Code.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Include load rating for each wind-force-restraint fitting and assembly.
 - 3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component.
 - 4. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by UL product listing, FM Approvals, or an agency acceptable to authorities having jurisdiction.

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5. Annotate to indicate application of each product submitted and compliance with requirements.
 6. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases.
 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal:
1. For each seismic-restraint device, including seismic-restrained mounting, snubber, seismic restraint, seismic-restraint accessory, and concrete anchor and insert, that is required by this Section or is indicated on Drawings, submit the following:
 - a. Seismic restraint, and vibration isolator, and isolation base selection: Select vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.
 - b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
 - c. Concrete Anchors and Inserts: Include calculations showing anticipated seismic and wind loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
 - d. Seismic Design Calculations: Submit all input data and loading calculations prepared in "Performance Requirements" Article in "Seismic Design Calculations" Paragraph.
 - e. Qualified Professional Engineer: All designated-design submittals for seismic calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.
 2. Seismic-Restraint Detail Drawing:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 3. Product Listing, Preapproval, and Evaluation Documentation: By UL, FM Approvals, or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

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4. All delegated-design submittals for seismic- and wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
5. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
6. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Welding certificates.
- C. Seismic Qualification Data: Provide special certification for designated seismic systems as indicated in ASCE/SEI 7-16, Paragraph 13.2.2, "Special Certification Requirements for Designated Seismic Systems" for all Designated Seismic Systems identified as such on Drawings or in the Specifications.
 1. Provide equipment manufacturer's written certification for each designated active plumbing seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7 and AHRI 1270, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction.
 2. Provide equipment manufacturer's written certification that components with hazardous contents maintain containment following the design earthquake by methods required in ASCE/SEI 7-16.
 3. Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by a licensed professional engineer.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing

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directory available to the public. Provide third-party listing by one or more of the following: UL product listing, FM Approvals, an agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design a seismic control system.
1. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7-16.
- B. Seismic Design Calculations:
1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-16. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is the edition intended as reference throughout the section text.
 - a. Data indicated below to be determined by Delegated-Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
 - b. Building Occupancy Category: Match Structural
 - c. Building Risk Category: Match Structural
 - d. Building Site Classification: Match Structural
 2. Calculation Factors, ASCE/SEI 7-16, Ch. 13 - Seismic Design Requirements for Nonstructural Components: All section, paragraph, equation, and table numbers refer to ASCE/SEI 7-16 unless otherwise noted.
 - a. Horizontal Seismic Design Force F_p : Match Structural
 - 1) S_{DS} = Spectral Acceleration: Match Structural. Value applies to all components on Project.
 - 2) z = Height in Structure of Point of Attachment of Component for Base: Determine from Project Drawings for each component by Delegated-Design Contractor. For items at or below the base, "z" shall be taken as zero.
 - 3) h = Average Roof Height of Structure for Base: Determine from Project Drawings by Delegated-Design Contractor.
 - b. Vertical Seismic Design Force: Match Structural

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- c. Seismic Relative Displacement D_{pl} : Match Structural
 - 1) D_p = Relative Seismic Displacement that Each Component Must Be Designed to Accommodate: Match Structural
 - 2) I_e = Structure Importance Factor: 1.0. Value applies to all components on Project.

- C. Consequential Damage: Provide additional seismic and wind-force restraints for suspended plumbing components or anchorage of floor, roof or wall mounted plumbing components as indicated in ASCE/SEI 7-16 so that failure of a non-essential or essential plumbing component will not cause the failure of any other essential architectural, mechanical or electrical building component.

- D. Fire/Smoke Resistance: Seismic-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.

- E. Component Supports:
 - 1. Load Ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
 - 2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-16 Section 13.6.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

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- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry static and seismic load within specified loading limits.

3.3 INSTALLATION OF VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICES

- A. Provide vibration-control devices for systems and equipment where required.
- B. Provide seismic-restraint devices for systems and equipment where required by applicable codes.
- C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."
- D. Installation of vibration isolators and seismic restraints must not cause any stresses, misalignment, or change of position of equipment or piping.
- E. Equipment Restraints:
 - 1. Install snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- F. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- G. Install seismic-restraint cables so they do not bend across edges of adjacent equipment or building structure.
- H. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- I. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- J. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

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- K. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- L. Post-Installed Concrete Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify Project structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Mechanical-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Provide flexible connections in piping systems where they cross structural seismic joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements in Section 22 11 16 "Domestic Water Piping" and Section 22 11 19 "Domestic Water Piping Specialties" for piping flexible connections.

3.5 ADJUSTING

- A. Adjust isolators after system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

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- B. Tests and Inspections:
1. Perform tests and inspections.
 2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 3. Schedule test with Owner, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 4. Obtain Owner's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 5. Test at least four of each type and size of installed anchors and fasteners selected by Owner, or 10 percent, whichever is greater.
 6. Test to 90 percent of rated proof load of device.
 7. Measure isolator restraint clearance.
 8. Measure isolator deflection.
 9. Verify snubber minimum clearances.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Units will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 22 05 48

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Warning tape.
 - 4. Pipe labels.
 - 5. Stencils.
 - 6. Valve tags.
 - 7. Warning tags.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve-numbering scheme.
- E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 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. Brady Corporation.
 - b. Craftmark Pipe Markers.

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2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
 3. Letter and Background Color: As indicated for specific application under Part 3.
 4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

- A. 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:
1. Brady Corporation.
 2. Craftmark Pipe Markers.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
- C. Letter and Background Color: As indicated for specific application under Part 3.
- D. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA 70E.

- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 WARNING TAPE

- A. 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:
 - 1. Brady Corporation.
 - 2. Craftmark Pipe Markers.
- B. Material: Vinyl.
- C. Minimum Thickness: 0.005 inch.
- D. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.
- E. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.
- F. Maximum Temperature: 160 deg F.
- G. Minimum Width: 4 inches.

2.4 PIPE LABELS

- A. 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:
 - 1. Brady Corporation.
 - 2. Craftmark Pipe Markers.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
- C. Letter and Background Color: As indicated for specific application under Part 3.
- D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover or cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
 - 1. Pipe size.

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2. Flow-Direction Arrows: Include flow-direction arrows on distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.5 STENCILS

A. Stencils for Piping:

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. Craftmark Pipe Markers.
2. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Aluminum, brass, or fiberboard.
4. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel in colors in accordance with ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
6. Letter and Background Color: As indicated for specific application under Part 3.

2.6 VALVE TAGS

- A. 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:
 1. Brady Corporation.
 2. Craftmark Pipe Markers.
- B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 1. Tag Material: Brass, 0.04-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass link chain or beaded chain.
- C. Letter and Background Color: As indicated for specific application under Part 3.

- D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Include valve-tag schedule in operation and maintenance data.

2.7 WARNING TAGS

- A. 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:
1. Brady Corporation.
 2. Craftmark Pipe Markers.
- B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
1. Size: Approximately 4 by 7 inches.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

- A. Permanently fasten labels on each item of plumbing equipment.
- B. Sign and Label Colors.
 - 1. White letters on an ANSI Z535.1 safety-green background.
- C. Locate equipment labels where accessible and visible.
- D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E.

3.4 INSTALLATION OF WARNING TAPE

- A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes.
- B. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.
- C. Locate tape so as to be readily visible from the point of normal approach.

3.5 INSTALLATION OF PIPE LABELS

- A. Piping Color Coding: Match surrounding finishes except for label.
- B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
- C. Stenciled Pipe Label Option: Stenciled labels showing service and flow direction may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- D. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Within 3 ft. of each valve and control device.
 - 2. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 3. Within 3 ft. of equipment items and other points of origination and termination.

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4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.
- E. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.
- F. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- G. Pipe-Label Color Schedule:
 1. Domestic Cold-Water Piping: White letters on an ANSI Z535.1 safety-green background.
 2. Domestic Hot-Water Piping: White letters on an ANSI Z535.1 safety-green background

3.6 INSTALLATION OF VALVE TAGS

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
 1. Valve-Tag Size and Shape:
 - a. Domestic Cold Water: 2 inches, round.
 - b. Domestic Hot Water: 2 inches, round.
 2. Valve-Tag Colors:
 - a. For each piping system, use the same lettering and background coloring system on valve tags as used in the piping system labels and background.

3.7 INSTALLATION OF WARNING TAGS

- A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.
- B. Attach warning tags, with proper message, to equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of the manufacturer, fabricator, type, description, and size, as well as ASTM standard designation and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
 - 1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.
- B. Products do not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

-
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.
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. Owens Corning.
 2. Preformed Pipe Insulation, Type II, Class 1: Unfaced.
 3. Preformed Pipe Insulation, Type II, Class 2: With factory-applied PSK jacket.
 4. Fabricated shapes in accordance with ASTM C450, ASTM C585, and ASTM C1639.
 5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I for tubular materials.
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. Armacell LLC.
- H. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.
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. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Owens Corning.
 2. Preformed Pipe Insulation: Type I, Grade A with factory-applied PSK jacket.
 3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
 4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. Mineral Wool, Preformed Pipe: Mandrel-wound mineral wool fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to 1200 deg F in accordance with ASTM C447. Comply with ASTM C547.
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:

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- a. Johns Manville; a Berkshire Hathaway company.
 - b. Owens Corning.
2. Preformed Pipe Insulation: Type II, Grade A with factory-applied PSK jacket.
 3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.

2.3 INSULATING CEMENTS

- A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.
 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. Ramco Insulation, Inc.
- B. Glass-Fiber and Mineral Wool Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.
 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. Ramco Insulation, Inc.

2.4 ADHESIVES

- A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
 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. Foster Brand; H. B. Fuller Construction Products.
- C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
 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. Armacell LLC.

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2. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
 3. Wet Flash Point: Below 0 deg F.
 4. Service Temperature Range: 40 to 200 deg F.
 5. Color: Black.
- D. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
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. Foster Brand; H. B. Fuller Construction Products.
- E. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
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. Foster Brand; H. B. Fuller Construction Products.

2.5 MASTICS AND COATINGS

- A. Materials are compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
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. Knauf Insulation.
 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 5. Color: White.
- C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.
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. Foster Brand; H. B. Fuller Construction Products.
 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 3. Service Temperature Range: 0 to 180 deg F.
 4. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
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. Knauf Insulation.
 2. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Color: White.

2.6 LAGGING ADHESIVES

- A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.
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. Foster Brand; H. B. Fuller Construction Products.
 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 3. Service Temperature Range: 0 to plus 180 deg F.
 4. Color: White.

2.7 SEALANTS

- A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:
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. Foster Brand; H. B. Fuller Construction Products.
 - b. Owens Corning.
2. Permanently flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 58 to plus 176 deg F.
 4. Color: White or gray.
- C. FSK and Metal Jacket Flashing Sealants:
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. Foster Brand; H. B. Fuller Construction Products.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: Aluminum.
- D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
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. Foster Brand; H. B. Fuller Construction Products.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: White.

2.8 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. PSK Jacket: Aluminum foil fiberglass reinforced scrim with polyethylene backing, complying with ASTM C1136, Type II.

2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.10 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
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. 3M Industrial Adhesives and Tapes Division.
 - b. Knauf Insulation.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
 - 8.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
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. 3M Industrial Adhesives and Tapes Division.
 - b. Knauf Insulation.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
- D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.

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3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

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1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

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3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation conforms to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe

- insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
 - 2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

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4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install prefabricated pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
 2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
 2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF FIELD-APPLIED JACKETS

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.

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4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless steel jackets.

3.11 FIELD QUALITY CONTROL

- A. Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.12 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Underground piping.

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2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation is one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - d. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.
2. NPS 1-1/4 and Larger: Insulation is one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - d. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

B. Domestic Hot Water:

1. NPS 1-1/4 and Smaller: Insulation is one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - d. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation is one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - c. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.

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PLUMBING PIPING INSULATION

C. Piping, Concealed:

1. Aluminum, Smooth: 0.020 inch thick.

D. Piping, Exposed:

1. None.
2. Aluminum, Smooth: 0.020 inch thick.

END OF SECTION 22 07 19

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Piping joining materials.
4. Dielectric fittings.

B. Related Requirements:

1. MASS-B for water-service piping outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. System purging and disinfecting activities report.
- C. Field quality-control reports.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B88, Type L.
- B. Annealed-Temper Copper Tube: ASTM B88, Type L.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- G. Wrought Copper Unions: ASME B16.22.
- H. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.
 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. T-DRILL Industries Inc.
 2. Description: Tee formed in copper tube in accordance with ASTM F2014.
- I. Submit press fittings for approval.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe:
 - 1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Standard-Pattern, Mechanical-Joint Fittings:
 - 1. AWWA C110/A21.10, ductile or gray iron.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Compact-Pattern, Mechanical-Joint Fittings:
 - 1. AWWA C153/A21.53, ductile iron.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B32, lead-free alloys.
- D. Flux: ASTM B813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Dielectric unions are not permitted on this project.

C. Dielectric Flanges:

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. Central Plastics Company.
 - b. WATTS.
 - c. Zurn Industries, LLC.
2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

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. Central Plastics Company.
2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

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. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
 - b. Elster Perfection; a Honeywell Company.
 - c. Precision Plumbing Products.
 - d. Sioux Chief Manufacturing Company, Inc.
2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.

5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:
 1. Annealed-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
 1. Drawn-temper or annealed-temper copper tube, ASTM B88, Type M; wrought-copper, solder-joint fittings; and brazed joints. To be used fo
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 1. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
 2. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
 3. Drawn-temper copper tube, ASTM B88, Type L; copper push-on-joint fittings; and push-on joints.
 4. PEX tube, NPS 1 and smaller.
 - a. Fittings for PEX tube:
 - 1) ASTM F1807, metal insert and copper crimp rings.
 - 2) ASTM F1960, cold expansion fittings and reinforcing rings.

3.2 EARTHWORK

- A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube in PE encasement according to ASTM A674 or AWWA C105/A21.5.
- E. Install valves according to the following:
 - 1. Section 22 05 23.12 "Ball Valves for Plumbing Piping."
 - 2. Section 22 05 23.13 "Butterfly Valves for Plumbing Piping."
 - 3. Section 22 05 23.14 "Check Valves for Plumbing Piping."
 - 4. Section 22 05 23.15 "Gate Valves for Plumbing Piping."
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Domestic Water Piping Specialties."
- G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

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- O. Install piping free of sags and bends.
 - P. Install fittings for changes in direction and branch connections.
 - Q. Install PEX tubing with loop at each change of direction of more than 90 degrees.
 - R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
 - S. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 22 05 19 "Meters and Gages for Plumbing Piping."
 - T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 11 23 "Domestic Water Pumps."
 - U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 05 19 "Meters and Gages for Plumbing Piping."
 - V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
 - W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
 - X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.

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- E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
 - F. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
 - G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
 - H. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.
 - I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF TRANSITION FITTINGS

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.

3.6 INSTALLATION OF DIELECTRIC FITTINGS

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

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- C. Install hangers for copper tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
 - D. Install vinyl-coated hangers for PEX tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
 - E. Support horizontal piping within 12 inches of each fitting.
 - F. Support vertical runs of copper tubing and piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
 - G. Support vertical runs of PEX tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Provide stops and fittings as required for a complete and working installation.
 - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

3.9 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

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- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. A pneumatic test to 50psig above operating pressure may be substituted for a hydrostatic test with written approval from the owner. Match 4 hour duration from paragraph above.
 - f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - g. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.

3.12 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

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- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 11 16

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Automatic water shutoff valve systems.
5. Balancing valves.
6. Temperature-actuated, water mixing valves.
7. Strainers for domestic water piping.
8. Outlet boxes.
9. Hose stations.
10. Hose bibbs.
11. Wall hydrants.
12. Ground hydrants.
13. Post hydrants.
14. Roof hydrants.
15. Drain valves.
16. Water-hammer arresters.
17. Trap-seal primer device.
18. Trap-seal primer systems.
19. Flexible connectors.
20. Water meters.

B. Related Requirements:

1. Section 22 11 16 "Domestic Water Piping" for water piping.

1.2 DEFINITIONS

- A. AMI: Advanced Metering Infrastructure.
- B. AMR: Automatic Meter Reading.
- C. FKM: A family of fluoroelastomer materials defined by ASTM D1418.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
 - 1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Test and inspection reports.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS**2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES**

- A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 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:

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- a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. WATTS.
 - c. Zurn Industries, LLC.
2. Standard: ASSE 1001.
 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 4. Body: Bronze.
 5. Inlet and Outlet Connections: Threaded.
 6. Finish: Rough bronze.
- B. Hose-Connection Vacuum Breakers:
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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. WATTS.
 - c. Woodford Manufacturing Company.
 - d. Zurn Industries, LLC.
 2. Standard: ASSE 1011.
 3. Body: Bronze, nonremovable, with manual drain.
 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 5. Finish: Rough bronze.

2.4 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
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. WATTS.
 2. Standard: ASSE 1013.
 3. Operation: Continuous-pressure applications.
 4. Size: as indicated on drawings.
 5. Design Flow Rate: as indicated on drawings.
 6. Pressure Loss at Design Flow Rate: 5 psig for sizes NPS 2 and smaller;
 7. Body: Bronze or stainless steel for NPS 2 and smaller.
 8. End Connections: Threaded for NPS 2 and smaller.
 9. Configuration: Designed for horizontal, straight-through flow.
 10. Accessories:
 - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.

b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Backflow-Preventer Test Kits:

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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. WATTS.
 - c. Zurn Industries, LLC.
2. Description: Factory calibrated, with gauges, fittings, hoses, and carrying case with test-procedure instructions.

2.5 HOSE BIBBS

A. Garden hose type Hose Bibbs:

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. Woodford Manufacturing Company.
2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze.
10. Finish for Service Areas: Rough bronze.
11. Operation for Equipment Rooms: Wheel or lever handle.
12. Operation for Service Areas: Wheel or lever handle.

B. Water fill station type Hose Bibbs:

1. Standard: All components to be NSF 61 certified for potable water.
2. Body Material: Bronze.
3. Supply Connections: NPS 1-1/2 threaded or solder.
4. Outlet Connection: 1-1/2 inch threaded, matching existing
5. Pressure Rating: 125 psig.
6. Vacuum Breaker: Field-installation, nonremovable, drainable, vacuum breaker complying with NSF 61 and ASSE.

7. Finish: Rough bronze.
8. Operation: lever handle.

2.6 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.7 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

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. Precision Plumbing Products.
 - b. Sioux Chief Manufacturing Company, Inc.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Diaphragm.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.8 TRAP-SEAL PRIMER SYSTEMS**A. Trap-Seal Primer Systems:**

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. Precision Plumbing Products.
2. Standard: ASSE 1044.
3. Inlet Size: NPS 3/4, ASTM B88, Type L; copper, water tubing.
4. Cabinet: Surface-mounted steel box with stainless steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120 V ac power.
 - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: Four.
8. Size Outlets: NPS 1/2.

2.9 FLEXIBLE CONNECTORS

- A. 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:
 1. Metraflex Company (The).
- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 1. Working-Pressure Rating: Minimum 200 psig.
 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
- C. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.
 1. Working-Pressure Rating: Minimum 200 psig.
 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

PART 3 - EXECUTION**3.1 INSTALLATION OF PIPING SPECIALTIES**

- A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
- C. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 PIPING CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 CONTROL CONNECTIONS

- A. Connect control wiring in accordance with Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Trap-seal primer systems.

- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.6 ADJUSTING

- A. Adjust each reduced-pressure-principle backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
 - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

- C. Prepare test and inspection reports.

END OF SECTION 22 11 19

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Hub-and-spigot, cast-iron soil pipe and fittings.
 2. Hubless, cast-iron soil pipe and fittings.
 3. Galvanized-steel pipe and fittings.
 4. Stainless steel drainage pipe and fittings.
 5. Ductile-iron pipe and fittings.
 6. Copper tube and fittings.
 7. ABS pipe and fittings.
 8. PVC pipe and fittings.
 9. Specialty pipe fittings.
 10. Encasement for underground metal piping.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.3 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.5 WARRANTY

- A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10 ft. head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment":
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Component Importance Factor: 1.0.

2.2 PIPING MATERIALS

- A. Piping materials to bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 ABS PIPE AND FITTINGS

- A. 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:
 - 1. Charlotte Pipe and Foundry Company.
- B. NSF Marking: Comply with NSF 14 for plastic piping components. Include "NSF-dwv" marking for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- C. Solid-Wall ABS Pipe: ASTM D2661, Schedule 40.
- D. Cellular-Core ABS Pipe: ASTM F628, Schedule 40.
- E. ABS Socket Fittings: ASTM D2661, made in accordance with ASTM D3311, drain, waste, and vent patterns.
- F. Solvent Cement: ASTM D2235.

2.4 PVC PIPE AND FITTINGS

- A. 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:
 - 1. Charlotte Pipe and Foundry Company.
- B. Comply with NSF 14 for plastic piping components. Include "NSF-dwv" marking for plastic drain, waste, and vent piping and "NSF-sewer" marking for plastic sewer piping.
- C. Solid-Wall PVC Pipe: ASTM D2665 drain, waste, and vent.
- D. Cellular-Core PVC Pipe: ASTM F891, Schedule 40.
- E. PVC Socket Fittings: ASTM D2665, made in accordance with ASTM D3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- F. Adhesive Primer: ASTM F656.
- G. Solvent Cement: ASTM D2564.

2.5 SPECIALTY PIPE FITTINGS**A. Transition Couplings:**

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:
 - a. 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:
 - 1) Fernco Inc.
 - b. Standard: ASTM C1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. End Connections: Same size as and compatible with pipes to be joined.
 - e. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C564, rubber.
 - 2) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926 PVC.
 - 3) For Dissimilar Pipes: ASTM D5926 PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
 - a. 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:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company, LLC; a division of MCP Industries.
 - b. Standard: ASTM C1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. End Connections: Same size as and compatible with pipes to be joined.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
 - 1) Not permitted on this project.
3. Dielectric Flanges:
 - a. 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:
 - 1) Central Plastics Company.
 - 2) WATTS.
 - 3) Zurn Industries, LLC.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Factory-fabricated, bolted, companion-flange assembly.
 - 3) Pressure Rating: 125 psig minimum at 180 deg F.
 - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Insulating Kits:
 - a. 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:
 - 1) Central Plastics Company.
 - b. Description:
 - 1) Nonconducting materials for field assembly of companion flanges.
 - 2) Pressure Rating: 150psig.
 - 3) Gasket: Neoprene or phenolic.
 - 4) Bolt Sleeves: Phenolic or polyethylene.
 - 5) Washers: Phenolic with steel backing washers.
5. Dielectric Nipples:
 - a. 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:

- 1) Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
- 2) Precision Plumbing Products.

b. Description:

- 1) Standard: IAPMO PS 66.
- 2) Electroplated steel nipple.
- 3) Pressure Rating: 300 psig at 225 deg F.
- 4) End Connections: Male threaded or grooved.
- 5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.

- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment".
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- L. Lay buried building waste piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 3. Maintain swab in piping and pull past each joint as completed.
- M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Waste Piping: Two percent downward in direction of flow.
 - 3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.
- N. Install aboveground ABS piping in accordance with ASTM D2661.
- O. Install aboveground PVC piping in accordance with ASTM D2665.
- P. Install underground ABS and PVC piping in accordance with ASTM D2321.
- Q. Install engineered soil and waste and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

R. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 - b. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
2. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

T. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join in accordance with ASTM D2235 and ASTM D2661 appendixes.
3. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in ODs.
 - 2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
 - 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits, or nipples.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment".
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42 clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Ft. and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Ft. if Indicated: MSS Type 49, spring cushion rolls.
 - 5. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52 spring hangers.

- C. Install hangers for ABS and PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

- D. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

- E. Support vertical runs of ABS and PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for cleanouts and drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
 - 6. Equipment: Connect waste piping as indicated.
 - a. Provide shutoff valve if indicated and union for each connection.
 - b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections in accordance with the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

- A. Aboveground, soil and waste piping NPS 4 and smaller are to be any of the following:
 1. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- B. Aboveground, vent piping NPS 4 and smaller is to be any of the following:
 1. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Underground, soil, waste, and vent piping NPS 4 and smaller are to be any of the following:
 1. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Underground, soil and waste piping NPS 5 and larger are to be any of the following:
 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
 - 1. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
 - 2. Section 07 72 00 "Roof Accessories" for preformed flashings.
 - 3. Section 07 84 13 "Penetration Firestopping" for through-penetration firestop assemblies.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile butadiene styrene.
- B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Show fabrication and installation details for frost-resistant vent terminals.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS**2.1 ASSEMBLY DESCRIPTIONS**

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

- A. Plastic Floor Cleanouts:
 - 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. Sioux Chief Manufacturing Company, Inc.
 - b. Zurn Industries, LLC.
 - 2. Size: Same as connected branch.
 - 3. Body: PVC.
 - 4. Closure Plug: PVC.
 - 5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Floor-Drain, Trap-Seal Primer Fittings:
 - 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 - 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- B. Air-Gap Fittings:
 - 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 - 2. Body: Bronze or cast iron.
 - 3. Inlet: Opening in top of body.

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4. Outlet: Larger than inlet.
 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- C. Stack Flashing Fittings:
1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
 2. Size: Same as connected stack vent or vent stack.
- D. Frost-Resistant Vent Terminals:
1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
 2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- E. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

- F. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- G. Install wood-blocking reinforcement for wall-mounting-type specialties.
- H. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
 - 1. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 13 19.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Floor drains.
 - 2. Floor sinks.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene styrene.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene.
- D. PE: Polyethylene.
- E. PP: Polypropylene.
- F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

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. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. WATTS.
 - e. Zurn Industries, LLC.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Backwater Valve: Not required.
9. Coating on Interior and Exposed Exterior Surfaces: Not required.
10. Sediment Bucket: Not required.
11. Top or Strainer Material: Nickel bronze.
12. Top of Body and Strainer Finish: Nickel bronze.
13. Top Shape: Round.
14. Dimensions of Top or Strainer: .
15. Top Loading Classification: Medium Duty.
16. Funnel: Not required.
17. Inlet Fitting: Not required.
18. Trap Material: Cast iron.
19. Trap Pattern: Standard P-trap.
20. Trap Features: With trap-primer inlet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.

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3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 22 13 19 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Install piping adjacent to equipment to allow service and maintenance.
- D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

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- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19.13

SECTION 22 42 13.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Floor-mounted, bottom-outlet water closets.
 2. Flushometer valves.
 3. Toilet seats.

1.2 DEFINITIONS

- A. Standard-Efficiency Flush Volume: 1.6 gal. per flush.
- B. High-Efficiency Flush Volume: 1.28 gal. or less per flush.
- C. WaterSense Fixture: Water closet and/or flushometer valve/tank certified by the EPA to meet the WaterSense performance criteria.

1.3 ACTION SUBMITTALS

- A. Product Data:
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

A. Standards:

1. Comply with ASME A112.19.2/CSA B45.1 for water closets.
2. Comply with ASME A112.19.5/CSA B45.15 for flush valves and spuds for water closets and tanks.
3. Comply with ASSE 1037/ASME A112.1037/CSA B125.37 for flush valves.
4. Comply with IAMPO/ANSI Z124.5 for water-closet (toilet) seats.
5. Comply with ICC A117.1 for ADA-compliant water closets.
6. Comply with ASTM A1045 for flexible PVC gaskets used in connection of vitreous china water closets to sanitary drainage systems.
7. Comply with ASME A112.4.3 for plastic fittings used in connection of vitreous china water closets to sanitary drainage systems.

2.2 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets - Floor Mounted, Bottom Outlet, Top Spud: .

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. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC.
2. Source Limitations: Obtain water closets from single source from single manufacturer.
3. Bowl:
 - a. Material: Vitreous china.
 - b. Type: Siphon jet.
 - c. Style: Flushometer valve.
 - d. Height: ADA compliant.
 - e. Rim Contour: Elongated.
 - f. Water Consumption: 1.28 gal. per flush.
 - g. Spud Size and Location: NPS 1-1/2; top.
 - h. Color: White.

2.3 FLUSHOMETER VALVES

A. Flushometer Valves - Diaphragm, Lever Handle:

1. Source Limitations: Obtain flushometer valve from single source from single manufacturer.
2. Minimum Pressure Rating: 125 psig.
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Style: Exposed.
6. Flushometer-Valve Finish: Chrome-plated.
7. Handle Finish: Chrome-plated.
8. Consumption: 1.28 gal. per flush.
9. Minimum Inlet: NPS 1.
10. Minimum Outlet: NPS 1-1/4.

2.4 TOILET SEATS

A. Toilet Seats:

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. American Standard.
 - b. Bemis Manufacturing Company.
 - c. Kohler Co.
 - d. TOTO USA, INC.
 - e. Zurn Industries, LLC.
2. Source Limitations: Obtain toilet seat from single source from single manufacturer.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.
10. Surface Treatment: Not required.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Water-Closet Installation:
 - 1. Install level and plumb.
 - 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
- B. Flushometer-Valve Installation:
 - 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 - 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
 - 4. Install actuators in locations easily reachable for people with disabilities.
 - 5. Install new batteries in battery-powered, electronic-sensor mechanisms.
- C. Install toilet seats on water closets.
- D. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 - 3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
 - 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to water-closet color.
 - 3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 PIPING CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.13

SECTION 22 42 16.13 - COMMERCIAL LAVATORIES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Vitreous-china, wall-mounted lavatories.
 - 2. Manually operated lavatory faucets.
 - 3. Supply fittings.
 - 4. Waste fittings.
 - 5. Lavatory supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS**2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES**

- A. Lavatory - Vitreous China, Wall Mounted, with Back:
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. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC.
 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Nominal Size: Rectangular, 22 by 18 inches.
 - d. Faucet-Hole Punching: Three holes, 2-inch centers.
 - e. Faucet-Hole Location: Top.
 - f. Color: White.
 - g. Mounting Material: Chair carrier.
 3. Lavatory Mounting Height: ABA.

2.2 MANUALLY OPERATED LAVATORY FAUCETS

- A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Lavatory Faucets - Manual Type: Two-Handle Mixing:
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. American Standard.
 - b. Chicago Faucets; Geberit Company.
 - c. Delta Faucet Company.
 - d. Elkay.

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- e. Gerber Plumbing Fixtures LLC.
 - f. Just Manufacturing.
 - g. Kohler Co.
 - h. Moen Incorporated.
 - i. Zurn Industries, LLC.
2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 4. Body Type: Widespread.
 5. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
 6. Finish: Polished chrome plate.
 7. Maximum Flow Rate: 0.5 gpm.
 8. Mounting Type: Deck, exposed.
 9. Valve Handle(s): two lever.
 10. Spout: Rigid type.
 11. Spout Outlet: Aerator.
 12. Drain: Not part of faucet.

2.3 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel handle.
- F. Risers:
 1. NPS 1/2.
 2. ASME A112.18.6/CSA B125.6, braided- or corrugated-stainless steel, flexible hose riser.

2.4 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

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- C. Trap:
1. Size: NPS 1-1/4.
 2. Material:
 - a. Chrome-plated, one-piece, cast-brass trap with swivel 0.029-inch-thick tubular brass wall bend; and chrome-plated, brass or steel wall flange.

2.5 LAVATORY SUPPORTS

- A. Lavatory Carrier:
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. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. WATTS.
 - d. Zurn Industries, LLC.
 2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb in accordance with roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.

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- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.
 - E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."
 - F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.13

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS**2.1 GENERAL MOTOR REQUIREMENTS**

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment stands.
8. Equipment supports.

- B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 05 16 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
4. Section 23 31 13 "Metal Ducts" for duct hangers and supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Pipe support and bracing.
 2. Metal framing systems.
 3. Equipment supports.

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- C. Delegated-Design Submittal: For pipe support and bracing and equipment support and bracing.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design pipe support and bracing, and equipment support and bracing.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS**A. MFMA Manufacturer Metal Framing Systems:**

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. Cooper B-line; brand of Eaton, Electrical Sector.
 - b. Unistrut; Atkore International.
2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturred lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Paint Coating: Match surrounding finishes.

2.5 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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. Cooper B-line; brand of Eaton, Electrical Sector.
 - b. Hilti, Inc.

2. Indoor Applications: Zinc-coated steel.
3. Outdoor Applications: Stainless steel.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- D. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

-
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

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- E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

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18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

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9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include

auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

- a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- N. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Delegated design – deferred submittal
- B. Related Requirements:
 - 1. Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.

1.3 DEFINITIONS

- A. Designated Seismic System: An HVAC component that requires design in accordance with ASCE/SEI 7, Ch. 13, and for which the Component Importance Factor is greater than 1.0.
- B. IBC: International Building Code.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Include load rating for each wind-force-restraint fitting and assembly.
 - 3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component.
 - 4. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by UL product listing, FM Approvals, or an agency acceptable to authorities having jurisdiction.
 - 5. Annotate to indicate application of each product submitted and compliance with requirements.

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6. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases.
 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal:
1. For each seismic-restraint device, including seismic-restrained mounting, snubber, seismic restraint, seismic-restraint accessory, and concrete anchor and insert, that is required by this Section or is indicated on Drawings, submit the following:
 - a. Seismic Restraint, and Vibration Isolation Base Selection: Select vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.
 - b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
 - c. Concrete Anchors and Inserts: Include calculations showing anticipated seismic and wind loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
 - d. Seismic Design Calculations: Submit all input data and loading calculations prepared under "Seismic Design Calculations" Paragraph in "Performance Requirements" Article.
 - e. Qualified Professional Engineer: All designated-design submittals for seismic- and wind-restraint calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.
 2. Seismic-Restraint Detail Drawing:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.
 3. All delegated-design submittals for seismic- and wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.

4. Product Listing, Preapproval, and Evaluation Documentation: By UL, FM Approvals, or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and basis for approval (tests or calculations).
5. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
6. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer.
- C. Welding certificates.
- D. Seismic Qualification Data: Provide special certification for designated seismic systems as indicated in ASCE/SEI 7-16, Paragraph 13.2.2, "Special Certification Requirements for Designated Seismic Systems" for all Designated Seismic Systems identified as such on Drawings or in the Specifications.
 1. Provide equipment manufacturer's written certification for each designated active mechanical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7 and AHRI 1270, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction.
 2. Provide equipment manufacturer's written certification that components with hazardous contents maintain containment following the design earthquake by methods required in.
 3. Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by a licensed professional engineer.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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- C. Seismic-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: UL product listing, FM Approvals, or an agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design seismic load control system.
1. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7-16.
- B. Seismic Design Calculations:
1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-16. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is the edition intended as reference throughout the Section Text.
 - a. Data indicated below to be determined by Delegated-Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
 - b. Building Risk Category: Match Structural.
 - c. Building Site Classification: Match Structural.
 2. Calculation Factors, ASCE/SEI 7-16, Ch. 13 - Seismic Design Requirements for Nonstructural Components: All section, paragraph, equation, and table numbers refer to ASCE/SEI 7-16 unless otherwise noted.
 - a. Horizontal Seismic Design Force F_p : Match Structural
 - 1) S_{DS} = Spectral Acceleration: Match Structural. Value applies to all components on Project.
 - 2) z = Height in Structure of Point of Attachment of Component for Base: Determine from Project Drawings for each component by Delegated-Design Contractor. For items at or below the base, "z" shall be taken as zero.
 - 3) h = Average Roof Height of Structure for Base: Determine from Project Drawings by Delegated-Design Contractor.
 - b. Vertical Seismic Design Force: Match Structural

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- c. Seismic Relative Displacement D_{pl} : Match Structural
- 1) D_p = Relative Seismic Displacement that Each Component Must Be Designed to Accommodate: Match Structural
 - 2) I_e = Structure Importance Factor: 1.0. Value applies to all components on Project.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 INSTALLATION OF VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICES

- A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.
- B. Provide seismic-restraint devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

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- C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."
- D. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- E. Comply with requirements in Section 07 72 00 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- F. Equipment Restraints:
1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Piping Restraints:
1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- H. Install seismic-restraint cables so they do not bend across edges of adjacent equipment or building structure.
- I. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- J. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- K. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- L. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- M. Mechanical Anchor Bolts:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered

during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Provide flexible connections in piping systems where they cross structural seismic joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements in Section 23 21 13 "Hydronic Piping" and Section 23 21 16 "Hydronic Piping Specialties" for piping flexible connections.

3.5 ADJUSTING

- A. Adjust isolators after system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 1. Perform tests and inspections.
 2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 3. Schedule test with Owner, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 4. Obtain Owner's approval before transmitting test loads to structure. Provide temporary load-spreading members.

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5. Test no fewer than four of each type and size of installed anchors and fasteners selected by Owner, or 10 percent, whichever is greater.
 6. Test to 90 percent of rated proof load of device.
 7. Measure isolator restraint clearance.
 8. Measure isolator deflection.
 9. Verify snubber minimum clearances.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Units will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 23 05 48

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Warning tape.
 - 4. Pipe labels.
 - 5. Duct labels.
 - 6. Stencils.
 - 7. Valve tags.
 - 8. Warning tags.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve-numbering scheme.
- E. Valve Schedules: Provide for each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 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:

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- a. Brady Corporation.
 - b. Craftmark Pipe Markers.
 - c. Seton Identification Products; a Brady Corporation company.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
 3. Letter and Background Color: As indicated for specific application under Part 3.
 4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

- A. 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:
1. Brady Corporation.
 2. Craftmark Pipe Markers.
 3. Seton Identification Products; a Brady Corporation company.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
- C. Letter and Background Color: As indicated for specific application under Part 3.
- D. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless steel rivets or self-taping screws.

- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA70E.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 WARNING TAPE

- A. 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:
 - 1. Brady Corporation.
 - 2. Craftmark Pipe Markers.
 - 3. Seton Identification Products; a Brady Corporation company.
- B. Material: Vinyl.
- C. Minimum Thickness: 0.005 inch.
- D. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.
- E. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.
- F. Maximum Temperature: 160 deg F.
- G. Minimum Width: 4 inches.

2.4 PIPE LABELS

- A. 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:
 - 1. Brady Corporation.
 - 2. Craftmark Pipe Markers.
 - 3. Seton Identification Products; a Brady Corporation company.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
- C. Letter and Background Color: As indicated for specific application under Part 3.
- D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

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- E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
 - F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
 - 1. Pipe size.
 - 2. Flow-Direction Arrows: Include flow-direction arrows on distribution piping. Arrows may be either integral with label or applied separately.
 - 3. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.5 DUCT LABELS

- A. 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:
 - 1. Brady Corporation.
 - 2. Craftmark Pipe Markers.
 - 3. Seton Identification Products; a Brady Corporation company.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter and Background Color: As indicated for specific application under Part 3.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings. Also include the following:
 - 1. Duct size.
 - 2. Flow-Direction Arrows: Include flow-direction arrows on distribution ducts. Arrows may be either integral with label or may be applied separately.
 - 3. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.6 STENCILS**A. Stencils for Piping:**

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. Craftmark Pipe Markers.
2. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Aluminum, brass, or fiberboard.
4. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel. Paint may be in pressurized spray-can form.
6. Letter and Background Color: As indicated for specific application under Part 3.

B. Stencils for Ducts:

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. Craftmark Pipe Markers.
2. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances of up to 15 ft. and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel. Paint may be in pressurized spray-can form.
6. Letter and Background Color: Color as indicated for specific application under Part 3.

C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

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. Craftmark Pipe Markers.
2. Lettering Size: Minimum letter height of 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, acrylic enamel. Paint may be in pressurized spray-can form.
6. Letter and Background Color: As indicated for specific application under Part 3.

2.7 VALVE TAGS

- A. 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:
1. Brady Corporation.
 2. Craftmark Pipe Markers.
 3. Seton Identification Products; a Brady Corporation company.
- B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Brass, 0.04-inch or aluminum, 0.031-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass link chain or beaded chain.
- C. Letter and Background Color: As indicated for specific application under Part 3.
- D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Include valve-tag schedule in operation and maintenance data.

2.8 WARNING TAGS

- A. 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:
1. Brady Corporation.
 2. Craftmark Pipe Markers.
 3. Seton Identification Products; a Brady Corporation company.
- B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
1. Size: Approximately 4 by 7 inches.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

- A. Permanently fasten labels on each item of mechanical equipment.
- B. Sign and Label Colors:
 - 1. White letters on an ANSI Z535.1 safety-blue background.
- C. Locate equipment labels where accessible and visible.
- D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

3.4 INSTALLATION OF WARNING TAPE

- A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes.
- B. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.
- C. Locate tape so as to be readily visible from the point of normal approach.

3.5 INSTALLATION OF PIPE LABELS

- A. Piping Color Coding: Match surrounding finishes except for label.
- B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
- C. Stenciled Pipe Label Option: Stenciled labels showing service and flow direction may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- D. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Within 3 ft. of each valve and control device.
 - 2. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 3. Within 3 ft. of equipment items and other points of origination and termination.
 - 4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping, ductwork, and equipment.
- E. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.
- F. Flow-Direction Arrows: Use arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- G. Pipe-Label Color Schedule:
 - 1. Flammable Gases: Black letters on an ANSI Z535.1 safety-yellow background.

3.6 INSTALLATION OF DUCT LABELS

- A. Install self-adhesive duct labels showing service and flow direction with permanent adhesive on air ducts.
 - 1. Provide labels in the following color codes:
 - a. For air supply ducts: White letters on blue background.
 - b. For air return ducts: White letters on blue background.
 - c. For exhaust-, outside-, relief-, return-, and mixed-air ducts: White letters on blue background.

- B. Stenciled Duct-Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.
 - 1. For all air ducts: Black letters on white background.
- C. Locate label near each point where ducts enter into and exit from concealed spaces and at maximum intervals of 20 ft. where exposed or are concealed by removable ceiling system.
- D. Stenciled Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
 - 1. Black letters on White background.

3.7 INSTALLATION OF VALVE TAGS

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below.
 - 1. Valve-Tag Size and Shape:
 - a. Gas: 2 inches, round.
 - 2. Valve-Tag Colors:
 - a. For each piping system, use the same lettering and background coloring system on valve tags as used for the Pipe Label Schedule text and background.

3.8 INSTALLATION OF WARNING TAGS

- A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.
- B. Attach warning tags, with proper message, to equipment and other items where required.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Testing, Adjusting, and Balancing of Air Systems:
 - a. Constant-volume air systems.
 - 2. Testing, adjusting, and balancing of equipment.
 - 3. Testing, adjusting, and balancing of existing HVAC systems and equipment.
 - 4. Procedures for exhaust hoods.
 - 5. Sound tests.
 - 6. Vibration tests.
 - 7. Duct leakage tests verification.
 - 8. Pipe leakage tests verification.
 - 9. HVAC-control system verification.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.
- G. UFAD: Underfloor air distribution.

1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: Conduct a TAB conference after approval of the TAB strategies and procedures plan, to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 1. Instrument type and make.
 2. Serial number.
 3. Application.
 4. Dates of use.
 5. Dates of calibration.

1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications, Certified by NEBB:

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1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB.
 2. TAB Technician: Employee of the TAB specialist and certified by NEBB.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- D. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, engage a TAB specialist with NEBB certifications.

3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data, including fan and pump curves.
1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

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- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
 - G. Examine test reports specified in individual system and equipment Sections.
 - H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
 - I. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainer baskets are installed and clean.
 - J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
 - K. Examine operating safety interlocks and controls on HVAC equipment.
 - L. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
 - M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
 - 1. Motors.
 - 2. Fans.
 - 3. Radiant heaters.
 - 4. Unit heaters.
 - 5. Heat exchangers.
 - 6. Air-handling units.

3.6 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' Record drawings duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

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- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
 - E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 - F. Verify that motor starters are equipped with properly sized thermal protection.
 - G. Check dampers for proper position to achieve desired airflow path.
 - H. Check for airflow blockages.
 - I. Check for proper sealing of air-handling-unit components.

3.7 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
 - c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

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- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
 2. Adjust submain and branch duct volume dampers for specified airflow.
 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 2. Measure inlets and outlets airflow.
 3. Adjust each inlet and outlet for specified airflow.
 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 2. Re-measure and confirm that total airflow is within design.
 3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
 4. Mark all final settings.
 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 6. Measure and record all operating data.
 7. Record final fan-performance data.

3.8 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Phase and hertz.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter size and thermal-protection-element rating.
 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.9 HVAC CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
1. Verify HVAC control system is operating within the design limitations.
 2. Confirm that the sequences of operation are in compliance with Contract Documents.

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3. Verify that controllers are calibrated and function as intended.
 4. Verify that controller set points are as indicated.
 5. Verify the operation of lockout or interlock systems.
 6. Verify the operation of valve and damper actuators.
 7. Verify that controlled devices are properly installed and connected to correct controller.
 8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.10 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent. If design value is less than 100 cfm, within 10 cfm.
 2. Air Outlets and Inlets: Plus or minus 10 percent <Insert value>. If design value is less than 100 cfm, within 10 cfm.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.11 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

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2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents, including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Notes to explain why certain final data in the body of reports vary from indicated values.
 14. Test conditions for fans performance forms, including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Face and bypass damper settings at coils.
 - d. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - e. Variable-frequency controller settings for variable-air-volume systems.
 - f. Settings for pressure controller(s).
 - g. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes..
 3. Balancing stations.

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4. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore (if present).
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and speed.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan speed.
 - d. Inlet and discharge static pressure in inches wg.
 - e. For each filter bank, filter static-pressure differential in inches wg.
 - f. List for each internal component with pressure-drop, static-pressure differential in inches wg.
 - g. Outdoor airflow in cfm.
 - h. Return airflow in cfm.
 - i. Outdoor-air damper position.
 - j. Return-air damper position.
- F. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.

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- d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and speed.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.
 - g. Air static-pressure differential in inches wg.
 - h. Low-fire fuel input in Btu/h.
 - i. High-fire fuel input in Btu/h.
 - j. Manifold pressure in psig.
 - k. High-temperature-limit setting in deg F.
 - l. Operating set point in Btu/h.
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btu/h.
- G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in Btu/h.
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.
 - g. Rated amperage.
 - h. Airflow rate in cfm.
 - i. Face area in sq. ft..
 - j. Minimum face velocity in fpm.

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2. Test Data (Indicated and Actual Values):
 - a. Heat output in Btu/h.
 - b. Airflow rate in cfm.
 - c. Air velocity in fpm.
 - d. Entering-air temperature in deg F.
 - e. Leaving-air temperature in deg F.
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and speed.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan speed.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
 - a. System fan and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.

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- d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.
- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary airflow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final airflow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

K. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.13 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Owner.

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- B. Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 - C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 - D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.
 - E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
 - 2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.
 - F. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 11 23 - FACILITY NATURAL-GAS PIPING**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Pipes, tubes, and fittings.
 2. Piping specialties.
 3. Joining materials.
 4. Manual gas shutoff valves.
 5. Earthquake valves.
 6. Pressure regulators.
 7. Dielectric fittings.

1.2 DEFINITIONS

- A. CWP: Cold working pressure.
- B. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. An example includes rooftop locations.
- C. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.3 ACTION SUBMITTALS

- A. Product Data:
1. Piping specialties.
 2. Corrugated, stainless steel tubing with associated components.
 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 4. Pressure regulators. Indicate pressure ratings and capacities.
 5. Service meters. Indicate pressure ratings and capacities. Include supports.
 6. Dielectric fittings.

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- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates:
 - 1. Welding certificates.
- B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- C. Field Quality-Control Submittals:
 - 1. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Steel Support Welding: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. Pipe Welding: Qualify procedures and operators in accordance with the ASME Boiler and Pressure Vessel Code.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping in accordance with requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

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- D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide purging and startup of natural-gas supply in accordance with requirements indicated:
1. Notify Owner no fewer than seven days in advance of proposed interruption of natural-gas service.
 2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed and concealed behind finished surfaces. Comply with requirements in Section 08 31 13 "Access Doors and Frames."
- C. Coordinate requirements for piping identification for natural-gas piping. Comply with requirements in Section 22 05 53 "Identification of Plumbing Piping and Equipment."

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each product type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Comply with the International Fuel Gas Code.
- B. Minimum Operating-Pressure Ratings:
1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 2. Service Regulators: 65 psig minimum unless otherwise indicated.
 3. Minimum Operating Pressure of Service Meter: 2 psig.

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- C. Natural-Gas System Pressure within Buildings:
1. Single Pressure: More than 0.5 psig, but not more than 2 psig.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Seismic Performance: Natural-gas piping system is to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
1. The term "withstand" means "the piping system will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the piping system will be fully operational after the seismic event."
 2. Component Importance Factor: 1.0.

2.3 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum O-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

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6. Mechanical Couplings:
- a. 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:
 - 1) Baker Hughes Company.
 - 2) Smith-Blair, a Xylem brand.
 - 3) Viega LLC.
 - b. Steel flanges and tube with epoxy finish.
 - c. NBR seals.
 - d. Steel bolts, washers, and nuts.
 - e. Coupling is to be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - f. Steel body couplings installed underground on plastic pipe are to be factory equipped with anode.
- B. PE Pipe: ASTM D2513, SDR 11.
- 1. PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type with dimensions matching PE pipe.
 - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
 - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A53/A53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet is threaded or flanged or suitable for welded connection.
 - e. Tracer wire connection.
 - f. UV shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
 - 4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet connected to steel pipe complying with ASTM A53/A53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet is threaded or flanged or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. UV shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

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5. Steel Mechanical Couplings: Suitable for joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - a. 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:
 - 1) Baker Hughes Company.
 - 2) Smith-Blair, a Xylem brand.
 - b. Steel flanges and tube with epoxy finish.
 - c. Seals: NBR.
 - d. Steel bolts, washers, and nuts.
 - e. Factory-installed anode for steel-body couplings installed underground.

2.4 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Operating-Pressure Rating: 0.5 psig.
4. End Fittings: Zinc-coated steel.
5. Threaded Ends: Comply with ASME B1.20.1.
6. Maximum Length: 72 inches.

B. Y-Pattern Strainers:

1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Basket Strainers:

1. Body: ASTM A126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

E. Weatherproof Vent Cap:

1. Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.5 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.6 MANUAL GAS SHUTOFF VALVES

- A. See "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
 5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves NPS 1-1/4 to NPS 2 having initials "WOG" permanently marked on valve body.

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- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig.
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
 4. Service Mark: Initials "WOG" permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. BrassCraft Manufacturing Co.; a Masco company.
 2. Body: Bronze, complying with ASTM B584.
 3. Ball: Chrome-plated brass.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
 7. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. BrassCraft Manufacturing Co.; a Masco company.
 2. Body: Bronze, complying with ASTM B584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
 8. CWP Rating: 600 psig.

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9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
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. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. BrassCraft Manufacturing Co.; a Masco company.
 2. Body: Bronze, complying with ASTM B584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. Bronze Plug Valves: MSS SP-78.
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. Lee Brass Company.
 2. Body: Bronze, complying with ASTM B584.
 3. Plug: Bronze.
 4. Ends: Threaded, socket, or flanged as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
 5. Operator: Square head or lug type with tamperproof feature where indicated.
 6. Pressure Class: 125 psig.
 7. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

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. Mueller Co.
2. Body: Cast iron, complying with ASTM A126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

I. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

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. Flowserve Corporation.
 - b. Mueller Co.
2. Body: Cast iron, complying with ASTM A126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

J. Valve Boxes:

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. R.W. Lyall; brand of Hubbell Utility Solutions; Hubbell Incorporated.

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2. Cast-iron, two-section box.
 3. Top section with cover with "GAS" lettering.
 4. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
 5. Adjustable cast-iron extensions of length required for depth of bury.
 6. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.7 EARTHQUAKE VALVES

- A. Earthquake Valves, Maximum Operating Pressure of 60 psig: Comply with ASCE/SEI 25.
 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. Pacific Seismic Products, Inc.
 2. Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 3. Maximum Operating Pressure: 60 psig.
 4. Cast-aluminum body with stainless steel internal parts.
 5. NBR, reset-stem O-ring seal.
 6. Valve position, open or closed, indicator.
 7. Composition valve seat with clapper held by spring or magnet locking mechanism.
 8. Level indicator.
 9. End Connections: Threaded for valves NPS 2 and smaller; flanged for valves NPS 2-1/2 and larger.

2.8 PRESSURE REGULATORS

- A. General Requirements:
 1. Single stage and suitable for natural gas.
 2. Steel jacket and corrosion-resistant components.
 3. Elevation compensator.
 4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.
- B. Appliance Pressure Regulators: Comply with ANSI Z21.18.
 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. Canadian Meter Company, LLC; a Honeywell Company.
 - b. Dormont; a WATTS brand.
 - c. Eaton.

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2. Body and Diaphragm Case: Die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: NBR.
 6. Seal Plug: UV-stabilized, mineral-filled nylon.
 7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 9. Maximum Inlet Pressure: 2 psig.

2.9 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 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. Central Plastics Company.
 - b. Jomar Valve.
 - c. WATTS.
 - d. Zurn Industries, LLC.
 2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 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. Central Plastics Company.
 - b. WATTS.
 2. Description:
 - a. Standard: ASSE 1079.
 - b. Factory-fabricated, bolted, companion-flange assembly.
 - c. Pressure Rating: 125 psig minimum at 180 deg F.

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- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

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. Calpico, Inc.
 - b. Central Plastics Company.
2. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.

2.10 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description and rated pressure of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.
- B. Label and identify gas piping and pressure outside a multitenant building by tenant.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

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- B. Inspect natural-gas piping in accordance with the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
 - C. Comply with the International Fuel Gas Code requirements for preventing accidental ignition.

3.3 INSTALLATION OF OUTDOOR PIPING

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping in accordance with ASTM D2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Install pressure gauge downstream from each service regulator. Pressure gauges are specified in Section 23 05 19 "Meters and Gauges for HVAC Piping."

3.4 INSTALLATION OF INDOOR PIPING

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

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- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
 - D. Do not install piping in concealed locations unless sleeved with the sleeve open at both ends.
 - E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 - F. Where installing piping above accessible ceilings, allow sufficient space for ceiling panel removal.
 - G. Locate valves for easy access. Do not locate valves within return air plenums.
 - H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
 - I. Install piping free of sags and bends.
 - J. Install fittings for changes in direction and branch connections.
 - K. Verify final equipment locations for roughing-in.
 - L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
 - M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
 - N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
 - O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
 - P. Connect branch piping from top or side of horizontal piping.
 - Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
 - R. Do not use natural-gas piping as grounding electrode.

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- S. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
 - T. Install pressure gauge downstream from each line regulator. Pressure gauges are specified in Section 23 05 19 "Meters and Gauges for HVAC Piping."
 - U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
 - V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
 - W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

3.5 INSTALLATION OF VALVES

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.
- F. Do not install valves in return-air plenums.

3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

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5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
1. Construct joints in accordance with AWS D10.12/D10.12M, using qualified processes and welding operators.
 2. Bevel plain ends of steel pipe.
 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints in accordance with AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, and then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join in accordance with ASTM D2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
- C. Install hangers for steel piping with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for corrugated stainless steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting.
- F. Support vertical runs of steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

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- G. Support vertical runs of corrugated stainless steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 PIPING CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas-appliance equipment grounding conductor of the circuit powering the appliance in accordance with NFPA 70.
- C. Where installing piping adjacent to appliances, allow space for service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

3.9 LABELING AND IDENTIFICATION

- A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base in accordance with seismic codes at Project. See Section 23 05 48 "Vibration and Seismic Controls for HVAC."
1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Use 3000 psig, 28-day, compressive-strength concrete and reinforcement as specified in Section 03 30 00 "Cast-in-Place Concrete."

3.11 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas in accordance with the International Fuel Gas Code and authorities having jurisdiction.
 - 2. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

3.12 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.13 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping is to be one of the following:
 - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
 - 2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
 - 3. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping is to be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller is to be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping is to be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with steel welding fittings and welded joints.

3.15 ABOVEGROUND, MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter are to be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter are to be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.
 3. Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller are to be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger are to be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.
 3. Cast-iron, nonlubricated plug valve.
- E. Valves in branch piping for single appliance are to be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.

END OF SECTION 23 11 23

SECTION 23 31 13 - METAL DUCTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
1. Single-wall rectangular ducts and fittings.
 2. Sheet metal materials.
 3. Sealants and gaskets.
 4. Hangers and supports.
 5. Seismic-restraint devices.
- B. Related Sections:
1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
1. Sealants and gaskets.
 2. Seismic-restraint devices.
- B. Shop Drawings:
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 2. Factory- and shop-fabricated ducts and fittings.
 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 4. Elevation of top and bottom of ducts.
 5. Dimensions of all duct runs from building grid lines.
 6. Fittings.
 7. Reinforcement and spacing.

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8. Seam and joint construction.
 9. Penetrations through fire-rated and other partitions.
 10. Equipment installation based on equipment being used on Project.
 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 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 with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. Seismically brace duct hangers and supports in accordance with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
1. Seismic Hazard Level (SHL): D.
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

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- E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
 - F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - 2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Transverse Joints: Fabricate joints in accordance with 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."
 - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 - 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with 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." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 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."

2.3 SHEET METAL 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.

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- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
 - C. Reinforcement Shapes and Plates: ASTM A36/A36M, 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.
 - D. 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.

2.4 SEALANT 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 in accordance with 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: 4 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.
- 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. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.**2.5 HANGERS AND SUPPORTS****A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.****B. 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."****C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.****D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.****E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.****F. Trapeze and Riser Supports:**

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.6 SEISMIC-RESTRAINT DEVICES

- A. 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:
 - 1. Cooper B-line; brand of Eaton, Electrical Sector.
 - 2. Hilti, Inc.
 - 3. Unistrut; Atkore International.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A603, galvanized-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E488/E488M.

PART 3 - EXECUTION**3.1 DUCT INSTALLATION**

- A. 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.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.

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- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
 - E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
 - F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
 - G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
 - H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
 - I. 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.
 - J. Install air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
 - K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.
 - L. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
 - M. Branch Connections: Use lateral or conical branch connections.

3.2 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 arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

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- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts at a minimum to the following seal classes in accordance with 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. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 6. Conditioned Space, Exhaust Ducts: Seal Class B.
 7. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER 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. Do not use powder-actuated concrete fasteners.
- 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.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7.
 - 1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. 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 in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "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.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use duct cleaning methodology as indicated in NADCA ACR.
- C. Use service openings for entry and inspection.
 - 1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 33 00 "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.
- D. 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.

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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.
- E. 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.
- F. 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 in accordance with NADCA ACR. 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 in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.10 STARTUP

- A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Supply Ducts:
1. Ducts in project:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4.
 - d. SMACNA Leakage Class for Round and Flat Oval: 4.
- C. Return Ducts:
1. Ducts in project:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4.
 - d. SMACNA Leakage Class for Round and Flat Oval: 4.
- D. Exhaust Ducts:
1. Ducts in project:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4.
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
1. Ducts in project:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4.
- F. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.

G. 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."

H. 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: Conical spin in.

END OF SECTION 23 31 13

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Barometric relief dampers.
 - 3. Manual volume dampers.
 - 4. Control dampers.
 - 5. Fire dampers.
 - 6. Ceiling radiation dampers.
 - 7. Smoke dampers.
 - 8. Combination fire and smoke dampers.
 - 9. Corridor dampers.
 - 10. Flange connectors.
 - 11. Duct silencers.
 - 12. Turning vanes.
 - 13. Remote damper operators.
 - 14. Duct-mounted access doors.
 - 15. Duct access panel assemblies.
 - 16. Flexible connectors.
 - 17. Duct security bars.
 - 18. Duct accessory hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

-
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, or BIM model, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved.
- B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 90A and NFPA 90B.
- B. 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.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. 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:
 - 1. Greenheck Fan Corporation.
 - 2. Ruskin Company.
- B. Description: Gravity balanced.

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C. Performance:

1. Maximum Air Velocity: 1250 fpm.
2. Maximum System Pressure: 2 inches wg.
3. Leakage:
 - a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
 - b. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
 - c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.
 - d. Class III: Leakage shall not exceed 40 cfm/sq. ft. against 1-inch wg differential static pressure.

D. Construction:

1. Frame:
 - a. Hat shaped.
 - b. 16-gauge-thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.
2. Blades:
 - a. Multiple single-piece blades.
 - b. Off-center pivoted, maximum 6-inch width, 16-gauge-thick, galvanized sheet steel with sealed edges.
3. Blade Action: Parallel.

E. Blade Seals: Neoprene, mechanically locked.

F. Blade Axles:

1. Material: Galvanized steel.
2. Diameter: 0.20 inch.

G. Tie Bars and Brackets: Galvanized steel.

H. Return Spring: Adjustable tension.

I. Bearings: synthetic pivot bushings.

J. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.

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3. Chain pulls.
 4. Screen Mounting:
 - a. Rear mounted in sleeve.
 - 1) Sleeve Thickness: 20 gauge minimum.
 - 2) Sleeve Length: 6 inches minimum.
 5. Screen Material: Galvanized steel.
 6. Screen Type: Bird.
 7. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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. Air Balance; a division of MESTEK, Inc.
 - b. Greenheck Fan Corporation.
 - c. Ruskin Company.
2. Performance:
 - a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Construction:
 - a. Linkage out of airstream.
 - b. Suitable for horizontal or vertical airflow applications.
4. Frames:
 - a. Hat-shaped, 18-gauge-thick stainless steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized steel; 16 gauge thick.

-
6. Blade Axles: Galvanized steel.
 7. Bearings:
 - a. Molded synthetic.
 - b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
 8. Tie Bars and Brackets: Galvanized steel.
 9. Locking device to hold damper blades in a fixed position without vibration.

2.4 FLANGE CONNECTORS

- A. 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:
 1. Ductmate Industries, Inc; a DMI company.
 2. DynAir; a Carlisle Company.
- B. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gauge and Shape: Match connecting ductwork.

2.5 TURNING VANES

- A. 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:
 1. Ductmate Industries, Inc; a DMI company.
 2. Duro Dyne Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply 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."
- D. Vane Construction:
 1. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.6 DUCT-MOUNTED ACCESS DOORS

- A. 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:
1. Duro Dyne Inc.
 2. Ruskin Company.
- B. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."
1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. 24-gauge-thick galvanized steel door panel.
 - d. Vision panel.
 - e. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - f. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - a. 24-gauge-thick galvanized steel.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.7 FLEXIBLE CONNECTORS

- A. 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:
1. Ductmate Industries, Inc; a DMI company.
 2. Duro Dyne Inc.
 3. DynAir; a Carlisle Company.
- B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

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- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 - D. Materials: Flame-retardant or noncombustible fabrics.
 - E. Coatings and Adhesives: Comply with UL 181, Class 1.
 - F. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel. Provide metal compatible with connected ducts.
 - G. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

2.8 DUCT ACCESSORY HARDWARE

- A. 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:
 - 1. Ductmate Industries, Inc; a DMI company.
 - 2. Duro Dyne Inc.
 - 3. DynAir; a Carlisle Company.
- B. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.9 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- C. 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.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
- E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
- F. Set dampers to fully open position before testing, adjusting, and balancing.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. Upstream from duct filters.
 - 2. At outdoor-air intakes and mixed-air plenums.
 - 3. Upstream from turning vanes.
 - 4. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.

- 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Section 23 05 53 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
 - 3. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.

END OF SECTION 23 33 00

SECTION 23 34 23 - HVAC POWER VENTILATORS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Ceiling-mounted ventilators.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
 - 2. Rated capacities, operating characteristics, and furnished specialties and accessories.
 - 3. Certified fan performance curves with system operating conditions indicated.
 - 4. Certified fan sound-power ratings.
 - 5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 6. Material thickness and finishes, including color charts.
 - 7. Dampers, including housings, linkages, and operators.
 - 8. Fan speed controllers.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators.
- C. Delegated Design Submittal: For unit hangars and supports 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. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, or BIM model, drawn to scale, showing the items described in this Section and coordinated with all building trades.
- B. Seismic Qualification Data: For fans, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity, and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Product Certificates: Submit certificates that specified equipment will withstand required wind forces, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVAC power ventilators to include in normal and emergency operation, and maintenance manuals.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

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- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design vibration isolation, supports, and seismic restraints, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- F. Seismic Performance: HVAC power ventilators shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. See Section 23 05 48 "Vibration and Seismic Controls for HVAC."
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Component Importance Factor: 1.0.

2.2 CEILING-MOUNTED VENTILATORS

- A. 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:
1. Broan-NuTone LLC.
 2. Greenheck Fan Corporation.
 3. Loren Cook Company.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel removable for service.
- D. Back-draft damper: Integral.
- E. Grille: Plastic, louvered grille with flange on intake and thumbscrew or spring retainer attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
1. Speed Controller: Speed controller to be used for balancing.
 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 3. Manufacturer's standard wall cap, and transition fittings.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 SOURCE QUALITY CONTROL

- A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.
- B. UL Standards: Power ventilators shall comply with UL 705.

PART 3 - EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:
 - 1. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
 - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

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- B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
 - C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.5 STARTUP SERVICE:

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Verify that shipping, blocking, and bracing are removed.
 - 3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 4. Verify that cleaning and adjusting are complete.
 - 5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual volume dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

- B. Lubricate bearings.
- C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.7 CLEANING

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safeties.
 - 3. Fans and components will be considered defective if they do not pass tests and inspections.
 - 4. Prepare test and inspection reports.

3.9 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 23 34 23

SECTION 23 37 13.23 - REGISTERS AND GRILLES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Adjustable blade face registers and grilles.
 - 2. Fixed face registers and grilles.
- B. Related Requirements:
 - 1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.

- B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 REGISTERS

- A. Fixed Face Register:

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. Price Industries.
 - b. Shoemaker Mfg. Co.
 - c. Titus; brand of Johnson Controls International plc, Global Products.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
5. Face Arrangement: Perforated core.
6. Core Construction: Integral.
7. Frame: 1 inch wide.

2.2 GRILLES

- A. Fixed Face Grille:

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. Price Industries.
 - b. Shoemaker Mfg. Co.
 - c. Titus; brand of Johnson Controls International plc, Global Products.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal; spaced 1/2 inch apart.
5. Face Arrangement: Perforated core.
6. Core Construction: Integral.
7. Frame: 1 inches wide.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13.23

SECTION 23 55 33.16 - GAS-FIRED UNIT HEATERS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes gas-fired unit heaters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of gas-fired unit heater.
 - 1. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings: For gas-fired unit heaters. Include plans, elevations, sections, and attachment details.
 - 1. Prepare by or under the supervision of a qualified professional engineer detailing fabrication and assembly of gas-fired unit heaters, as well as procedures and diagrams.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 4. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which equipment will be attached.
 - 2. Items penetrating wall and the following:
 - a. Vent and gas piping rough-ins and connections.

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- B. Seismic Qualification Certificates: For gas-fired unit heaters, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gas-fired unit heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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:
1. Modine Manufacturing Company.
 2. REZNOR, a brand of Nortek Global HVAC.
 3. Sterling HVAC Products; a Mestek company.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Gas-fired unit heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Seismic Fabrication Requirements: Fabricate and reinforce suspension attachments of gas-fired unit heaters, accessories mountings, and components with reinforcement strong enough to withstand seismic forces defined in Section 23 05 48 "Vibration and Seismic Controls for HVAC" Section 15074 "Vibration and Seismic Controls for HVAC" when gas-fired unit heater is anchored to building structure.
 2. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Capacities and Characteristics:
1. Gas Input: See Drawings.
 2. Gas Output: See Drawings.
 3. Annual Gas Utilization Efficiency: minimum 80 percent.
 4. Motor Enclosure: Totally enclosed, fan cooled.
 5. Electrical Characteristics:
 - a. Motor Size: See Drawings.
 - b. Volts: 120.
 - c. Phase: Single.
 - d. Hertz: 60.

2.3 MANUFACTURED UNITS

- A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.
- B. Gas Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- C. Type of Venting: Indoor, separated combustion, power vented.
- D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.
1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
 2. Discharge Louvers: Independently adjustable, horizontal blades.
 3. Discharge Nozzle: Discharge at 25 to 65 degrees (0.44 to 1.13 radians) from horizontal.
- E. Accessories:
1. Four-point suspension kit.

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2. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.
 3. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.
- F. Heat Exchanger: Aluminized or Stainless steel.
- G. Burner Material: Aluminized steel with stainless-steel inserts.
- H. Propeller Unit Fan:
1. Aluminum propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
 2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
- I. Motors:
1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
 2. Enclosure Materials: Rolled steel.
 3. Efficiency: Premium efficient.
- J. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
1. Gas Control Valve: Single stage.
 2. Ignition: Electronically controlled electric spark with flame sensor.
 3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
 4. Vent Flow Verification: Flame rollout switch.
 5. Control transformer.
 6. High Limit: Thermal switch or fuse to stop burner.
 7. Thermostat: Devices and wiring are specified in Section 23 09 23.27 "Temperature Instruments."
 8. Wall-Mounted Thermostat:
 - a. Single stage.
 - b. Fan on-off-automatic switch.
 - c. 24-V ac.
 - d. 50 to 90 deg F (10 to 32 deg C) operating range.
- K. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written instructions.

3.2 EQUIPMENT MOUNTING

- A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
- B. Substrate-Mounted Units: Provide supports connected to substrate. Secure units to supports.
 - 1. Spring hangers and seismic restraints are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
 - 2. Threaded Rods, Spring Hangers, and Building Attachments: Comply with requirements in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" and Section 23 05 48 "Vibration and Seismic Controls for HVAC."
 - 3. Threaded Rods, Spring Hangers, Building Attachments, and Seismic Restraints: Comply with requirements in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment." and Section 23 05 48 "Vibration and Seismic Controls for HVAC."
 - 4. Anchor the unit to resist code-required horizontal acceleration.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.
- C. Gas Piping: Comply with Section 23 11 23 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
- D. Vent Connections: Comply with Section 23 51 23 "Gas Vents."
- E. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

- B. Perform the following tests and inspections:
1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 2. Verify bearing lubrication.
 3. Verify proper motor rotation.
 4. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Gas-fired unit heater will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain gas-fired unit heaters.

END OF SECTION 23 55 33.16

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.
- B. The work under this division includes furnishing all materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, testing and operation of all electrical work for this project as shown on the electrical drawings specified herein.
- C. Related Work Described Elsewhere: Where other divisions require electrical materials or installations, comply with all applicable requirements herein. Provide all electrical materials and installation work required to connect, test and operate equipment required by other divisions. Electrical installations required by other divisions but not shown on the electrical drawings shall be provided.
- D. Warranty: The Contractor shall guarantee all work installed under this specification and make good, repair or replace at his own expense any defective work, materials or parts.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.
- C. Provide: To furnish and install.
- D. Wiring: Raceway, conductors and connections.

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- E. Exposed: Visible from occupied areas.
 - F. Install: To set in position and make fully operational.
 - G. Furnish: Purchase and deliver to the job site.
 - H. Required: As required by code, authority having jurisdiction or contract documents for the system and/or installation to be fully operational.

1.4 REGULATIONS

- A. Codes and Ordinances: Comply with all applicable codes, ordinances and regulations including the National Electrical Code, National Electrical Safety Code, NFPA and all other national, state and local codes and ordinances. Notify the Engineer of any noncompliance in contract documents to applicable codes and regulations prior to installation of the work. Changes in the work after initial installation due to requirements of code enforcing agencies shall be at no additional cost to the Owner.
- B. Permits: Provide and pay for all permits and fees required for this project. In addition to paying for all permits and fees, the Contractor shall be responsible for contacting the various Approving Authorities, arranging for review of shop drawings where appropriate, scheduling inspections in a timely manner, and making necessary corrections as required by the Approving Authorities.
- C. Approving Authority: It is the Contractor's responsibility to ascertain and contact the appropriate "Approving Authorities" for this project. Approving Authorities will include, but not be limited to the electrical inspector and the Fire Marshal having jurisdiction.
- D. Certificate of Inspection: Obtain a Certificate of Electrical Inspection indicating final acceptance from the local inspecting authority.
- E. Safety Measures To Be Taken: The Engineer has not been retained or compensated to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The Contractor will be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. The duty of the Engineer to conduct construction observations of the contractor's performance is not intended to include review of the adequacy of the contractor's safety measures in, on or near the construction site.

1.5 DRAWINGS AND SPECIFICATIONS

- A. Intent: The electrical drawings and specifications are intended to include all labor and materials necessary to provide a complete and operating facility. Any materials shown and called for on the drawings but not mentioned in the specifications, or vice versa, which are necessary for the proper completion of the installation or operation of the equipment, shall be

furnished the same as if specifically called for in both. By submitting a bid, the Contractor is acknowledging that he has made a thorough examination of the contract documents, existing site conditions, and has determined that these documents and conditions do sufficiently describe the scope of construction work required under this contract. Any questions regarding interpretation of the contract documents shall be made in writing in a timely manner prior to the bid date to allow reasonable time for resolution of the questions.

- B. Diagrammatic Drawings: The electrical drawings are diagrammatic and do not show exact or complete raceway and wiring configurations, routing, rating or the necessary number and types of raceway fittings or pull boxes. Provide all labor and materials required to execute the work.

1.6 SUBMITTALS AND SHOP DRAWINGS

- A. It is the Contractor's responsibility to thoroughly review vendor-assembled shop drawings, catalog cuts, etc. to ensure that these documents are complete and comply with the specifications.
- B. All submittals and shop drawings must be stamped by the Electrical Contractor and the General Contractor confirming they have been reviewed and comply with the contract documents. Submittals which are not stamped will be returned unreviewed.
- C. Submittal Format:
 - 1. General: The submittals must include all specified material. Multiple submittals will not be accepted.
 - 2. Electronic submittals can be submitted. However, bound hard copies of the distribution equipment (switchboards, transformers, distribution panels and panelboards) and lighting must be provided.
 - 3. Shop Drawings: Only one hard copy shall be provided for review. One electronic copy (PDF) will be returned.
- D. Review: The review of a manufacturer's name or product does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the contract documents. Contractor shall be solely responsible for submitting materials at such a time to allow a minimum of two weeks for Engineer's review.

1.7 OPERATIONS AND MAINTENANCE MANUALS

- A. Prepare operations and maintenance manuals for all electrical equipment installed on this project.
- B. Provide table of contents at front of manual indicating general content of each section. Provide index for each section of the manual with complete equipment catalog item or identification.
- C. The information and diagrams included must be on the specific equipment installed for this project. General "product line" information is not acceptable. The equipment model and

catalog numbers with appropriate prefixes and suffixes must be clearly indicated on the data sheets. Manuals shall contain shop drawings, schematic and wiring diagrams (showing all external connections), parts lists, operating and maintenance information. Any modifications to equipment in the field shall be updated on the drawings, diagrams, etc. to reflect the "as-built" conditions.

- D. Bind with three-screw post-type binder with heavy-duty hardboard cover and cloth backing. Imprint the edge of volume with name of the project, year of completion and the words "Electrical Equipment." Front of manual shall be imprinted with the words "Electrical Equipment," the name of the project, the name of the Owner, year completed, and name of the Architect, Engineer and Contractor. If the thickness of the manual exceeds approximately two inches, provide separate volumes, each being a maximum two inches thick. Each volume shall be imprinted as described above and include the volume number.
- E. Submit 2 CD-ROM copies of the operations and maintenance manual. Disk data is to be in Adobe Acrobat v11.0 or later. Arrange information and materials in the same order and categories as is typical of printed hard copy O&M manuals as described in this section. Disk PDF file shall include electronic "bookmarks" for each category, specification section and subsection.
- F. One preliminary copy shall be submitted to the Engineer for review 30 days prior to completion of the project. Preliminary copy shall include proposed wording for cover and back edge of the manual. Submit final bound copies for distribution as required in Division 01.

1.8 RECORD DRAWINGS

- A. A record shall be made during the progress of the project indicating the work as actually installed. Corrections and changes shall be kept up to date at all times on a separate set of record drawings kept at the job site for review. Mark-ups may be schematic as related to interior raceway systems; however, all raceways shall be shown in proper relationship with junction boxes, panelboards, devices and equipment. Raceways installed below grade shall be shown with both horizontal and vertical dimensions with an accuracy of \pm six inches.
- B. Project Closeout: The Contractor shall provide as-built drawings at completion of the project indicating work as revised, detailed and actually installed.

1.9 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.

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4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
 - C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
 - D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Firestopping."
 - E. UTILITIES SERVICES
 1. It shall be the Contractor's responsibility to contact all utility companies, including but not limited to the power company, and telephone company and verify the extent of work to be performed by the utility companies. All other labor and necessary materials, provided by the utility companies shall be provided by the Contractor.
 2. Coordination and scheduling new services with the various utility companies is the sole responsibility of the Contractor.
 3. In general, the Contractor shall be responsible for providing the following:
 - a. Trenching, backfill and compaction.
 - b. Raceways.
 - c. Manholes and vaults (including grounding).
 - d. Concrete encasement of raceways (where called out on the drawings or specified).
 - e. Obtaining all necessary permits.
 4. Service Charges: All utility service charges will be paid by the Owner.
 5. Applications for Services: It shall be the contractor's responsibility to complete and submit all required applications for service with the various utility companies.
 - F. Work of Other Trades: The electrical drawings do not show complete details of the building construction. Refer to the Architectural, Structural, Civil, Landscape, Mechanical Drawings for details which may affect the execution of this work. Specific locations of construction features shall be obtained from the reference drawings, field measurements, or the trade providing the material or equipment. No extra payments will be allowed for failure to obtain this information.
 - G. The Contractor will not be paid for work requiring reinstallation due to lack of coordination prior to installation such as removing and replacing, relocating, cutting, patching or finishing. Special attention is called to the following items and all conflicts shall be coordinated prior to installation:
 1. Light switches will be located on the "strike" side of the door.

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2. All electrical outlets, lighting fixtures and other electrical outlets and equipment are installed to avoid conflict with grilles, pipes, sprinkler heads, ducts and other mechanical equipment.
 3. Electrical outlets, lighting fixtures and equipment are to be installed in proper relation to cabinets, counters, doors and other architectural appurtenances.
 4. Electrical characteristics (HP, kVA, voltage, phase, fusing, overload protection) of actual equipment furnished under other divisions being different from that shown on the electrical drawings.

PART 2 - PRODUCTS

2.1 STANDARD OF QUALITY

- A. General: Whenever any material or equipment is specified by patent or proprietary name or by the name of the manufacturer, such specification shall establish the minimum standard of quality in that particular field of manufacture. The engineer shall be the sole and final judge as to quality and acceptability of substitutions, no exceptions.

2.2 PRODUCT LISTING AND LABELING

- A. All electrical equipment shall be Underwriters Laboratories listed and labeled. Equipment in compliance with UL standards but not bearing their label is not acceptable. If the manufacturer cannot arrange for labeling of an assembled unit at the factory, the necessary inspection and acceptance by the testing facility shall be performed in the field at no additional cost to the Owner and be acceptable to the Authority Having Jurisdiction.

2.3 ELECTRICAL DISTRIBUTION EQUIPMENT

- A. Scope: Provide the equipment for the various primary and secondary voltage distribution systems including switchgear, service transformer, service switchboards, distribution switchboards, panelboard equipment, motor control centers, dry-type transformers, and all miscellaneous equipment.
- B. Type: The distribution equipment shall provide a quality system with the highest degree of safety, protection, and integrity.
- C. Space for Future Circuit Breakers and Fused Switches: Provide as indicated on drawings; shall be completely equipped for the future addition of a circuit breaker or fused switch, including all connections. Each switchboard or panelboard section shall be fully bussed with spaces available the entire height of the equipment.
- D. Finish: Finish of all distribution equipment and other associated equipment shall match and unless specified otherwise shall be manufacturer's standard light gray.

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- E. Phasing:
1. Phase arrangement for all bussing and terminations in switchboards, panelboards, motor starter centers, transformers, etc. shall be as follows when viewed from the front:
 - a. Phase A Front Left Top
 - b. Phase B Center Center Center
 - c. Phase C Rear Right Bottom
 2. Lugs for switchboards, panelboards, transformers and other distribution equipment connections shall be hydraulically set compression lugs.
- F. Manufacturer: The number of manufacturers shall be kept to a minimum to maintain close control and coordinate the various components of the distribution systems,. All electrical distribution equipment shall be provided by the same manufacturer. Dimensions are critical. Each manufacturer shall verify that the equipment proposed will fit within the spaces provided with adequate working clearances.

2.4 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.5 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
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. Advance Products & Systems, Inc.
 - b. Calpico, Inc.

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- c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
- 2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Plastic or Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

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- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
 - E. Cut sleeves to length for mounting flush with both surfaces of walls.
 - F. Extend sleeves installed in floors 2 inches above finished floor level.
 - G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
 - H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
 - I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
 - J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Firestopping."
 - K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
 - L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

3.5 CUTTING AND PATCHING

- A. Provide all required cutting, demolition and patching required for the installation of the electrical work. Penetrations through structural walls, ceiling or floor slabs shall be core drilled. In no case shall structural members be penetrated without prior approval of the structural engineer.

3.6 PAINTING

- A. Touch up electrical equipment with factory-finished surfaces as required using factory-furnished paint. Do not paint screw heads, hinges, nameplates, hardware, etc. All surface-mounted raceways in finished areas shall be painted to match adjacent surfaces.

3.7 CLEANING

- A. Promptly remove waste material and rubbish resulting from electrical work.
- B. Prior to energizing equipment, remove all dirt and debris. Vacuum and wipe-down all surfaces.
- C. Clean all equipment and fixtures at completion of the project.

3.8 CONSTRUCTION OBSERVATION AND FINAL ACCEPTANCE

- A. Site Review: On-site meetings or reviews of construction by the Engineer shall not be construed as acceptance by these parties as related to quantities, rough-in locations and compliance with code enforcing authorities.
- B. Testing: The Contractor shall test all wiring and all electrical equipment to verify absence of grounds and short circuits and verify proper operation, rotation, and phase relationship. Contractor will be responsible for scheduling of tests and demonstrations at times mutually acceptable to the Owner. All equipment shall be demonstrated to operate in accordance with the requirements of this specification and the manufacturer's recommendations. Operate every device manually and automatically in accordance with its purpose. Tests shall be performed in the presence of the Owner or his designated representative. All instruments and personnel required to conduct the test shall be provided by the Contractor. Any test not witnessed by the Owner shall be waived by written document. All such documents must become the property of the Owner upon completion of construction.

3.9 INSTRUCTION FOR OWNER'S PERSONNEL

- A. Scope: Following initial operation of all electrical equipment and prior to acceptance of the electrical work, conduct demonstrations of equipment operation and instruction periods for the Owner's representatives.
- B. Instruction Periods: Shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings, followed by tours of equipment spaces explaining maintenance requirements, access methods, servicing and maintenance procedures, settings and available system and equipment adjustments.
- C. Contractor's representatives, in general, who conduct these instructions and demonstrations shall be qualified foremen or superintendents acquainted with this project and from the trade involved. The representative shall be the manufacturer's representatives with operating experience and substantial design experience on this project for major equipment. Their qualifications shall be submitted to the Architect and Engineer before conducting the instruction period.
- D. Minimum Duration of Instruction Periods:
 - 1. Electrical Distribution System: one hour.
 - 2. Low-Voltage Systems: Four hours each unless noted otherwise.
 - 3. Refer to other sections of the specification for additional testing requirements.
- E. Scheduling of Instruction Periods: Provide notice of contractor's readiness to conduct such instruction and demonstration periods to the Owner at least two weeks prior to each instruction period and reach agreement on the date of each instruction period.
- F. Prepare a written statement of acceptance for the Owner's signature. The statement shall be substantially as follows:

MUNICIPALITY OF ANCHORAGE
FIRE STATION 11 STORAGE BUILDING

DIVISION 26
ELECTRICAL

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COMMON WORK RESULTS FOR ELECTRICAL

"I (the Contractor), the associated factory representatives and the subcontractor, have thoroughly tested each of the following systems and have proved their normal operation to the Owner's representative and have instructed him in the operation and maintenance thereof."

Owner's System	Demonstrator	Representative	Date
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Electrical Distribution & Lighting _____

Communications Systems _____

(List each system specified)

Safety and Security Systems _____

(List each system specified)

Owner's Representative	Date
------------------------	------

Electrical Contractor	Date
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- G. Send copies of this acceptance to the Architect and the Engineer and place one copy in each maintenance manual.

END OF SECTION 26 05 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Metal-clad cable, Type MC, rated 600 V or less.
 - 3. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.
- B. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer's authorized service representative.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS**2.1 COPPER BUILDING WIRE**

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- D. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.
 - 2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 - 3. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Comply with UL 1569.
 - 3. RoHS compliant.
 - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Circuits:
 - 1. Single circuit and multicircuit with color-coded conductors.
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- E. Ground Conductor: Bare.

- F. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.
- G. Armor: Aluminum, interlocked.
- H. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper
 - 2. Type: Two hole with standard barrels.
 - 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: stranded Copper
- B. All conductors are based on copper unless specifically noted as aluminum.
- C. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type XHHW-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.

-
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
 - E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
 - F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC.
 - G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
 - H. Minimum Conductor Size:
 - 1. Neutral: #10 AWG (#12 AWG minimum for dedicated neutrals and lighting circuits.)
 - 2. Ground: #12 AWG.
 - 3. Phase Conductors (more than six in a raceway): #10 AWG.
 - 4. Phase Conductors (six or less in a raceway): #12 AWG.
 - 5. Branch Circuit Homeruns (longer than 75 feet): #10 AWG.
 - I. Class 1 Control Circuits: Type THHN-THWN, in raceway.
 - J. Class 2 Control Circuits: Type THHN-THWN, in raceway.
 - K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Provide insulated screw-on type connectors on lighting and receptacle branch circuit splices. Hydraulically-set compression lugs for terminations at panel and switchboard busses.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- E. Below-grade splices shall be made in handholes and shall be made watertight with epoxy resin type splicing kits. Scotchcast or equal.
- F. Termination at busses (panel, switchboard, ATS, etc.), and transformers to be made with hydraulically set compression lugs.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 00 "Common Work Results For Electrical."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 84 10 "Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
1. Procedures used.
 2. Results that comply with requirements.
 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors: Stranded copper wire or cable.

- C. Grounding Bus: Predrilled Rectangular bars of annealed copper, 1/4 x 2 x 12 inch in cross section unless otherwise indicated; with insulators.

2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- D. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- E. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

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- C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- D. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

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- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.6 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. Use exothermic welds for all below-grade connections.
 - 3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
 - 4. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 2. Bury ground ring not less than 24 inches from building's foundation.
- H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- I. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel slotted support systems.
 - 2. Aluminum slotted support systems.
 - 3. Nonmetallic slotted support systems.
 - 4. Conduit and cable support devices.
 - 5. Support for conductors in vertical conduit.
 - 6. Structural steel for fabricated supports and restraints.
 - 7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Fasteners.
 - f. Anchors.
 - g. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.

- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
1. Hangers. Include product data for components.
 2. Slotted support systems.
 3. Equipment supports.
 4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For hangers and supports for electrical systems.
1. Include design calculations and details of hangers.
 2. Include design calculations for seismic restraints.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design hanger and support system.
- B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified."
 2. Component Importance Factor: 1.0.
 3. For component supported per ASCE 7.
- C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame Rating: Class 1.
 2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-Line
 - b. Thomas & Betts

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- c. Unistrut
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Material for Channel, Fittings, and Accessories: Galvanized steel.
 4. Channel Width: Selected for applicable load criteria.
 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c., in at least one surface.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 2. Channel Width: Selected for applicable load criteria.
 3. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
 4. Fitting and Accessory Materials: Same as those for channels and angles.
 5. Rated Strength: Selected to suit applicable load criteria.
 6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Hilti
 - b. DeWALT
 - c. Simpson Strong-Tie

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Hilti
 - b. DeWALT
 - c. Simpson Strong-Tie
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. General: Provide complete seismic anchorage and bracing for all electrical raceways, fixtures and equipment required by the International Building code (IBC), Section 1613. Contractor shall retain and pay for the services of a licensed structural engineer to design the required anchorage and bracing to comply with the requirements of the IBC.
- B. Conduit Crossing Structural Separation: Conduit that crosses structural or seismic separations between building units shall be installed with flexible connections, suitable to accommodate longitudinal and transverse displacements. Secure raceways each side of joint and provide minimum of 36 inches length flexible conduit between building units.
- C. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA 1.
 2. NECA 101
 3. NECA 105.
- D. Comply with requirements in Section 07 84 10 "Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- E. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- F. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

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- G. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- H. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not for slabs less than 4 inches thick.
 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 PAINTING

- A. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Nonmetallic conduits and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.
 - 7. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing
- B. FMC: Flexible metal conduit
- C. LFMC: Liquidtight flexible metal conduit
- D. RMC: Rigid metal conduit
- E. GRC: Galvanized rigid Steel conduit
- F. RNC: Rigid nonmetallic conduit
- G. SMR: Surface Metal Raceway

1.4 SUBMITTALS

1. Product Data: Submit for each type of product provided.

PART 2 - PRODUCTS**2.1 METAL CONDUITS AND FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AFC Cable
 2. Allied Tube
 3. Electri-Flex
- B. Metal Conduit:
 1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. GRC: Comply with ANSI C80.1 and UL 6.
 3. IMC: Comply with ANSI C80.6 and UL 1242.
 4. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch, minimum.
 5. EMT: Comply with ANSI C80.3 and UL 797.
 6. FMC: Comply with UL 1; zinc-coated steel or aluminum.
 7. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- C. Metal Fittings:
 1. Comply with NEMA FB 1 and UL 514B.
 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Fittings, General: Listed and labeled for type of conduit, location, and use.
 4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 5. Fittings for EMT:
 - a. 1-1/2 inches and smaller: Steel compression type employing a split corrugated ring and tightening nut.
 - b. Two inches and larger: Steel, set-screw-type containing dual set-screws on each side of coupling.

- c. Exterior: UL-Listed, raintight, steel, compression-type with silicon rubber internal sealing rings.
 - d. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- D. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. AFC Cable
 - 2. Anamet
 - 3. Electri-Flex
 - 4. Carlon
- B. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 1. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
 - 2. LFNC: Comply with UL 1660.
- C. Nonmetallic Fittings:
- 1. Fittings, General: Listed and labeled for type of conduit, location, and use.
 - 2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
 - a. Fittings for LFNC: Comply with UL 514B.
 - 3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Thomas & Betts
 2. Wiremold
- C. Color: Ivory
- D. Single-Channel Raceway: Two-piece raceway with a single compartment and snap cover. Provide raceways with nominal dimensions as follows:
1. Raceway fill shall not exceed 40 percent.
 2. Power Conductors:
 - a. Up to Three #12 AWG Conductors: 21/32 x 3/4 inch.
 - b. Up to Six #12AWG Conductors: 1-9/32 x 3/4 inch.
 3. UTP Cables:
 - a. Up to Two Cables: 1-9/32 x 3/4 inch.
 - b. Up to (15) Cables: 2-3/4 x 1-7/16 inch.
 - c. More than 15 Cables: Provide multiple raceways.
 4. Other Low-Voltage Cables:
 - a. One Cable: 21/32 x 3/4 inch.
 - b. More Than One Cable: Size raceway for 40 percent full. Maximum raceway size shall be 2-3/4 x 1-7/16 inch.
- H. Two-Channel Raceway:
1. Raceway fill shall not exceed 40 percent.
 2. Provide where shown on the drawings.
 3. Raceway: Two-piece raceway with divider and snap cover. Nominal dimensions shall be 4-3/4 x 1-3/4 inch.
 4. Device-Mounting Brackets: High-impact plastic bracket with trim plate. Trim plate shall overlap raceway cover for a seamless transition between cover fittings. Provide insert for each device installed. Provide blank insert where only one device is provided.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Crouse-Hinds
 2. EGS/Appleton Electric
 3. Hoffman

4. Hubbell
5. RACO
6. Thomas & Betts
7. Wiremold

- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

2.5 Metal Floor Boxes:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Hubbell Systemone (General Purpose)
- B. General Purpose:
 1. Recessed, 4-gang, 16-gauge, galvanized sheet metal floor box with all required accessories to mount the receptacles and low-voltage devices as shown on the drawings.
 2. The floor box shall be listed as follows:
 - a. UL 514A
 - b. UL scrub water compliant
 3. Provide black powder-coated ADA compliant cover as follows:
 - a. Carpet, Tile, VCT or Wood Floors: Surface style cover.
 - b. Tile, Concrete or Terrazzo Floors: Flush style cover.
 4. Provide box with fusion-bonded green epoxy paint for slab on grade installations.

2.6 Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

2.7 Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with SCTE 77.
1. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
 2. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 4. Cover Legend: Molded lettering, "ELECTRIC.", "TELEPHONE." as indicated for each service.
 5. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carson Industries LLC.
 - b. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-40-PVC.
 4. Retain first option in first subparagraph below if raceway may be exposed to physical damage.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 6. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

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- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size:
1. 3/4-inch trade size unless otherwise indicated.
 2. Raceways with no more than three No. 12 AWG conductors shall be 1/2 inches unless otherwise indicated.
 3. 1-inch trade size for Data and Communications systems.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits.

Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

- C. Do not fasten conduits onto the bottom side of a metal deck roof.
- D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Complete raceway installation before starting conductor installation.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- G. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- H. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- I. Support conduit within 12 inches of enclosures to which attached.
- J. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- K. Stub-Ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal

bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Conduit extending from interior to exterior of building.
 - 4. Conduit extending into pressurized duct and equipment.
 - 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - 6. Where otherwise required by NFPA 70.
- V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- W. Expansion-Joint Fittings:
 - 1. RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 degrees F and that has straight-run length that

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- exceeds 25 feet. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change.
2. EMT and RMC: Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 degrees F and that has straight-run length that exceeds 100 feet. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per degree Fahrenheit of temperature change for metal conduits.
 3. Install expansion-joint fittings for each of the following locations and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 degrees F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 degrees F temperature change.
 - c. Indoor Spaces: Connected with the outdoors without physical separation; 125 degrees F temperature change.
 - d. Attics: 135 degrees F temperature change.
 - e. Utility Tunnels: 155 degrees F temperature change.
 4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit.
2. Backfill shall be imported structure fill or imported gravel borrow according to civil drawing requirements.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
5. Elbows: All elbows shall be RMC.
 - a. Wrapped elbows with 3M Scotchrap Tape 50.
 - b. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with three inches of concrete.
 - c. Extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation for stub-ups at equipment mounted on outdoor concrete bases.
 - d. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

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- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 10 "Firestopping."

3.7 SOUND CONTROL

- A. General: The installation of the outlet boxes and conduit shall utilize installation methods which minimize sound transmission from one room to adjacent room or areas boxes shall not be located within 24 inches of each other or within the same study cavity.
- B. Installation:
1. Boxes mounted in a common wall shall be offset horizontally whenever possible so that they are not mounted back-to-back. Connect offset boxes with flexible conduit not to exceed 24 inches in length.
 2. Boxes may be mounted back-to-back (with permission) where it is not practical to offset, with a minimum clearance of ¼ inch between boxes. Wrap both boxes with STI putty pads. Connect boxes with flexible conduit. Do not nipple boxes mounted back-to-back.

3.8 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 48.16 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. ASCE: American Society of Civil Engineers, ASCE 7-10 "Minimum Design Loads for Buildings and Other Structures".

1.3 SUMMARY

- A. Section Includes:
 - 1. Restraint channel bracings.
 - 2. Restraint cables.
 - 3. Seismic-restraint accessories.
 - 4. Mechanical anchor bolts.
 - 5. Adhesive anchor bolts.
- B. Related Requirements:
 - 1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

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- a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Delegated-Design Submittal: For each seismic-restraint device.
1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 3. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints. Electrical components include:
1. Control and monitoring panels.
 2. Generators.
 3. Luminaires.
 4. Motor control centers.
 5. Panelboards.
 6. Substations.

7. Switchboards.
 8. Switchgear.
 9. Transformers.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
1. Site Class as Defined in the IBC: D.
 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: III.
 - a. Component Importance Factor: 1.25.
 - b. Component Response Modification Factor: Per ASCE 7.
 - c. Component Amplification Factor: Per ASCE 7.
 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 100 percent.
 4. Design Spectral Response Acceleration at 1.0-Second Period: 65 percent.

2.2 RESTRAINT CHANNEL BRACINGS

- A. The following manufactures are acceptable:
1. B-line, an Eaton business
 2. Hilti, Inc.
 3. Mason Industries, Inc.
 4. Unistrut; Part of Atkore International
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building

structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

- A. The following manufactures are acceptable:
1. CADDY; a brand of nVent
 2. Gripple Inc.
 3. Kinetics Noise Control, Inc.
 4. Vibration Mountings & Controls, Inc.
- B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

- A. The following manufactures are acceptable:
1. B-line, an Eaton business
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

- A. The following manufactures are acceptable:
1. Hilti, Inc.

2. Simpson Strong-Tie
3. DeWALT

- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.6 ADHESIVE ANCHOR BOLTS

- A. The following manufactures are acceptable:

1. Hilti, Inc.
2. Simpson Strong-Tie
3. DeWALT

- B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

-
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Equipment and Hanger Restraints:
1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- F. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 5. Set anchors to manufacturer's recommended torque using a torque wrench.
 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least two of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
- C. Seismic controls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 05 48.16

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Bands and tubes.
 - 4. Tapes and stencils.
 - 5. Tags.
 - 6. Signs.
 - 7. Cable ties.
 - 8. Paint for identification.
 - 9. Fasteners for labels and signs.

1.3 SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E requirements for arc-flash warning labels.

- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded conductors.
 - 1. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White
 - e. Ground: Green
 - f. Travelers: Yellow
 - 2. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Neutral: Gray
 - e. Ground: Green
 - f. Travelers: Lavender
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

E. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.5 Underground-Line Warning Tape:

- A. Description: Permanent, bright-colored, continuous-printed polyethylene tape.
 1. Compounded for permanent direct-burial service.
 2. Embedded continuous metallic strip or core.
 3. Printed legend shall indicate type of underground line.

2.6 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- B. Write-on Tags:
 - 1. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment.
 - 2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
- C. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F.
 - 5. Color: Black.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- L. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

- M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- Q. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- S. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
- T. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- U. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- V. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- W. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Conductors to Be Extended in the Future: Attach write-on tags to conductors.
- D. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- E. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- F. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- H. Arc Flash Warning Labeling: Self-adhesive labels.
- I. Operating Instruction Signs: Self-adhesive labels.
- J. Equipment Identification Labels:
 - 1. Indoor Equipment: Self-adhesive label.
 - 2. Outdoor Equipment: Laminated acrylic or melamine sign.
 - 3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchgear.

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- e. Switchboards.
- f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- g. Emergency system boxes and enclosures.
- h. Motor-control centers.
- i. Enclosed switches.
- j. Enclosed circuit breakers.
- k. Enclosed controllers.
- l. Variable-speed controllers.
- m. Push-button stations.
- n. Power-transfer equipment.
- o. Contactors.
- p. Remote-controlled switches, dimmer modules, and control devices.
- q. Battery-inverter units.
- r. Battery racks.
- s. Power-generating units.
- t. Monitoring and control equipment.
- u. UPS equipment

END OF SECTION 26 05 53

SECTION 26 05 73 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SUMMARY

- A. This section includes computer-based, fault-current and overcurrent protective device coordination studies for all new and existing devices. Protective devices shall be set based on results of the protective device coordination study.
- B. This study shall also include:
 - 1. Short-circuit study.
 - 2. Arc flash risk assessment with self-adhesive arc flash warning labels.
- C. Provide an initial study and submit with the electrical gear submittals.
- D. Provide a final study prior to substantial completion. The final study shall include all changes made during construction.

1.3 SUBMITTALS

- A. Product Data: Submit for computer software program to be used for studies.
- B. Product Certificates: Submit for coordination-study and fault-current-study computer software programs to certify compliance with IEEE 399.
- C. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed.
 - 1. Short-circuit study:
 - a. Short-circuit study input data, including completed computer program input data sheets.
 - b. Short-circuit study report.

2. Coordination study:
 - a. Coordination-study input data, including completed computer program input data sheets.
 - b. Coordination-study report.
3. Arc-flash risk assessment:
 - a. Arc-flash study input data, including completed computer program input data sheets.
 - b. Arc-flash risk assessment report with labels in PDF format.

1.4 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this section. Manual calculations are not acceptable.
- B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices. Professional engineer, licensed in the state where project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
- C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:
 1. Power Analytics
 2. EDSA Micro Corporation
 3. ESA Inc.
 4. Operation Technology, Inc.
 5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399.
- B. Comply with IEEE 1584.
- C. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

PART 3 - EXECUTION**3.1 GENERAL**

- A. Examine project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.
- B. Existing Devices: Field verify data for all existing devices.
- C. Existing Feeders: Field verify conductor and raceway data for all existing feeders.

3.2 POWER SYSTEM DATA

- A. Gather and tabulate the following input data to support coordination study:
 - 1. Product data for overcurrent protective devices specified in other Division 26 sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Impedance of utility service entrance.
 - 3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
 - a. Circuit-breaker and fuse-current ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - d. Generator kilovolt amperes, size, voltage, and source impedance.
 - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.

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- f. Busway ampacity and impedance.
 - g. Motor horsepower and code letter designation according to NEMA MG 1.
4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
- a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Ratings, types, and settings of utility company's overcurrent protective devices.
 - e. Special overcurrent protective device settings or types stipulated by utility company.
 - f. Time-current-characteristic curves of devices indicated to be coordinated.
 - g. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
 - h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
 - i. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 SHORT-CIRCUIT STUDY

- A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 1. Switchgear and switchboard bus
 2. Distribution panelboard
 3. Branch circuit panelboard
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current. Show interrupting (five-cycle) and time-delayed currents (six cycles and above) on medium-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.

D. Equipment Evaluation Report:

1. 600-Volt Overcurrent Protective Devices: Ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. Devices and Equipment Rated for Asymmetrical Fault Current: Apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (five cycles to two seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
2. Device settings shall protect transformers according to IEEE C57.12.00 for fault currents.

C. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

D. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag

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- b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings
 - d. Fuse-current rating and type
 - e. Ground-fault relay-pickup and time-delay settings
 2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag
 - b. Voltage and current ratio for curves
 - c. Three-phase and single-phase damage points for each transformer
 - d. No damage, melting, and clearing curves for fuses
 - e. Cable damage curves
 - f. Transformer inrush points
 - g. Maximum fault-current cutoff point
 - E. Completed data sheets for setting of overcurrent protective devices.

3.5 ARC FLASH RISK ASSESSMENT

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Calculations shall be performed in accordance with the current edition of IEEE 1584.
- C. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.
- D. Calculate maximum and minimum contributions of fault-current size.
 1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
 3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
 4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.
- E. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where it is likely that personnel could perform work on energized parts.
- F. Calculate the limited and restricted approach boundaries for each location.

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- G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
 2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
- H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
1. When the circuit breaker is in a separate enclosure.
 2. When the line terminals of the circuit breaker are separate from the work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.
- J. Provide Arc-Flash Warning Labels. Labels shall comply with the following:
1. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch (76-by-127-mm) self-adhesive equipment label for each work location included in the analysis.
 2. Label shall have an orange header with the wording, "WARNING" for equipment with calculated incident energy less than 40 cal/cm². For equipment with calculated incident energy of 40 cal/cm² or greater, the label shall have a red header with the word "DANGER". The label shall include the following information taken directly from the arc-flash hazard analysis:
 - a. Equipment designation.
 - b. Nominal voltage.
 - c. Arc Flash Boundary.
 - d. Incident Energy (in cal/cm²) at specified working distance.
 3. Labels shall be machine printed, self-adhesive, with no field-applied markings.

END OF SECTION 26 05 73

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Photoelectric switches.
 - 2. Indoor occupancy and vacancy sensors.
 - 3. Switchbox-mounted occupancy sensors.
 - 4. High-bay occupancy sensors.
 - 5. Lighting contactors.
 - 6. Emergency shunt relays.
- B. Related Requirements:
 - 1. Section 26 27 26 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.
 - 2. Interconnection diagrams showing field-installed wiring.
 - 3. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On manufacturer's website. Provide names, versions, and website addresses for locations of installed software.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control software.
 - b. Faulty operation of lighting control devices.
 - 2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 OUTDOOR PHOTOELECTRIC SWITCHES**

- A. Description: Solid state, with dry contacts rated for 1000 W incandescent or 1800 VA inductive, to operate connected load, complying with UL 773, and compatible with LED lamps.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
 - 3. Time Delay: Thirty-second minimum, to prevent false operation.
 - 4. Lightning Arrester: Air-gap type.
 - 5. Mounting: Twist lock complying with NEMA C136.10, with base.
 - 6. Failure Mode: Luminaire stays ON.

-
- B. Description: Solid state; one set of NO dry contacts rated for 24 V dc at 1 A, to operate connected load, complying with UL 773, and compatible with lighting control panelboard.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
 3. Time Delay: Thirty-second minimum, to prevent false operation.
 4. Mounting: 1/2-inch threaded male conduit.
 5. Failure Mode: Luminaire stays ON.
 6. Power Pack: Digital controller capable of accepting three RJ45 inputs with two outputs rated for 20-A incandescent or LED load at 120- and 277-V ac, for 16-A LED at 120- and 277-V ac. Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
 - a. With integral current monitoring.
 - b. Compatible with digital addressable lighting interface.
 - c. Plenum rated.

2.2 INDOOR OCCUPANCY AND VACANCY SENSORS

- C. General Requirements for Sensors:
1. Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
 2. Passive infrared, Ultrasonic or Dual technology.
 3. Integrated or Separate power pack.
 4. Hardwired or Wireless connection to switch; and BAS and lighting control system.
 5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 6. Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 7. Sensor Output: Sensor is powered from the power pack.
 8. Power: Line voltage.
 9. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.

-
10. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 12. Bypass Switch: Override the "on" function in case of sensor failure.
 13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- A. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
 2. Detection Coverage (Room, Ceiling Mounted): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
 3. Detection Coverage (Corridor, Ceiling Mounted): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.
- D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet.
 6. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 84 inches above finished floor.
- E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of

average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired connection.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.
- B. Wall-Switch Sensor:
 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft..
 2. Sensing Technology: PIR.
 3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
 4. Capable of controlling load in three-way application.
 5. Voltage: Dual voltage - 120 and 277 V.
 6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 7. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
 8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
 9. Color: White.
 10. Faceplate: Color matched to switch.

2.3 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Square D
 2. Siemens
 3. General Electric

-
- B. Description: Electrically operated and electrically held, combination-type lighting contactors with fusible switch, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control power transformer, HOA switch and red pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.4 EMERGENCY SHUNT RELAY

- A. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
1. Coil Rating: 120 V.

2.3 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

- A. Comply with NECA 1.
- B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 EMERGENCY (LIFE SAFETY) CIRCUITS

- A. Provide UL 924 listed lighting control unit where emergency (Life Safety) circuits are controlled.

3.5 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.6 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.8 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to one visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.9 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

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- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 26 09 23

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SUBMITTALS

- A. Product Data: Submit for each type of panelboard, overcurrent protective device, transient voltage suppression device and accessory provided.
- B. Overcurrent Protective Device Coordination Study: Submit for review along with product data. Refer to Division 26, "Overcurrent Protective Device Coordination Study."

1.3 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards and Overcurrent Protective Devices:
 - a. Square D
 - b. General Electric
 - c. Siemens
 - 2. Transient Voltage Suppression Panelboards:
 - a. Square D
 - b. General Electric

c. Siemens

- B. The basis of design manufacturer for this project is Square D to establish the minimum standards for quality and performance. Other manufacturers are acceptable only if:
1. The equipment is from one of the manufacturers listed above.
 2. The equipment quality and performance is equal to the Basis of Design.
 3. The equipment dimensions are equal to or smaller than the Basis of Design.

2.2 FABRICATION

- A. Enclosures:
1. Rated for environmental conditions at installed location.
 - a. Outdoor, Wet or Damp Locations: NEMA 250, Type 3R.
 2. Doors: Door-within-door type.
 3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 4. Directory Card: Provide transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- C. Conductor Connectors: Suitable for use with conductor material.
1. Main and Neutral Lugs: Compression type.
 2. Ground Lugs and Bus Configured Terminators: Compression type.
 3. Feed-Through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 SHORT-CIRCUIT RATING

- A. Fully rated to interrupt the symmetrical short-circuit current available at the terminals.

2.4 DISTRIBUTION PANELBOARDS

- A. Branch Overcurrent Protective Devices:
1. Circuit-Breaker Frame Sizes 125 Ampere and Smaller: Bolt-on circuit breakers.
 2. Circuit-Breaker Frame Sizes Larger Than 125 Ampere: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- B. Doors: Door-within-door type secured with vault-type latch with tumbler lock; keyed alike.

2.5 PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Door-within-door type, concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-case circuit breaker with interrupting capacity to meet available fault currents. Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.
- B. Circuit Breakers Rated 800 Amps or More: Provide electronic trip unit with adjustable Long-Time, Short-Time and Instantaneous trip functions. Provide ground fault protection (G) where called out on the one-line drawing.

2.7 SPACE FOR FUTURE CIRCUIT BREAKERS OR FUSED SWITCHES

- A. Provide as indicated on the drawings. Spaces shall be completely equipped for the future addition of a circuit breaker or fused switch, including all mounting hardware and buss connections. Unless otherwise noted, spaces shall be sized to accommodate the following future circuit breaker or fused switch:

<u>Panel Rating</u>	<u>Minimum Space Ampacity</u>
100 Amperes	70 Amperes
225 Amperes	125 Amperes
400 Amperes	225 Amperes
600 Amperes	400 Amperes
800 Amperes	600 Amperes
1200 Amperes	800 Amperes

2.8 INSTRUMENTATION (DISTRIBUTION PANELBOARDS)

- A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
1. Potential Transformers: Secondary voltage rating of 120 volt and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
 2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
 3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3kV.
 4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondaries to ground overcurrent relays to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker ground-fault protection.
- B. Main Bus:
1. Provide digital power monitor which displays:
 - a. Phase-to-phase and phase-to-neutral voltage on all three phases.
 - b. Current on all three phases and the neutral.
 - c. Power factor kW and kVA.
- C. Each Feeder:
1. Provide digital power monitor which displays:
 - a. Phase-to-phase and phase-to-neutral voltage on all three phases.
 - b. Current on all three phases and the neutral.
 - c. Power factor kW and kVA.
 - d. KWH, revenue-grade, nonresetable. KWH meter to have pulsed output, same as utility meter.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- B. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- C. Install overcurrent protective devices and controllers. Set field-adjustable switches and circuit-breaker trip ranges.
- D. Install filler plates in unused spaces.

- E. Stub four one-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four one-inch empty conduits into raised floor space or below slab not on grade.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 DIRECTORY

- A. Provide a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

3.3 IDENTIFICATION DEVICES

- A. Label each panelboard with an engraved laminated plastic nameplate as specified in Division 26, "Identification."

3.4 ACCEPTANCE TESTING

- A. After all wiring is complete, all feeder and branch circuit terminations shall be checked with a torque wrench. Torque levels shall be in accordance with NETA Standard ATS unless otherwise specified by the manufacturer. A test report which gives the following information for each panelboard shall be submitted to the Engineer two weeks prior to final inspection:
 - 1. Size and insulation type of the phase, neutral and ground conductors.
 - 2. Phase-to-phase and phase-to-neutral operating load voltage.
 - 3. Operating load current (each phase, neutral and ground).
- B. Phase-to-phase and phase-to-neutral conductor insulation resistance. Test shall be made with a DC "Megger" (500-volt minimum) type tester. If tests indicate faulty insulation (less than 8 megohms), the conductors shall be replaced and retested.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SUBMITTALS

- A. Product Data: Submit for each type of product provided.

1.3 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Devices with preconnectorized pigtails are not acceptable.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Specification and Hospital Grade
 - a. Arrow Hart
 - b. Hubbell
 - c. Leviton
 - d. Pass & Seymour
 - 2. Industrial Extra Duty Grade and Hospital Extra Duty Grade
 - a. Hubbell. No Substitutions.

2.3 SPECIFICATION-GRADE DEVICES

1. Convenience and Dedicated Receptacles, 125 volt, 20 ampere, NEMA 5-20R. Subject to compliance with requirements, provide one of the following products:
 - a. Arrow Hart; 5352 (duplex)
 - b. Hubbell; 5352 (duplex)
 - c. Leviton; 5352 (duplex)
 - d. Pass & Seymour; 5352 (duplex)

- B. GFCI Receptacles:
 1. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
 2. Duplex GFCI Convenience Receptacles, 125 volt, 20 ampere: Subject to compliance with requirements, provide one of the following products:
 - a. Arrow Hart; SGF20
 - b. Hubbell; GFRST20 series
 - c. Pass & Seymour; 2097TRA
 - d. Leviton; GFNT2

2.4 INDUSTRIAL EXTRA-DUTY GRADE DEVICES

- A. Straight Blade Receptacles:
 1. Convenience or Dedicated Receptacles, 125 volt, 20 ampere, NEMA 5-20R with one piece brass mounting strap. Subject to compliance with requirements, provide one of the following products:
 - a. Hubbell; HBL5362 (duplex).

- B. GFCI Receptacles:
 1. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped and end of life indicator.
 2. Duplex GFCI Convenience Receptacles, 125 volt, 20 ampere: Subject to compliance with requirements, provide one of the following products:
 - a. Hubbell; GFR5362SG.

2.5 TOGGLE SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 Volt, 20 Amperes: Subject to compliance with requirements, provide one of the following products:
 - 1. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way)
 - 2. Hubbell; 1221 (single pole), 1222 (two pole), 1223 (three way), 1224 (four way)
 - 3. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way)
 - 4. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way)
- C. Pilot Light Switches, 20 Ampere: Subject to compliance with requirements, provide one of the following products:
 - 1. Cooper; 2221PL for 120 Volt and 277 Volt
 - 2. Hubbell; HPL1221PL for 120 Volt and 277 Volt
 - 3. Leviton; 1221-PLR for 120 Volt, 1221-7PLR for 277 Volt
 - 4. Pass & Seymour; PS20AC1-PLR for 120 Volt

2.6 WEATHERPROOF RECEPTACLES

- A. Provide 20A duplex GFCI receptacle with metallic cover that is UL Extra-Duty While-In-Use weatherproof whether or not the attachment plug is inserted.
 - 1. Intermatic WP 1010MC cover.
 - 2. Hubbell WP26E

2.7 CORD AND PLUG SETS

- A. Retain this article if cord and plug sets for equipment are furnished by Owner or are specified in other Sections. Coordinate with other Sections and with Part 3.
- B. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- C. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
- D. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.8 OCCUPANCY SENSORS

- A. Wall Switch Sensor Light Switch, Dual Technology:
1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
 2. Standards: Comply with UL 20.
 3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
 4. Adjustable time delay of 10 minutes.
 5. Connections: RJ-45 communications outlet.

2.9 DEVICE PLATES

- A. Finished Areas-Surface or Flush-Mounted: 302/304 stainless steel.
1. Hubbell; SS Series
 2. Pass & Seymour
- B. Unfinished Areas-Surface-Mounted Devices: 4/S raised steel.

2.10 FINISHES

- A. Color:
1. Wire device catalog numbers in section do not designate the device color.
 2. Wiring Devices Connected to Normal Power System: White.
 3. Wiring Devices Connected to Generator: Red.
 4. Isolated-Ground Receptacles: Orange.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 2. Install device boxes in brick or block walls so that the coverplate does not cross a joint unless the joint is troweled flush with the face of the wall.

-
3. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors: The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300 without pigtails.
- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than six inches in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-ampere circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation: Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated mount flush with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
- B. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections:
 - 1. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- D. Tests for Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- E. Wiring device will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 26 27 26

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 specification sections, apply to this section.

1.2 SUBMITTALS

- A. Product Data: Submit for each type of enclosed switch, circuit breaker and accessory being provided.

1.3 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
 - 1. Square D
 - 2. General Electric
 - 3. Siemens
- B. The basis of design for this project is Square D to establish the minimum standards for quality and performance. Other manufacturers are acceptable only if:
 - 1. The equipment is from one of the manufacturers listed above.
 - 2. The equipment quality and performance is equal to the basis of design.
 - 3. The equipment dimensions are equal to or smaller than the basis of design.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Fusible Switch-600A and Smaller: NEMA KS 1, Type HD with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. Nonfusible Switch-600A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Molded-Case Circuit Breaker: NEMA AB 1 with interrupting capacity to meet available fault currents. Provide with the following features and accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
- B. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating. Provide with the following features and accessories:
 - 1. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

2.4 ENCLOSURES

- A. Rated for environmental conditions at installed locations.
 - 1. Outdoor, wet or damp locations; NEMA 250, Type 3R.
 - 2. Other wet or damp indoor locations; NEMA 250, Type 4.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Control Equipment Mounted to Walls: Mount adjacent units at uniform height. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. Provide freestanding racks complying with Division 26, Section 26 05 29, "Hangers and Supports," for controllers not located on walls.

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- B. Floor-Mounted Control Equipment: Anchor to concrete base.
- C. Install fuses in each fusible switch.

3.2 IDENTIFICATION DEVICES

- A. Label each switch and circuit breaker on engraved laminated plastic as specified in Division 26, Section 26 05 53, "Identification."

3.3 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

END OF SECTION 26 28 16

SECTION 26 51 19 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following types of LED luminaires:
 - 1. Highbay, nonlinear.
 - 2. Linear industrial.
 - 3. Strip light.
 - 4. Surface mount, linear.
Suspended, linear.
- B. Related Requirements:
 - 1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Arrange in order of luminaire designation.
 2. Include data on features, accessories, and finishes.
 3. Include physical description and dimensions of luminaires.
 4. Include emergency lighting units, including batteries and chargers.
 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 6. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.5 COORDINATION

- A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.
- B. Provide drivers that match the service voltage being provided to the fixture.
- C. Provide drivers as required to accommodate the fixture switching/dimming scheme shown on the drawings.

1.6 EXTERIOR AND DAMP LOCATION FIXTURES

- A. Fixtures installed in the following locations shall be UL listed and labeled for wet locations:
1. Exterior locations
 2. Interior wet locations
 3. Interior damp locations

1.7 ACCESSORIES

- A. General: Provide all required hardware and accessories for a complete installation.
- B. Trims: The Contractor shall coordinate with the architectural drawings and provide the appropriate trim for each recessed fixture.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

1.1 MANUFACTURERS

- A. Refer to Luminaire Schedule on the drawings.

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI.
- C. Standards:
 - 1. RoHS compliant.

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2. UL Listing: Listed for damp location.

2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A 36/A 36M for carbon structural steel.
2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:

1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

2.4 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.5 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

2.6 Diffusers:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and/or UV radiation.
 - a. Lens Thickness: 0.125 inch minimum.
 - b. UV stabilized.

2.7 Linear Luminaires:

- A. LED linear luminaires are shown actual length on the drawings based on increments offered by manufacturer. Driver quantity to be based on manufacturer's recommendation per fixture length.

2.8 General Requirements for Leds

- A. Correlated color temperature (CCT), as indicated on the Luminaire Schedule on the drawings, for phosphor-coated white LEDs must have one of the following designated CCT's and fall within the following binning standards:
 1. 2700K defined as 2725 +/- 145K
 2. 3000K defined as 3045 +/- 175K
 3. 3500K defined as 3465 +/- 245K
 4. 4000K defined as 3985 +/- 275K
 5. 5000K defined as 5028 +/- 283K
 6. 6500K defined as 6530 +/- 510K
- B. Color spatial uniformity shall be limited to variations in chromaticity for different directions (i.e., changes in viewing angle).
- C. Color maintenance shall be limited to a maximum change in chromaticity of 0.007 over the lifetime of the product.
- D. Color Rendering Index:
 1. Color rendering index to be determined using ANSI C78.377-2008 and applicable IESNA standards.
 2. Laboratory tests must be produced using specific module(s)/array(s) and driver combination that will be used in production.
 3. Manufacturers must provide a test report from a laboratory accredited by NVLAP or one of its MRA signatories.
- E. Lumen Depreciation:
 1. Lumen depreciation to be measured using IESNA LM-80-08 standard for IES approved method of measuring lumen maintenance of LED light sources.

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2. Phosphor coated white LED module(s)/array(s) shall deliver at least 70% of initial lumens for a minimum of 50,000 hours when installed in position and operated at 100% output and the maximum specified operating temperature.

F. Luminaire Efficacy:

1. Luminaire efficiency shall be measured using IESNA LM-79-08 standard for electrical and photometric measurements of solid-state lighting products.
2. Manufacturer shall provide published luminaire efficacy, which is defined as luminaire light output divided by luminaire input power measured in a 25 degree Celsius environment. Efficacy shall include driver, thermal, optical, and luminaire losses.

G. Thermal Management:

1. Solid-state luminaire shall not exceed LED manufacturer's maximum junction temperature requirements when operated in position at luminaire manufacturer's maximum ambient operating temperature and 100% light output.
2. Solid-state luminaire shall be thermally protected using one or more of the following thermal management techniques:
 - a. Metal Core Board
 - b. Gap Pad
 - c. Internal Monitoring Firmware
3. Solid-state luminaire housing shall be designed to transfer heat from the LED board to the outside environment.

2.9 LED Drivers:

- A. Driver shall have a power factor of 0.90 or greater for primary application.
- B. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%.
- C. Driver output operating frequency to be equal to or greater than 120 Hz.
- D. Driver shall operate with sustained input variations of +/- 10% (voltage and frequency) with no damage to the driver.
- E. Driver shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.
- F. Driver output shall be regulated to +/- 5% across published load range.
- G. Driver shall have a Class A sound rating.
- H. Driver output shall have current limiting protection.

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- I. Driver shall operate LEDs at constant and regulated current levels. LEDs shall not be overdriven beyond the diode manufacturer's specified nominal voltage and current.

2.10 LED Luminaires

- A. All hardwired connections to solid-state luminaires shall be reverse polarity protected and provide high-voltage protection in the event connections are reversed.
- B. Solid-state lighting installations shall be UL listed as a low-voltage lighting system, including, but not limited to; luminaire, driver, controller, keypad and wiring.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaires:
 - 1. Secured to outlet box.

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2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaires:
1. Attached to structural members in walls or attached to a minimum 20 gauge backing plate attached to wall structural members.
 2. Do not attach luminaires directly to gypsum board.
- G. Suspended Luminaires:
1. Ceiling Mount:
 - a. Two 5/32-inch- diameter aircraft cable supports adjustable to 10 feet in length.
 - b. Pendant mount with 5/32-inch- diameter aircraft cable supports adjustable to 10 feet in length.
 - c. Hook mount.
 2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

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- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 51 19

SECTION 26 52 13 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Emergency lighting units.
 - 2. Exit signs.
 - 3. Luminaire supports.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
 - 1. Include data on features, accessories, and finishes.
 - 2. Include physical description of the unit and dimensions.
 - 3. Battery and charger for light units.
 - 4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining four years.
 - 2. Warranty Period for Self-Powered Exit Sign Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining six years.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. Luminaires and lamps shall be labeled vibration and shock resistant.
1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.

2.3 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Emergency Lighting Unit:
1. Emergency Lighting Unit: as indicated on Drawings.
 2. Operating at nominal voltage of 120 V ac.
 3. Wall or ceiling mount with universal junction box adaptor.
 4. UV stable thermoplastic housing, rated for damp locations.
 5. Two LED lamp heads.
 6. Internal emergency power unit.
- C. Remote Emergency Lighting Units:
1. Emergency Lighting Unit: as indicated on Drawings.
 2. Operating at nominal voltage as indicated on the drawings.
 3. Wall or ceiling mount with universal junction box adaptor.
 4. UV stable thermoplastic housing, rated for damp locations and rated for -20 degrees F.
 5. One LED lamp head.

2.4 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Operating at nominal voltage of 120 V ac.
 - 2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
 - 3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.5 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
 - 1. Smooth operating, free of light leakage under operating conditions.
 - 2. Designed to permit relamping without use of tools.
 - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
 - 4. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 5. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.6 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
 - 1. Sized and rated for luminaire and emergency power unit weight.
 - 2. Able to maintain luminaire position when testing emergency power unit.
 - 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.
- D. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls or attached to a minimum 20-gage backing plate attached to wall structural members.
 - 2. Do not attach luminaires directly to gypsum board.
- E. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

- F. Ceiling Grid Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Perform startup service:
 - 1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

END OF SECTION 26 52 13

SECTION 26 56 19 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
 - 2. Luminaire supports.
 - 3. Luminaire-mounted photoelectric relays.
- B. Related Requirements:
 - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
1. Arrange in order of luminaire designation.
 2. Include data on features, accessories, and finishes.
 3. Include physical description and dimensions of luminaire.
 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
 - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
 6. Wiring diagrams for power, control, and signal wiring.
 7. Photoelectric relays.
 8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- B. Delegated-Design Submittal: For luminaire supports.
1. Include design calculations for luminaire supports and seismic restraints.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.

- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.8 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including luminaire support components.
 - b. Faulty operation of luminaires and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. UL Compliance: Comply with UL 1598 and listed for wet location.
- D. CRI of minimum 70. CCT of 4100 K.
- E. L70 lamp life of 50,000 hours.
- F. Lamps dimmable from 100 percent to 1 percent of maximum light output.
- G. Internal driver.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 - 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.4 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Corrosion-resistant aluminum, stainless steel or epoxy-coated steel. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

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- D. Diffusers and Globes:
1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 2. Glass: Annealed crystal glass unless otherwise indicated.
 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
1. White Surfaces: 85 percent.
 2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.
- G. Housings:
1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
 2. Provide filter/breather for enclosed luminaires.
- H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage and coating.
 - c. CCT and CRI for all luminaires.

2.5 LED Drivers:

- A. Driver shall have a power factor of 0.90 or greater for primary application.
- B. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%.
- C. Driver shall have a minimum operating temperature of minus 20 degrees Fahrenheit or below when used in luminaires intended for outdoor applications.
- D. Driver output operating frequency to be equal to or greater than 120 Hz.

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- E. Driver shall operate with sustained input variations of +/- 10% (voltage and frequency) with no damage to the driver.
 - F. Driver shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.
 - G. Driver output shall be regulated to +/- 5% across published load range.
 - H. Driver shall have a Class A sound rating.
 - I. Driver output shall have current limiting protection.
 - J. Driver shall operate LEDs at constant and regulated current levels. LEDs shall not be overdriven beyond the diode manufacturer's specified nominal voltage and current.

2.6 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.7 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

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- C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
 - D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls or attached to a minimum 1/8 inch backing plate attached to wall structural members, or attached using through bolts and backing plates on either side of wall.
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- I. Coordinate layout and installation of luminaires with other construction.
- J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- K. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
 - 3. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- C. Luminaire will be considered defective if it does not pass tests and inspections.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

END OF SECTION 26 56 19

SECTION 28 16 00 - INTRUSION DETECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 DESCRIPTION

- A. This section describes general requirements, products and methods of execution relating to the Intrusion System for the project.

1.3 SCOPE

- A. Provide in operating condition an electrically operated intrusion system as described herein. The system shall include, but not be limited to, control unit, power supplies, alarm initiating and indicating devices, conduit, wire, fittings and accessories required to provide a complete operating system. All units shall be located in accordance with the plans.

1.4 CODES AND STANDARDS

- A. Comply with the applicable codes and meet all requirements by Underwriters' Laboratories, Inc. and FCC Rules Part 68.
- B. Provide all wiring in accordance with Article 725 of the National Electrical Code and local ordinances, and other sections of these specifications.

1.5 TYPE OF SYSTEM

- A. The system shall consist of an integrated alarm processor, digital communicator, keypad, etc., and shall monitor alarm circuits specified herein. Alarms shall report over a radio dialer provided by the security monitoring company (Guardian Security).

1.6 SUBMITTALS

- A. Submit for approval manufacturer's catalog information with complete description of all panel mounted and remote equipment.
- B. Include complete one-line risers and point-to-point wiring diagrams.

1.7 OWNER'S MANUALS

- A. Furnish two (2) complete sets of Owner's Operation and Maintenance Manuals and other information necessary for use and upkeep of the system.

1.8 WARRANTY AND SERVICE

- A. Warrant all components, parts and assemblies against defects in materials and workmanship for a period of 12 months. Warranty service shall be provided by a trained specialist of the equipment manufacturer.
- B. Warranty response time shall not exceed twenty-four (24 hours).

1.9 OPERATOR INSTRUCTION

- A. After the system provided in this section is completely installed and operational, and at a time chosen by the Owner, provide the Owner's system operators with a total of one (1) hour of instruction on the operation of all equipment provided under this Section of the Specifications.

PART 2 - PRODUCTS**2.1 SEQUENCE OF OPERATION**

- A. Upon actuation of any automatic detection device, or a keypad initiated alarm, all alarm functions shall operate in appropriate fashion. Alarms shall continue to be actuated until manually reset on-site by authorized personnel.
- B. The following additional functions shall be performed in the event of an alarm, as shown:
 - 1. Intrusion alarms shall activate the remote signaling circuit of the intrusion panel, which shall activate an alarm on the radio dialer for transmission to the remote location.
 - 2. Building systems "trouble" signals shall be transmitted to the remote location as separate and distinct signals.

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3. Shutdown of the system shall be accomplished at the panel by authorized personnel.
- C. The arming procedure shall be as follows:
1. Entering the arming code on the keyboard shall cause the system to be armed.
 2. System shall give visual and audible indication if it is armed while a non-auto-shunted zone is in trouble status. A low battery condition shall give an audible alarm upon arming.
 3. System shall test standby battery and burglary alarm on arming by briefly activating the burglary alarm from the standby battery.
 4. After system has been successfully armed, the exit delay period (user programmable up to 4 minutes) shall begin (if the delay has not been canceled by the operator), allowing the operator to exit the building without causing an alarm.
- D. The disarming procedure shall be as follows:
1. Entering the disarming code on the keyboard shall cause the burglary zones to be disarmed. The other zones shall remain operational.
- E. To enter the programming mode, the user shall be required to enter the correct keypad programming authorization code.

2.2 INTRUSION PANEL CONTROL UNIT

- A. Control Unit:
1. Provide a UL listed, solid-state, microprocessor-based, modular design intrusion panel control unit with keypad and digital communicator, NAPCO Gemini P9600 Burglar Alarm Package or approved equal.
 2. The control unit shall have the following features:
 - a. Provide burglary zones as indicated on the Intrusion Riser diagram on the drawings, with at least one programmable as a dedicated exit/entry delay zone. Unit to be capable of expanding to 96 zones.
 - b. At least two non-shutable 24-hour auxiliary zones with 50 millisecond detection response.
 - c. At least one non-shutable supervisory zone capable of reporting both trouble and alarm conditions.
 - d. At least one day zone activated only on circuit opening (trouble).
 - e. All zones shall be end-of-line resistor supervised and each shall function with a combination of normally closed and normally open contacts.
 - f. Integral siren driver, or relay(s) programmable for this function.
 - g. Automatic battery charger.
 - h. The control panel shall monitor detection devices having normally open or normally closed contacts. Devices shall be supervised to meet the requirements for UL Grade A (+50%) operation according to UL Standard No. 1076.

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- i. Sealed lead-acid battery(s) integral with controller, of sufficient capacity for 8 hours of standby operation.
 - j. Dynamic battery test for test under load.
 3. The following programmable zone options shall be available:
 - a. Adjustable exit/entry delay times.
 - b. Detection delay on burglary zones with devices in the exit/entry path during entry and exit periods.
 - c. Automatic exit delay initiation after verification of central station response.
 - d. Priority, individual and group manual shunt, 24-hour protection and auto-reset on burglary zones.
 - e. Automatic shunting of burglary zones to allow control center to be armed even if trouble exists on those zones.
 - B. Keypad:
 1. Keypad shall have the following factory supplied features:
 - a. English-language LCD display, backlit.
 - b. LED and sounder annunciators.
 - c. Provisions for medical emergency, fire, panic alarms at keypad.
 - d. Locate and Fault-Find Modes facilitate testing and trouble-shooting.
 - e. Test for communicator's ability to dial out.
 - f. Audible indication of a faulted zone returning to normal condition.
 - g. Sixteen access/control codes and one electric door lock activation code of 4 digits each shall be user programmable from the keyboard.
 - h. Single button reset of fire (supervisory) zone indicators, latched detectors and day zone indication.
 - i. Separate supervisory zone indication.
 - j. Capability of arming while powered by the standby battery.
 - k. Activation of a panic alarm on one 24-hour auxiliary zone.
 - l. Digital zone identification by pressing a digit key.
 - m. Digital display of shunted zone numbers.
 - n. Illuminated keypad.
 2. Keypad shall have the following user programmable options:
 - a. Audible indication of dial tone detection success or failure.
 - b. Manual zone shunting individually and/or by group.
 - c. Ambush code disguised as disarming code shall transmit a silent alarm if an intruder forces the user to disarm.
 - d. Fallback code shall set the system to either armed or disarmed status on power up. This code shall also allow arming/disarming if and only if no keypad-programmed user codes are loaded.
 3. Provide one keypad on face of Intrusion System Control Panel enclosure and at locations shown on the plans.

4. Keypads shall be Napco GEMK1CA or approved equal.
- C. Provide to the Owner one complete copy of the programming and downloading software (PC-compatible) and one complete PC-compatible interface kit.

2.3 INITIATING DEVICES

- A. Intrusion Alarm:
 1. Passive Infrared Motion Detector: Provide passive infrared motion detectors with the following features:
 - a. 0.5 to 15.0 ft./sec detectable speed.
 - b. Integral tamper contact.
 - c. 120 degree rotatable optical assembly with calibrated range and direction scale.
 - d. Surface mounted.
 - e. Wide coverage detectors shall be UTCFS AP669 or equal with 60 ft. x 60 ft. coverage and 18 full curtains, Ceiling mounted.
 - f. Detectors shall be powered from the intrusion panel.
 - g. All conductors shall be solid or stranded copper, #20 AWG minimum.

2.4 REMOTE MONITORING

- A. Provide dry contacts as required for remote monitoring of the intrusion system by the Building Control System as follows:
 1. Common alarm.
 2. Panel status (armed or disarmed).

2.5 CONDUCTORS

- A. All conductors shall be solid or stranded copper, of a size and type recommended by the manufacturer for each input and output.

2.6 SUBSCRIBER CODES AND SYSTEM PROGRAMMING

- A. System programming will be performed by the Contractor. The Contracting Agency shall provide the contractor a list of codes prior to checkout. The Contracting Agency shall program final codes at the turnover of the project.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount Security Control Panel enclosure(s) in office area (as shown on the Drawings) where accessible only by authorized personnel.
- B. Install conductors and field devices in accordance with Section 26 05 33 Raceway and Boxes for Electrical Systems. Use of plenum cable is acceptable for the security wiring in lieu of conduit.
- C. Mount keypad on face of intrusion control panel. Provide matching backplate as necessary.
- D. Coordinate exact mounting locations with manufacturer's requirements and Owner prior to rough-in. Obtain statement of Owner approval.
- E. Adjust sensitivity of system components in accordance with manufacturer's recommendations for the specific location.

3.2 ZONING

- A. Locate end-of-line resistors as recommended by system manufacturer.
- B. Each device shall be capable of being programmed as an individual zone or grouped into any zone.
- C. Exterior doors with keypads or in direct path to a keypad shall be designed or capable of being designed as an entry/exit zone.

END OF SECTION 28 16 00

SECTION 31 00 00 - EARTHWORK FOR STRUCTURES AND SITE IMPROVEMENTS AND SITE IMPROVEMENTS**PART 1 - GENERAL****1.1 DESCRIPTION OF WORK**

- A. The extent of earthwork is shown on drawings and includes, but is not limited to all excavation, backfill, and final grading necessary and incidental for the building, foundations, footings, and site improvements including paving, utilities, concrete walks and curbs.

1.2 RELATED REQUIREMENTS

- A. Sections of Division 01.
- B. Section 33 00 00: MOA Referenced Specifications.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM C 136 Sieve Analysis of Fine and Course Aggregates
 - b. ASTM D 422 Test Method for Particle-Size Analysis of Soils
 - c. ASTM D 1556 Test Method for Density of Soils in Place by Sand-Cone Method
 - d. ASTM D 1557 Test Methods for Moisture-Density of Soils and Soil-Aggregate Mixtures
 - e. ASTM D 2167 Test Method for Density and Unit Weights of Soil in Place by the Rubber Balloon Method
 - f. ASTM D 2922 Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods

1.4 DEFINITIONS

- A. Existing grade shall mean the grades that existed prior to the start of excavation.
- B. Unstable Soil: Soft, loose, or wet ground that is incapable of supporting material, equipment, personnel, or structure.

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- C. Non-frost Susceptible: Non-organic soil containing less than 3% by weight of particles smaller than 0.02 mm.
 - D. Backfill: Material placed in an excavated area.
 - E. Bedding: Material or supports on which pipe is laid.
 - F. Borrow: Material used as fill and/or backfill which is obtained from a source other than required excavation.
 - G. Compaction: Tamping by hand or machine to achieve required density in soils.
 - H. Disposal Area: Any area where waste from construction is placed.
 - I. Excavation: Area or material removed to provide a suitable base for improvement.
 - J. Fill: Material placed above the original ground line.
 - K. Trench: Any excavation for a utility.
 - L. Unsuitable Material: Soil materials which do not qualify for "classified" or "unclassified" material and which cannot be satisfactorily compacted or otherwise used in the work. Also, material which, in the opinion of the Owner, is inadequate for use in the proposed construction.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. The Contractor shall provide soil testing and inspection service by an independent testing firm experienced in performing soil analyses. The testing firm shall be approved by the Owner prior to commencing work.
- C. Testing Standards:
 - 1. Where compaction density is specified, the maximum density shall be determined in accordance with the current requirements of ASTM D 1557.
 - 2. The in-place soil density may be determined by use of:
 - a. ASTM D 2922.
 - b. ASTM D 1556.
 - c. ASTM D 2167.
 - 3. Compaction tests shall be taken on each lift of fill or backfill, including trenches, and at the average rate of one test per 2500 s.f. of graded or landscaped areas, and per 1,000 s.f. of improved horizontal areas, and max. 50' o.c. for footing trenches. Failing tests shall be retested at no additional cost to the Owner.

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4. Gradation test, in accordance with ASTM C 136, shall be performed on each type of aggregate materials used in fills and backfills at the rate of one test per 1,000 cubic yards or each day's haul, whichever is less material. If material is to be non-frost susceptible, perform hydrometer tests in accordance with ASTM D 422.

1.6 STORM WATER POLLUTION PREVENTION.

- A. Contractor shall be responsible for obtaining permits from the Alaska Department of Environmental Conservation (ADEC) and the Environmental Protection Agency (EPA) for the Construction Phase of the project. Permits will be required from ADEC for Storm Water Pollution Prevention and from EPA for National Pollution Discharge Elimination System (NPDES). Additional permits may be required and shall be the responsibility of the Contractor.

1.7 SUBMITTALS

- A. Testing Agency Reports.
- B. Cold weather work plan.
- C. ADEC Storm Water Pollution Prevention Plan and permit.
- D. EPA NPDES plan and permit.

1.8 JOB CONDITIONS

- A. Site Information: Geotechnical investigation data are not intended as representations or warranties of accuracy or continuity between soil borings, but is made available for the convenience of the Contractor. It is expressly understood that the Owner will not be responsible for interpretations or conclusions drawn there from by Contractor.
- B. Existing Utilities:
 1. Verify utility locations prior to beginning of any excavation. Request utility locates from Locate Call Center 278-3121.
 2. Note existing underground utilities in areas of work, and provide adequate means of protection during earthwork operations.
 3. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult Owner immediately for directions. Cooperate in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Owner.
- C. Use of Explosives is not permitted.

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- D. Protection of persons and property:
1. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.
 2. Protect bench marks, structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 3. Protect above and below grade utilities which are to remain.
 4. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.
 5. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do no earthwork when outside temperature is expected to be below 32°F or when the subgrade is frozen or has standing water or snow, unless approved by Owner. Provide work plan for accomplishing earthwork when outside temperature is expected to be below 32°F.
- B. Do not place frozen fill materials unless approved by Owner.

1.10 CONTAMINATED SOILS

- A. In the event contaminated soils are encountered in the excavation, as evidenced by staining or odor, stop work and notify the Owner.

PART 2 - PRODUCTS

2.1 MATERIAL SOURCE

- A. Backfill materials may be selected from excess site excavation materials if they meet the specified material and gradation requirements, can be placed and compacted to the specified densities, and are not contaminated. Otherwise all material will be obtained by the Contractor from an approved source at no additional cost to the Owner. Over excavation beyond the limits indicated or specified is not permitted. No representation is made as to the suitability of on site material.

2.2 UNCLASSIFIED BACKFILL

- A. Approved select inorganic material free trash, peat, volcanic ash, debris, organic material, frozen clods, or stones in excess of 6" in any dimension; silts with a plasticity index greater than 6; clays which are capable of being satisfactorily compacted. The material may be frost susceptible. Material shall be suitable for compaction to the required density. In addition to the

above requirements, unclassified fill or backfill placed beneath building slabs-on-grade and paved areas shall be free of materials classified as PT, OH, OL, ML, MH, CL, or CH by ASTM D2487.

2.3 CLASSIFIED BACKFILL

- A. Type II. Classified material shall be non-frost susceptible and shall be graded within the following limitations:

U.S. STANDARD SIEVE	CUMULATIVE % PASSING BY WEIGHT
8"	100
3"	70-100
1-1/2"	55-100
3/4"	45-85
#4	20-60
#10	12-50
#40	4-30
#200	*2-6

*In addition to the grading limits listed above, the fraction of material passing the #200 sieve shall not be greater than 20% of the fraction passing the #4 sieve.

- B. Type II-A. Classified material shall be non-frost susceptible and shall be graded within the following limitations:

U.S. STANDARD SIEVE	CUMULATIVE % PASSING BY WEIGHT
3"	100
3/4"	50-100
#4	25-60
#10	15-50
#40	4-30
#200	*2-6

*In addition to the grading limits listed above, the fraction of material passing the #200 sieve shall not be greater than 20% of the fraction passing the #4 sieve.

2.4 BEDDING MATERIAL

- A. Class "B". Bedding material shall be classified material and shall be graded within the following limitations:

U.S. STANDARD SIEVE	CUMULATIVE % PASSING BY WEIGHT
1"	100
3/8"	60-100
#4	40-85
#10	25-70
#40	5-40
#200	*0-6

*In addition to the grading limits listed above, the fraction of material passing the #200 sieve shall not be greater than 35% of the fraction passing the #40 sieve.

2.5 FILTER MATERIAL

- A. Type "C". Filter material shall be gravel or sand consisting of crushed or naturally occurring granular material. It shall be free of clay particles and shall be graded within the following limitations:

U.S. STANDARD SIEVE	CUMULATIVE % PASSING BY WEIGHT
2"	100
1-1/2"	95-100
3/4"	0-20
3/8"	0-5

PART 3 - EXECUTION

3.1 CLEARING

- A. Area of work shall be cleared of existing stumps, logs, and brush to the limits shown on the Drawings or, if limits are not indicated, as required to accomplish construction. Debris shall be removed from the site and disposed of by the Contractor.

3.2 EXCAVATION

- A. Excavation consists of the removal and reuse or disposal of all materials encountered to obtain the required subgrade elevations. Excess material not incorporated in the work shall be removed from the site. Extent of excavation as indicated on the drawings and as follows:
1. The excavation shall be shaped to drain and shall be maintained in a dry condition, free of puddles or holes where water may accumulate.

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2. The Contractor shall plan his operations in a sequence that will provide drainage at all times. Any areas not so drained shall be kept free of standing water by pumping, if necessary.
 3. Subgrade for footings is as indicated on the drawings.
 4. Subgrade for interior slabs on grade is as indicated on the drawings.
 5. Subgrade for exterior concrete and asphalt paving is as indicated on the drawings.
 6. Bottom of excavation for concrete stoops and landings at exterior doors shall be at the same elevation as the adjacent building bottom of footing. Extend excavation a minimum of five (5) feet beyond building face and three (3) feet beyond each edge of stoop. Taper excavation at 1:1 to meet adjacent subgrade excavation limits.
- B. Unsuitable materials shall be excavated and disposed of off site at no additional cost to the Owner.
- C. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', including requirements for special fill. Extend a sufficient distance from footings and foundation to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection. Taper all change in excavation elevations, out side of the building foot print, at 1:1 to meet adjacent subgrade excavation limits.
- D. In excavating for footings and foundations, take care not to disturb bottom of excavation. Trim bottoms to required lines and grades to leave solid base to receive work. The upper 6" of receiving surface shall be compacted to not less than 95% of maximum dry density.
- E. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction.
1. Unauthorized excavation, as well as remedial work as directed, shall be at Contractor's expense.
 2. Backfill and compact unauthorized excavations as specified for authorized excavations of same classification.
- F. Additional Excavation: When excavation has reached required subgrade elevations, notify Owner who will make an inspection of conditions.
1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material with material as directed.
 2. If it is verified that encountered materials are unsuitable and extra excavation is required, a change order, using quoted unit prices and reflecting the agreed amount of increase in excavation and backfill, will be issued.
 3. No compensation will be allowed unless Contractor notifies Owner of unsuitable materials prior to additional excavation.
- G. Reduced Excavation: If during the excavation it is found that material encountered, at elevation higher than those basically required, satisfies the fill/backfill requirements specified below, notify Owner who will make an inspection of conditions.

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1. If it is verified that encountered materials are acceptable and no further excavation is required, a credit change order, using quoted unit prices and reflecting the agreed amount of reduction in backfill, will be issued.
- H. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction.
1. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
 2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- I. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations.
 2. Dispose of excess soil materials and waste materials off site.
- J. Any topsoil material removed as part of the excavation shall be stockpiled and reused at areas to be seeded.
- K. Cold Weather Protection: Protect excavation bottoms against freezing when the atmospheric temperature is less than 35 degrees F by covering with dry insulating materials of sufficient depth to prevent frost penetration. In the event bearing surfaces are softened by water or frost, re-excavate to approved bearing material and backfill to designated elevations with compacted backfill and specified herein.

3.3 DEWATERING

- A. Surface runoff, rainfall, or groundwater shall not be allowed to accumulate in excavations. It shall be the Contractor's responsibility to sample and test such water and subsequently collect and dispose of the water in accordance with applicable local, state, and federal regulations.

3.4 EXISTING UTILITIES

- A. Hand digging may be required to prevent damage to existing utilities.
- B. Notify the Owner and utility Owner immediately upon damage to any utility. Located or identified utilities damaged by the Contractor will be repaired at no cost to the utility Owner. Unidentified utilities damaged by the Contractor will be repaired by the utility Owner.

3.5 FILL AND BACKFILL

- A. General:

1. When the quantity of suitable soils material required for the work exceeds that available from excavated materials, the additional material shall be from Contractor-furnished borrow areas. The Contractor is required to locate, obtain, develop, and process suitable materials to complete the requirements of work.
 2. Fills and backfills shall consist of classified and unclassified materials, as required, to obtain the proper grades, sections, and contours as indicated on the drawings. Fill and backfill materials placed in excess of these requirements shall not be paid unless authorized by a fully executed change order.
 3. All excavated materials, satisfying the classified or unclassified material description shall be, insofar as practicable, incorporated in the work.
 4. Areas to receive fill and backfill shall be free of organic topsoil, vegetation, and other objectionable matter. The receiving surface shall be uniformly graded and free of soft or yielding areas.
 5. The Contractor shall keep all fills and backfill well shaped, drained and maintained.
 6. Moisture condition by adding water or drying, as necessary for compaction.
 7. Do not start backfilling operations until piping, mechanical, electrical, and other utility systems have been tested, inspected, and approved.
- B. For Building Area:
1. Fill, backfill and grade to required elevation with classified or unclassified materials as indicated or specified. In all cases no aggregate exceeding 1-1/2" shall be placed within the top 6" under slabs and footings.
 2. All fill and backfill shall be placed and compacted in lifts of 8" thickness to facilitate uniform compaction.
 3. Grade fill under building slabs smooth and even, free of voids, compacted as specified, and to required elevations. Provide final grades within a tolerance of 1/4" in 10'.
- C. For Asphalt and Concrete Paving:
1. Fills and backfills shall be constructed with classified or unclassified materials, providing that the upper 30" layer shall be of classified material. In addition, the top 6" shall consist of well graded sandy gravel or gravelly sand, and shall have a maximum aggregate size of 1-1/2".
 2. Fills and backfills shall be constructed in lifts of 12" maximum thickness and compacted to not less than 95% of maximum dry density.
 3. The surface shall be smooth with no soft or yielding areas and shall be graded to not more than 0.05' above or below the design subgrade.

3.6 COMPACTION

- A. Compact fill to required density by hand or with mechanical tampers.
- B. Compact to not less than the percentages of maximum dry density (relative compaction) shown on the Drawings for material which exhibits a well-defined moisture density relationship determined in accordance with ASTM D-1557 test method.

-
- C. Unless otherwise indicated, minimum compaction shall be as follows:
1. Under structural footing and slabs on grade - 95%.
 2. Under sidewalks and paved parking areas - 95%.
 3. Other areas - 85%.

3.7 AREA GRADING

- A. Area grading consists of that type of work also commonly referred to by such terms as "site grading" or "over-lot grading" and consists of the excavation and placement of materials to the lines and grades indicated on the drawings. No special consideration will be given to whether or not frost-susceptible materials exist in the subgrade for area grading and its removal therefrom will not be required.
- B. Area grading fill shall be constructed of unclassified materials. The fill material shall be placed in successive horizontal layers not exceeding 12" in loose thickness and shall be compacted to not less than 85% of maximum density. The finish grade surface shall be smooth and free from irregular surface changes. The finish grade shall be not more than 0.15' above or below the established finish grade. In those areas where the grade at the limit of grading is above or below the elevation of the adjoining natural surface, the finish grade shall be maintained to the limit of grading, and the edge of the cut or fill feathered off to make a smooth transition. No boulders, rocks, or hard clumps larger than 4" shall be left within the top 6" of the design finish grade. Depth of topsoil shall be as defined in Section 32 92 00 and as indicated.

3.8 WASTE DISPOSAL

- A. All soil with garbage and any excess soil or unsuitable soil shall be removed from work areas and disposed of by the Contractor off the site.

3.9 MAINTENANCE

- A. Contractor shall water the site while grading is in progress to control dust.
- B. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- C. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.
- D. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

MUNICIPALITY OF ANCHORAGE
FIRE STATION 11 STORAGE BUILDING

DIVISION 31
EARTHWORK

SECTION 31 00 00 - Page 11
EARTHWORK FOR STRUCTURES

3.10 CLEAN UP

- A. Smooth grade transition to existing soils grade at any depressions or disturbed areas adjacent to the backfilled areas.
- B. Repair any damage to existing structures or roadways which result from earthwork.

END OF SECTION 31 00 00

SECTION 33 00 00 - MOA REFERENCED SPECIFICATIONS**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section references the Municipality of Anchorage (MOA) Standard Specifications as described below and shall be incorporated into these specifications as though physically contained herein.
- B. Standard Specification, Street Drainage-Utilities-Utilities-Parks, Municipality Of Anchorage, 2015, As:
1. Division 20.00 – Earthwork:
 - Section 20.01 General
 - Section 20.02 Stormwater Pollution Prevention Plan
 - Section 20.03 Exploratory Test Pits
 - Section 20.04 Clearing & Grubbing
 - Section 20.07 Removal of Concrete Apron
 - Section 20.08 Removal of Curb and Gutter
 - Section 20.09 Removal of Pavement
 - Section 20.10 Excavation of Traffic Ways
 - Section 20.11 Grading Existing Surfaces
 - Section 20.12 Dewatering
 - Section 20.13 Trench Excavation and Backfill
 - Section 20.14 Trench Excavation, Backfill and Compaction for Service Connections
 - Section 20.15 Furnish Trench Backfill
 - Section 20.16 Furnish Bedding Material
 - Section 20.17 Furnish Filter Material
 - Section 20.18 Drain Filter Rock
 - Section 20.19 Furnish Foundation Backfill
 - Section 20.20 Unclassified Fill and Backfill
 - Section 20.21 Classified Fill and Backfill
 - Section 20.22 Leveling Course
 - Section 20.25 Geotextile
 - Section 20.26 Insulation
 - Section 20.27 Disposal of Unusable or Surplus Material
 - Section 20.28 Reconstruct Driveway
 2. Division 30.00 – Portland Cement Concrete:
 - Section 30.01 General
 - Section 30.02 Portland Cement Concrete, Curb and Gutter and Valley Gutter
 - Section 30.03 Portland Cement Concrete Sidewalks
 - Section 30.04 Portland Cement Concrete Curb Ramps

MUNICIPALITY OF ANCHORAGE
FIRE STATION 11 STORAGE BUILDINGDIVISION 33
CIVILSECTION 33 00 00 - Page 2
MOA REFERENCED SPECIFICATIONS

-
- | | | |
|--|---------------|--------------------------------|
| | Section 30.05 | Structures and Retaining Walls |
| | Section 30.07 | Concrete - Building Structures |
| | Section 30.11 | Sidewalk Joint Sealant |
3. Division 40.00 - Asphalt Surfacing:
- | | | |
|--|---------------|--------------------------------------|
| | Section 40.01 | General |
| | Section 40.02 | Seal Coat |
| | Section 40.04 | Tack Coat |
| | Section 40.06 | Asphalt Concrete Pavement |
| | Section 40.11 | Remove and Replace Asphalt Surfacing |
4. Division 50.00 - Sanitary Sewers:
- | | | |
|--|---------------|-------------------------------------|
| | Section 50.01 | General |
| | Section 50.02 | Furnish and Install Pipe |
| | Section 50.08 | Lateral Connection to Existing Pipe |
| | Section 50.10 | Sanitary Sewer Service Connections |
| | Section 50.12 | Construct Sanitary Sewer Cleanout |
| | Section 50.15 | On-Property Sanitary Sewer Service |
5. Division 60.00 - Water Systems:
- | | | |
|--|---------------|----------------------------------|
| | Section 60.01 | General |
| | Section 60.02 | Furnish and Install Pipe |
| | Section 60.03 | Furnish and Install Valves |
| | Section 60.06 | Water Service Lines |
| | Section 60.08 | Temporary Water Systems |
| | Section 60.13 | Connect to Existing Water System |
6. Division 65.00 - Construction Survey:
- | | | |
|--|---------------|------------------------|
| | Section 65.01 | General |
| | Section 65.02 | Construction Surveying |
7. Division 70.00 – Miscellaneous:
- | | | |
|--|---------------|--|
| | Section 70.01 | General |
| | Section 70.02 | Adjust Gas Valve Key Box to Finish Grade |
| | Section 70.07 | Remove Pipe |
| | Section 70.10 | Traffic Markings |
| | Section 70.11 | Standard Signs |
| | Section 70.12 | Traffic Maintenance |
| | Section 70.13 | Bollards |
| | Section 70.19 | Silt Fence |
| | Section 70.20 | Soil Stabilization |
8. Division 75.00 – Landscape Improvements
- | | | |
|--|---------------|-------------|
| | Section 75.01 | General |
| | Section 75.02 | Landscaping |
| | Section 75.03 | Topsoil |
| | Section 75.04 | Seeding |

Section 75.05	Sod
Section 75.06	Landscape Edging
Section 75.07	Landscape Fabric
Section 75.09	Site Furnishings

1.2 Modification and/or additions to municipality of anchorage standard specifications

- A. All Divisions, All Sections - All references to construction within a public Right of Way shall also include the on-site construction area as indicated on the drawings.
- B. Division 20 - Standard Construction Specifications for Earthwork:
1. General: Soil testing and inspection reports shall be as specified in SECTION 31 00 00, EARTHWORK FOR STRUCTURES AND SITE IMPROVEMENTS.
 2. Section 20.10 - Excavation for Traffic Ways:
 - Article 10.2 - Survey Stakes:
 - a. Delete entire paragraph. Add "Survey staking shall be the responsibility of the Contractor."
 - Article 10.4 - Unusable and Usable Excavation:
 - b. Delete second paragraph entirely, add: "Usable excavation shall consist of all inorganic material suitable for classified or unclassified fill or backfill excavated from the site."
 - c. Fifth paragraph, first sentence: Substitute the word "subbase" for "subgrade".
 3. Section 20.21 - Classified Fill or Backfill:
 - Article 21.1 – General:
 - a. Add "All classified fill shall be Type II or Type II-A. All classified fill within six inches (6") of the surface shall be 2" minus Type II-A".
 - Article 5.2 – Material:
 - b. Paragraph b. Type II; Add the following sentence: "Type II material shall be non-frost susceptible."
 - c. Paragraph c. Type II-A; Add the following sentence: "Type II-A material shall be non-frost susceptible."
- C. Division 50 - Sanitary Sewers:
1. Section 50.01 – General:
 - Article 1.1 - Scope of Work:
 - Add the following paragraphs:
 - a. "In addition to testing requirements specified herein, all utility lines shall be tested after installation and backfilling is complete. This requirement may be in addition to AWWU requirements for testing prior to backfilling operations."
 - b. "The contractor shall provide a red lined drawing within 10 days of final acceptance of the sewer line showing as-built information on the following:
 - 1) Horizontal location and elevation at least every 200 feet along the pipe and inverts of all pipes at manholes and cleanouts.
 - 2) Horizontal and vertical location of any other utilities intercepted in the trench.

- 3) Type and depth of bedding used, if any.
- 4) Accurate detail and location of any unique tie-ins, special combination of fittings, etc. "

D. Division 60 - Water Systems:

1. Section 60.01 – General:

Article 1.1 - Scope of Work:

Add the following paragraphs:

- a. "In addition to testing requirements specified herein, all utility lines shall be tested after installation and backfilling is complete. This requirement may be in addition to AWWU requirements for testing prior to backfilling operations."
- b. "The contractor shall provide a red lined drawing within 10 days of final acceptance of the water line showing as-built information on the following:
 - 1) Horizontal location and elevation at least every 200 feet along the pipe and of all tees, bends, p.c.'s, changes in grade and end of any dead-end runs.
 - 2) Horizontal location for all valves, hydrants, bleeders, change in pipe size or class. In addition to stationing, location of valves shall also be shown by three (3) swing ties from each valve to appropriate prominent features. Distances should be less than 100 feet.
 - 3) Horizontal and vertical location of any other utilities intercepted in the trench.
 - 4) Type and depth of bedding used, if any.
 - 5) Accurate detail and location of any unique tie-ins, special combination of fittings, etc.
 - 6) On service key boxes, show station on mainline for corporation stop, length and size of service line, location of key box by 2 or more swing ties and station and offset to terminus. Swing ties to be as close to 90 degrees to one another as possible."

PART 2 - PRODUCTS (Not APPLICABLE).

PART 3 - EXECUTION (Not APPLICABLE).

END OF SECTION 33 00 00



MINIMUM RATES OF PAY For Laborers and Mechanics

Effective September 1, 2022

Issue 45

PAMPHLET No. 600

Title 36. Public Contracts
AS 36.05

DEPARTMENT OF LABOR
AND WORKFORCE DEVELOPMENT

Wage and Hour



THE STATE
of **ALASKA**
GOVERNOR MIKE DUNLEAVY

Department of Labor and Workforce Development

Office of the Commissioner

Post Office Box 111149
Juneau, Alaska 99811
Main: 907.465.2700
fax: 907.465-2784

September 1, 2022

TO ALL CONTRACTING AGENCIES:

At the Alaska Department of Labor and Workforce Development our goal is putting Alaskans to work. This pamphlet is designed to help contractors awarded public construction contracts understand the most significant laws of the State of Alaska pertaining to prevailing wage.

This pamphlet identifies current prevailing wage rates for public construction contracts (any construction projects awarded for the State of Alaska or its political subdivisions, such as local governments and certain non-profit organizations). Because these rates may change in a subsequent determination, please be sure you are using the appropriate rates. The rates published in this edition become effective September 1, 2022.

The prevailing wage rates contained in this pamphlet are applicable to public construction projects with a final bid date of September 11, 2022, or later. As the law now provides, these rates will remain stable during the life of a contract or for 24 calendar months, whichever is shorter. **The 24-month period begins on the date the prime contract is awarded.** Upon expiration of the initial 24-month period, the latest wage rates issued by the department shall become effective for a subsequent 24-month period or until the original contract is completed, whichever occurs first. This process shall be repeated until the original contract is completed.

The term "original contract" means the signed contract that resulted from the original bid and any amendments, including changes of work scope, additions, extensions, change orders, and other instruments agreed to by the parties that have not been subject to subsequent open bid procedures.

If a higher federal rate is required due to partial federal funding or other federal participation, the higher rate must be paid.

For additional copies of this pamphlet go to: <http://labor.state.ak.us/lss/pamp600.htm>

For questions regarding prevailing wage or employment preference requirements, please contact the nearest Wage and Hour office. These offices are listed on Page x.

Sincerely,

A handwritten signature in black ink, appearing to read "Tamika L. Ledbetter".

Dr. Tamika L. Ledbetter
Commissioner

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Note to Readers: The statutes and administrative regulations listed in this publication were taken from the official codes, as of the effective date of the publication. However, there may be errors or omissions that have not been identified and changes that occurred after the publication was printed. This publication is intended as an informational guide only and is not intended to serve as a precise statement of the statutes and regulations of the State of Alaska. To be certain of current laws and regulations, please refer to the official codes.

- (2) shall withhold from the final payment an amount sufficient to pay the department's estimate of what may be needed to compensate the employees of any contractors under investigation on this construction contract, and any unpaid filing fees.
- (d) The notice and filing fee required under (a) of this section may be filed after work has begun if
 - (1) The public construction contract is for work undertaken in immediate response to an emergency; and
 - (2) The notice and fees are filed not later than 14 days after the work has begun.
- (e) A false statement made on a notice required by this section is punishable under AS 11.56.210.

Sec. 36.05.060. Penalty for violation of this chapter.

A contractor who violates this chapter is guilty of a misdemeanor and upon conviction is punishable by a fine of not less than \$100 nor more than \$1,000, or by imprisonment for not less than 10 days nor more than 90 days, or by both. Each day a violation exists constitutes a separate offense.

Sec. 36.05.070. Wage rates in specifications and contracts for public works.

- (a) The advertised specifications for a public construction contract that requires or involves the employment of mechanics, laborers, or field surveyors must contain a provision stating the minimum wages to be paid various classes of laborers, mechanics, or field surveyors and that the rate of wages shall be adjusted to the wage rate under AS 36.05.010.
- (b) Repealed by §17 ch 142 SLA 1972.
- (c) A public construction contract under (a) of this section must contain provisions that
 - (1) the contractor or subcontractors of the contractor shall pay all employees unconditionally and not less than once a week;
 - (2) wages may not be less than those stated in the advertised specifications, regardless of the contractual relationship between the contractor or subcontractors and laborers, mechanics, or field surveyors;
 - (3) the scale of wages to be paid shall be posted by the contractor in a prominent and easily accessible place at the site of the work;
 - (4) the state or a political subdivision shall withhold so much of the accrued payments as is necessary to pay to laborers, mechanics, or field surveyors employed by the contractor or subcontractors the difference between
 - (A) the rates of wages required by the contract to be paid laborers, mechanics, or field surveyors on the work; and
 - (B) the rates of wages in fact received by laborers, mechanics, or field surveyors.

Sec. 36.05.080. Failure to pay agreed wages.

Every contract within the scope of AS 36.05.070 shall contain a provision that if it is found that a laborer, mechanic, or field surveyor employed by the contractor or subcontractor has been or is being paid a rate of wages less than the rate of wages required by the contract to be paid, the state or its political subdivision may, by written notice to the contractor, terminate the contractor's right to proceed with the work or the part of the work for which there is a failure to pay the required wages and to prosecute the work to completion by contract or otherwise, and the contractor and the contractor's sureties are liable to the state or its political subdivision for excess costs for completing the work.

Sec. 36.05.090. Payment of wages from withheld payments and listing contractors who violate contracts.

- (a) The state disbursing officer in the case of a state public construction contract and the local fiscal officer in the case of a political subdivision public construction contract shall pay directly to laborers, mechanics, or field surveyors from accrued payments withheld under the terms of the contract the wages due laborers, mechanics, or field surveyors under AS 36.05.070.
- (b) The state disbursing officer or the local fiscal officer shall distribute to all departments of the state government and to all political subdivisions of the state a list giving the names of persons who have disregarded their obligations to employees. A person appearing on this list and a firm, corporation, partnership, or association in which the person has an interest may not work as a contractor or

(3) the contractor pays the per diem to each laborer, mechanic, or field surveyor on the same day that wages are paid.

(b) A contractor may not pay per diem instead of board and lodging on a highway project located

- (1) west of Livengood on the Elliot Highway, AK-2;
- (2) on the Dalton Highway, AK-11;
- (3) north of milepost 20 on the Taylor Highway, AK-5;
- (4) east of Chicken on the Top of the World Highway; or
- (5) south of Tetlin Junction to the Alaska-Canada border on the Alaska Highway, AK-2.

8 AAC 30.056. Alternative arrangement. Upon a contractor's written request, the commissioner may approve an alternative board and lodging or per diem arrangement, provided

- (1) the arrangement does not reduce the laborer, mechanic, or field surveyor's wages below the prevailing wage rate; and
- (2) the laborer, mechanic, or field surveyor voluntarily enters into and signs the written arrangement; a labor organization representing laborers, mechanics, or field surveyors may enter into the written agreement on their behalf.

8 AAC 30.900. General definitions (selected excerpts only):

In this chapter and in AS 36

(22) "domiciled resident" means a person living within 65 road miles of a public construction project, or in the case of a highway project, the mid-point of the project, for at least 12 consecutive months prior to the award of the public construction project;

(23) "employed on the project" means the time period from the date the laborer, mechanic, or field surveyor first reports on-site to the project through the final date the person reports on-site to the project.

ADDITIONAL INFORMATION

PER DIEM

Notice: New regulations relating to board and lodging and per diem went into effect on November 25, 2018. The regulations provide a comprehensive set of requirements for the provision of board and lodging or per diem for workers on remote projects. Please refer to Alaska Administrative Code 8 AAC Chapter 30 and read the chapter carefully.

The Alaska Department of Labor and Workforce Development has determined that per diem is an established work practice for certain work classifications. These classifications are indicated throughout the Pamphlet by an asterisk (*) under the classification title. If all of the conditions of 8 AAC 30.054 are met, an employer may pay workers in these classifications per diem instead of providing board and lodging on a remote project.

Per Diem Rate: As of May 1st, 2019, the minimum per diem rate is \$100.00 per day, or part thereof, the worker is employed on the project. In the event that a contractor provides lodging facilities, but no meals, the department will accept a payment of \$48 per day for meals to meet the per diem requirements.

SPECIAL PREVAILING WAGE RATE DETERMINATION

Special prevailing wage rate determinations may be requested for special projects or a special worker classification if the work to be performed does not conform to traditional public construction for which a prevailing wage rate has been established under 8 AAC 30.050(a) of this section. Requests for special wage rate determinations must be in writing and filed with the Commissioner at least 30 days before the award of the contract. An applicant for a special wage rate determination shall have the responsibility to support the necessity for the special rate. An application for a special wage rate determination filed under this section must contain:

- (1) a specification of the contract or project on which the special rates will apply and a description of the work to be performed;
- (2) a brief narrative explaining why special wage rates are necessary;
- (3) the job class or classes involved;
- (4) the special wage rates the applicant is requesting, including survey or other relevant wage data to support the requested rates;
- (5) the approximate number of employees who would be affected; and
- (6) any other information which might be helpful in determining if special wage rates are appropriate.

Requests made pursuant to the above should be addressed to:

Director
Alaska Department of Labor and Workforce Development
Labor Standards and Safety Division
Wage and Hour
P.O. Box 111149
Juneau, AK 99811-1149

-or-

Email: statewide.wagehour@alaska.gov

EMPLOYMENT PREFERENCE INFORMATION

In October 2019, the Alaska Attorney General issued a formal opinion stating that the Alaska Statutes 36.10.150 of the State's 90% Employment Preference law, also known as the Alaska Resident Hire law, violates both the U.S. and Alaska Constitutions. As a result, the state has stopped all enforcement activity.

A copy of the Attorney General opinion is found here:

http://law.alaska.gov/pdf/opinions/opinions_2019/19-005_AK-hire.pdf

Laborers' & Mechanics' Minimum Rates of Pay

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
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Boilermakers

*See per diem note on last page

A0101	Boilermaker (journeyman)	46.97	8.57	18.08	1.90	VAC 4.25 SAF 0.34	80.11
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Bricklayers & Blocklayers

*See per diem note on last page

A0201	Blocklayer	42.01	9.00	10.20	0.62	L&M 0.20	62.03
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Bricklayer
Marble or Stone Mason
Refractory Worker (Firebrick, Plastic, Castable, and Gunitite Refractory Applications)
Terrazzo Worker
Tile Setter

A0202	Tuck Pointer Caulker	42.01	9.00	10.20	0.62	L&M 0.20	62.03
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Cleaner (PCC)

A0203	Marble & Tile Finisher	35.84	9.00	10.20	0.62	L&M 0.20	55.86
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Terrazzo Finisher

A0204	Torginal Applicator	35.84	9.00	10.20	0.62	L&M 0.20	55.86
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Carpenters, Region I (North of 63 latitude)

*See per diem note on last page

N0301	Carpenter (journeyman)	43.34	10.35	15.82	1.75	L&M 0.20 SAF 0.20	71.66
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Lather/Drywall/Acoustical

Carpenters, Region II (South of N63 latitude)

*See per diem note on last page

S0301	Carpenter (journeyman)	43.34	10.35	16.36	1.75	L&M 0.20 SAF 0.20	72.20
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Lather/Drywall/Acoustical

Cement Masons

*See per diem note on last page

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Cement Masons

*See per diem note on last page

A0404	Group IV, including:	40.13	8.70	11.80	1.43		L&M 0.10	62.16
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Preparing, scratching and browsing of all ceilings and walls, finished with terrazo or tile

Tunnel Worker

A0405	Group V, including:	40.13	8.70	11.80	1.43		L&M 0.10	62.16
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Casting and finishing

EIFS Systems

Finishing of all interior and exterior plastering

Fireproofing (Pryocrete, Cafco, Albi-Clad, sprayed fiberglass)

Gypsum, Portland Cement

Kindred material and products

Operation and control of all types of plastering machines, including power tools and floats, used by the industry

Overcoating and maintenance of interior/exterior plaster surfaces

Plasterer

Veneer plastering process (Rapid Plaster, U.S.G. "Imperial Systems", and Pabcoat Systems")

Venetian plaster and color-integrated Italian/Middle-Eastern line plaster

Culinary Workers

A0501	Baker/Cook	29.12	7.31	8.68			LEG	45.11
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A0503	General Helper	25.82	7.31	8.68			LEG	41.81
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Housekeeper

Janitor

Kitchen Helper

A0504	Head Cook	29.72	7.31	8.68			LEG	45.71
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A0505	Head Housekeeper	26.20	7.31	8.68			LEG	42.19
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Head Kitchen Help

Dredgemen

*See per diem note on last page

A0601	Assistant Engineer	42.76	11.05	13.75	1.00		L&M 0.10 0.05	68.71
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Craneman

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Electricians

*See per diem note on last page

A0707	Straight Line Installer - Repairman	48.78	14.23	17.11	0.95	L&M 0.20	LEG 0.15	81.42
A0708	Powderman	59.29	14.23	18.97	0.95	L&M 0.25	LEG 0.15	93.84
A0710	Material Handler	26.57	13.92	5.80	0.15	L&M 0.15	LEG 0.15	46.74
A0712	Tree Trimmer Groundman	29.12	14.23	13.35	0.15	L&M 0.15	LEG 0.15	57.15
A0713	Journeyman Tree Trimmer	38.05	14.23	13.62	0.15	L&M 0.15	LEG 0.15	66.35
A0714	Vegetation Control Sprayer	41.60	14.23	13.73	0.15	L&M 0.15	LEG 0.15	70.01
A0715	Inside Journeyman Communications CO/PBX	41.02	14.23	13.87	0.95	L&M 0.20	LEG 0.15	70.42

Elevator Workers

*See per diem note on last page

A0802	Elevator Constructor	44.21	16.02	20.21	0.65	L&M 0.60	VAC 4.90	86.59
A0803	Elevator Constructor Mechanic	63.16	16.02	20.21	0.65	L&M 0.60	VAC 7.01	107.65

Heat & Frost Insulators/Asbestos Workers

*See per diem note on last page

A0902	Asbestos Abatement-Mechanical Systems	40.32	9.24	11.12	1.20	IAF 0.14	LML 0.05	62.07
A0903	Asbestos Abatement/General Demolition All Systems	40.32	9.24	11.12	1.20	IAF 0.14	LML 0.05	62.07
A0904	Insulator, Group II	40.32	9.24	11.12	1.20	IAF 0.14	LML 0.05	62.07
A0905	Fire Stop	40.32	9.24	11.12	1.20	IAF 0.14	LML 0.05	62.07

Iron Workers

*See per diem note on last page

A1101	Ironworkers, including:	41.49	9.91	24.95	0.77	L&M 0.20	IAF 0.24	77.56
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Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)

*See per diem note on last page

						L&M	LEG	
N1201	Group I, including:	33.00	8.95	21.16	1.40	0.20	0.20	64.91

- Ditch Digger
- Dumpman
- Environmental Laborer (hazard/toxic waste, oil spill)
- Fence Installer
- Fire Watch Laborer
- Flagman
- Form Stripper
- General Laborer
- Guardrail Laborer, Bridge Rail Installer
- Hydro-seeder Nozzleman
- Laborer, Building
- Landscaper or Planter
- Laying of Mortarless Decorative Block (retaining walls, flowered decorative block 4 feet or less - highway or landscape work)
- Material Handler
- Pneumatic or Power Tools
- Portable or Chemical Toilet Serviceman
- Pump Man or Mixer Man
- Railroad Track Laborer
- Sandblast, Pot Tender
- Saw Tender
- Slurry Work
- Steam Cleaner Operator
- Steam Point or Water Jet Operator
- Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)
- Tank Cleaning
- Utiliwalk & Utilidor Laborer
- Watchman (construction projects)
- Window Cleaner

						L&M	LEG	
N1202	Group II, including:	34.00	8.95	21.16	1.40	0.20	0.20	65.91

- Burning & Cutting Torch
- Cement or Lime Dumper or Handler (sack or bulk)
- Certified Erosion Sediment Control Lead (CESCL Laborer)
- Choker Splicer
- Chucktender (wagon, air-track & hydraulic drills)
- Concrete Laborer (power buggy, concrete saws, pumpcrete nozzleman, vibratorman)
- Culvert Pipe Laborer
- Cured Inplace Pipelayer

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
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Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)

*See per diem note on last page

					L&M	LEG	
N1204	Group IIIA	38.18	8.95	21.16	1.40	0.20	70.09
	Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)						
	Pioneer Drilling & Drilling Off Tugger (all type drills)						
	Pipelayers						
	Powderman (Employee Possessor)						
	Storm Water Pollution Protection Plan Specialist (SWPPP Specialist)						
	Traffic Control Supervisor, DOT Qualified						

					L&M	LEG	
N1205	Group IV	22.57	8.95	21.16	1.40	0.20	54.48
	Final Building Cleanup						
	Permanent Yard Worker						

					L&M	LEG	
N1206	Group IIIB	41.97	6.24	21.16	1.40	0.20	71.17
	Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours)						
	Federal Powderman (Responsible Person in Charge)						
	Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones)						
	Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours)						
	Stake Hopper						

Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

					L&M	LEG	
S1201	Group I, including:	33.00	8.95	21.16	1.40	0.20	64.91
	Asphalt Worker (shovelman, plant crew)						
	Brush Cutter						
	Camp Maintenance Laborer						
	Carpenter Tender or Helper						
	Choke Setter, Hook Tender, Rigger, Signalman						
	Concrete Labor (curb & gutter, chute handler, curing, grouting, screeding)						
	Crusher Plant Laborer						
	Demolition Laborer						
	Ditch Digger						
	Dumpman						
	Environmental Laborer (hazard/toxic waste, oil spill)						
	Fence Installer						
	Fire Watch Laborer						
	Flagman						

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

					L&M	LEG	
S1202	Group II, including:	34.00	8.95	21.16	1.40	0.20	65.91

Jackhammer/Chipping Gun or Pavement Breaker
Laser Instrument Operator
Laying of Mortarless Decorative Block (retaining walls, flowered decorative block over 4 feet - highway or landscape work)
Mason Tender & Mud Mixer (sewer work)
Pilot Car
Pipelayer Helper
Plasterer, Bricklayer & Cement Finisher Tender
Powderman Helper
Power Saw Operator
Railroad Switch Layout Laborer
Sandblaster
Scaffold Building & Erecting
Sewer Caulker
Sewer Plant Maintenance Man
Thermal Plastic Applicator
Timber Faller, Chainsaw Operator, Filer
Timberman

					L&M	LEG	
S1203	Group III, including:	34.90	8.95	21.16	1.40	0.20	66.81

Bit Grinder
Camera/Tool/Video Operator
Guardrail Machine Operator
High Rigger & Tree Topper
High Scaler
Multiplate
Plastic Welding
Slurry Seal Squeegee Man
Traffic Control Supervisor
Welding Certified (in connection with laborer's work)

					L&M	LEG	
S1204	Group IIIA	38.18	8.95	21.16	1.40	0.20	70.09

Asphalt Raker, Asphalt Belly Dump Lay Down
Drill Doctor (in the field)
Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)
Pioneer Drilling & Drilling Off Tugger (all type drills)
Pipelayers
Powderman (Employee Possessor)
Storm Water Pollution Protection Plan Specialist (SWPPP Specialist)

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
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Painters, Region I (North of N63 latitude)
 *See per diem note on last page

N1302	Group II, including:	36.60	9.27	15.10	1.08	L&M 0.07	62.12
	Machine/Automatic Taping						
	Pot Tender						
	Sandblasting						
	Specialty Painter						
	Spray						
	Structural Steel Painter						
	Wallpaper/Vinyl Hanger						

N1304	Group IV, including:	40.74	9.27	18.21	1.05	0.05	69.32
	Glazier						
	Storefront/Automatic Door Mechanic						

N1305	Group V, including:	39.44	9.27	5.00	1.10	0.10	54.91
	Carpet Installer						
	Floor Coverer						
	Heat Weld/Cove Base						
	Linoleum/Soft Tile Installer						

N1306	Group VI, including:	50.44	10.23	5.00	1.10	0.10	66.87
	Traffic Control Striper						

Painters, Region II (South of N63 latitude)
 *See per diem note on last page

S1301	Group I, including :	33.22	9.27	15.95	1.08	L&M 0.07	59.59
	Brush						
	General Painter						
	Hand Taping						
	Hazardous Material Handler						
	Lead-Based Paint Abatement						
	Roll						
	Spray						

S1302	Group II, including :	34.47	9.27	15.95	1.08	L&M 0.07	60.84
	General Drywall Finisher						
	Hand/Spray Texturing						
	Machine/Automatic Taping						
	Wallpaper/Vinyl Hanger						

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Piledrivers								
*See per diem note on last page								

A1405 Diver (standby) **See note on last page	47.65	10.35	15.82	1.75	0.20	0.20	75.97
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A1406 Dive Tender **See note on last page	46.65	10.35	15.82	1.75	0.20	0.20	74.97
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A1407 Welder (American Welding Society, Certified Welding Inspector)	48.90	10.35	15.82	1.75	0.20	0.20	77.22
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Plumbers, Region I (North of N63 latitude)								
*See per diem note on last page								

N1501 Journeyman Pipefitter	45.41	11.75	17.45	1.50	0.65	76.76
Plumber						
Welder						

Plumbers, Region II (South of N63 latitude)								
*See per diem note on last page								

S1501 Journeyman Pipefitter	41.00	11.88	15.27	1.55	0.20	69.90
Plumber						
Welder						

Plumbers, Region IIA (1st Judicial District)								
*See per diem note on last page								

X1501 Journeyman Pipefitter	41.32	13.37	11.75	2.50	0.24	69.18
Plumber						
Welder						

Power Equipment Operators								
*See per diem note on last page								

A1601 Group I, including:	43.53	11.05	13.75	1.00	0.10	0.05	69.48
Asphalt Roller: Breakdown, Intermediate, and Finish							
Back Filler							
Barrier Machine (Zipper)							
Belcrete with Power Pack & similar conveyors							
Bending Machine							
Boat Coxswain							
Bulldozer							
Cableways, Highlines & Cablecars							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
Power Equipment Operators								
*See per diem note on last page								

		L&M						
A1601	Group I, including:	43.53	11.05	13.75	1.00	0.10	0.05	69.48
	Service Oiler/Service Engineer							
	Shot Blast Machine							
	Shovels, Backhoes, Excavators with all attachments, and Gradealls (3 yards & under)							
	Sideboom (under 45 tons)							
	Sub Grader (Gurries & similar types)							
	Tack Tractor							
	Truck Mounted Concrete Pump, Conveyor/Tele-belt, & Creter							
	Wate Kote Machine							

		L&M						
A1602	Group IA, including:	45.29	11.05	13.75	1.00	0.10	0.05	71.24
	Camera/Tool/Video Operator (Slipline)							
	Certified Welder, Electrical Mechanic, Camp Maintenance Engineer, Mechanic (over 10,000 hours)							
	Cranes (over 45 tons or 150 feet including jib & attachments)							
	(a) Clamshells & Draglines (over 3 yards)							
	(b) Tower Cranes							
	Licensed Water/Waste Water Treatment Operator							
	Loaders (over 5 yards)							
	Motor Patrol Grader, Dozer, Grade Tractor (finish: when finishing to final grade and/or to hubs, or for asphalt)							
	Power Plants (1000 k.w. & over)							
	Profiler, Reclaimer, and Roto-Mill							
	Quad							
	Scrapers (over 40 yards)							
	Screed							
	Shovels, Backhoes, Excavators with all attachments (over 3 yards)							
	Sidebooms (over 45 tons)							
	Slip Form Paver, C.M.I. & similar types							
	Topside (Asphalt Paver, Slurry machine, Spreaders, and similar types)							

		L&M						
A1603	Group II, including:	42.76	11.05	13.75	1.00	0.10	0.05	68.71
	Boiler - Fireman							
	Cement Hogs & Concrete Pump Operator							
	Conveyors (except those listed in Group I)							
	Hoists on Steel Erection, Towermobiles & Air Tuggers							
	Horizontal/Directional Drill Locator							
	Locomotives, Rod & Geared Engines							
	Mixers							
	Screening, Washing Plant							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Power Equipment Operators

*See per diem note on last page

A1605	Group IV, including:	35.83	11.05	13.75	1.00	L&M		61.78
	Spotter					0.10	0.05	
	Steam Cleaner							
	Swamper (on trenching machines or shovel type equipment)							

Roofers

*See per diem note on last page

A1701	Roofer & Waterproofer	44.62	13.75	3.91	0.81	L&M		63.25
						0.10	0.06	

A1702	Roofer Material Handler	31.23	13.75	3.91	0.81	L&M		49.86
						0.10	0.06	

Sheet Metal Workers, Region I (North of N63 latitude)

*See per diem note on last page

N1801	Sheet Metal Journeyman	49.04	11.85	14.61	1.80	L&M		77.42
						0.12		

- Air Balancing and duct cleaning of HVAC systems
- Brazing, soldering or welding of metals
- Demolition of sheet metal HVAC systems
- Fabrication and installation of exterior wall sheathing, siding, metal roofing, flashing, decking and architectural sheet metal work
- Fabrication and installation of heating, ventilation and air conditioning ducts and equipment
- Fabrication and installation of louvers and hoods
- Fabrication and installation of sheet metal lagging
- Fabrication and installation of stainless steel commercial or industrial food service equipment
- HVAC-R Service Mechanic, servicing and maintaining HVAC-R Systems
- Manufacture, fabrication assembly, installation and alteration of all ferrous and nonferrous metal work
- Metal lavatory partitions
- Preparation of drawings taken from architectural and engineering plans required for fabrication and erection of sheet metal work
- Sheet Metal shelving
- Sheet Metal venting, chimneys and breaching
- Skylight installation

Sheet Metal Workers, Region II (South of N63 latitude)

*See per diem note on last page

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
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Surveyors

*See per diem note on last page

A2006	Chain Person (for crews with more than 2 people)	37.51	12.23	13.64	1.15	L&M 0.10	64.63
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Truck Drivers

*See per diem note on last page

A2101	Group I, including:	42.94	12.23	13.64	1.15	L&M 0.10	70.06
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- Air/Sea Traffic Controllers
- Ambulance/Fire Truck Driver (EMT certified)
- Boat Coxswain
- Captains & Pilots (air & water)
- Deltas, Commanders, Rollagons, & similar equipment (when pulling sleds, trailers or similar equipment)
- Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) over 40 yards up to & including 60 yards
- Helicopter Transporter
- Liquid Vac Truck/Super Vac Truck
- Material Coordinator or Purchasing Agent
- Ready-mix (over 12 yards up to & including 15 yards) (over 15 yards to be negotiated)
- Semi with Double Box Mixer
- Tireman, Heavy Duty/Fueler
- Water Wagon (250 Bbls and above)

A2102	Group 1A including:	44.21	12.23	13.64	1.15	L&M 0.10	71.33
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- Dump Trucks (including rockbuggy, side dump, belly dump & trucks with pups) over 60 yards up to & including 100 yards (over 100 yards to be negotiated)
- Jeeps (driver under load)
- Lowboys, including tractor attached trailers & jeeps, up to & including 12 axles (over 12 axles or 150 tons to be negotiated)

A2103	Group II, including:	41.68	12.23	13.64	1.15	L&M 0.10	68.80
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- All Deltas, Commanders, Rollagons, & similar equipment
- Batch Trucks (8 yards & up)
- Batch Trucks (up to & including 7 yards)
- Boom Truck/Knuckle Truck (over 5 tons)
- Cacasco Truck/Heat Stress Truck
- Construction and Material Safety Technician
- Dump Trucks (including rockbuggy, side dump, belly dump, & trucks with pups) over 20 yards up to & including 40 yards
- Gin Pole Truck, Winch Truck, Wrecker (truck mounted "A" frame manufactured rating over 5 tons)

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other Benefits	THR
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Truck Drivers

*See per diem note on last page

						L&M	
A2105	Group IV, including:	40.28	12.23	13.64	1.15	0.10	67.40
	Loadmaster (air & water operations)						
	Lumber Carrier						
	Ready-mix, (up to & including 7 yards)						
	Rigger (air/water/oilfield)						
	Tireman, Light Duty						
	Track Truck Equipment						
	Truck Vacuum Sweeper						
	Warehouseperson						
	Water Truck (Below 250 Bbls)						
	Water Truck (straight)						
	Water Wagon, Semi						

						L&M	
A2106	Group V, including:	39.52	12.23	13.64	1.15	0.10	66.64
	Buffer Truck						
	Bull Lifts & Fork Lifts, Fork Lifts with Power Boom & Swing Attachments (up to & including 5 tons)						
	Bus Operator (up to 30 passengers)						
	Farm Type Rubber Tired Tractor (when material handling or pulling wagons on a construction project)						
	Flat Beds, Single Rear Axle						
	Foam Distributor Truck Single Axle						
	Fuel Handler (station/bulk attendant)						
	Gear/Supply Truck						
	Gravel Spreader Box Operator on Truck						
	Hydro Seeders, Single axle						
	Pickups (pilot cars & all light-duty vehicles)						
	Rigger/Swamper						
	Tack Truck						
	Team Drivers (horses, mules, & similar equipment)						

Tunnel Workers, Laborers (The Alaska areas north of N63 latitude and east of W138 longitude)

*See per diem note on last page

						L&M	LEG	
N2201	Group I, including:	36.30	8.95	21.16	1.40	0.20	0.20	68.21
	Brakeman							
	Mucker							
	Nipper							
	Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)							
	Topman & Bull Gang							

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Class Code	Classification of Laborers & Mechanics	BHR	H&W	PEN	TRN	Other	Benefits	THR
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Tunnel Workers, Laborers (The area that is south of N63 latitude and west of W138 longitude)

*See per diem note on last page

S2201	Group I, including:	36.30	8.95	21.16	1.40	L&M	LEG	68.21
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Brakeman
Mucker
Nipper
Storm Water Pollution Protection Plan Worker (SWPPP Worker - erosion and sediment control Laborer)
Topman & Bull Gang
Tunnel Track Laborer

S2202	Group II, including:	37.40	8.95	21.16	1.40	L&M	LEG	69.31
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Burning & Cutting Torch
Certified Erosion Sediment Control Lead (CESCL Laborer)
Concrete Laborer
Floor Preparation, Core Drilling
Jackhammer/Chipping Gun or Pavement Breaker
Laser Instrument Operator
Nozzlemen, Pumpcrete or Shotcrete
Pipelayer Helper

S2203	Group III, including:	38.39	8.95	21.16	1.40	L&M	LEG	70.30
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Miner
Retimberman

S2204	Group IIIA, including:	42.00	8.95	21.16	1.40	L&M	LEG	73.91
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Asphalt Raker, Asphalt Belly Dump Lay Down
Drill Doctor (in the field)
Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)
Pioneer Drilling & Drilling Off Tugger (all type drills)
Pipelayer
Powderman (Employee Possessor)
Storm Water Pollution Protection Plan Specialist (SWPPP Specialist)
Traffic Control Supervisor, DOT Qualified

S2206	Group IIIB, including:	46.17	6.24	21.16	1.40	L&M	LEG	75.37
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Driller (including, but not limited to wagon drills, air-track drills, hydraulic drills)(over 5,000 hours)
Federal Powderman (Responsible Person in Charge)
Grade Checking (setting or transferring of grade marks, line and grade, GPS, drones)
Pioneer Drilling & Drilling Off Tugger (all type drills)(over 5,000 hours)

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

Shipyards Rates Addendum

This Addendum was developed to address the specialized industry of shipbuilding/repair in Alaska, as it relates to public works. For the purposes of providing rates for shipyard work the Department is adopting Shipyards rates from the state of Washington (King County). These rates only apply to work done in shipbuilding/repair in Alaska, under a public contract. This addendum will be updated two times a year to coincide with the corresponding Issue of *Laborers and Mechanics MINIMUM RATES OF PAY*.

Class Code		BHR	H&W	PEN	TRN	Other Benefits	THR
Shipyards Workers *See total hourly(THR) note below							
A2300	Ship Building/Repair Boilermaker						47.45
A2305	Ship Building/Repair Carpenter						47.35
A2310	Ship Building/Repair Crane Operator						45.06
A2315	Ship Building/Repair Electrician						48.92
A2320	Ship Building/Repair Heat & Frost Insulator						82.02
A2325	Ship Building/Repair Laborer						47.35
A2330	Ship Building/Repair Mechanist						47.35
A2335	Ship Building/Repair Operating Engineer						45.06
A2340	Ship Building/Repair Painter						47.35
A2345	Ship Building/Repair Pipefitter						47.35
A2350	Ship Building/Repair Rigger						47.45
A2355	Ship Building/Repair Sheet Metal						47.35
A2360	Ship Building/Repair Shipwright						47.35
A2365	Ship Building/Repair Warehouse						45.06

*The THR includes the base hourly rate (BHR) and fringe benefits. Employers must pay a BHR and fringe benefit package that adds up to the THR. Fringe benefits included in the THR can be paid to employees in three ways; paid into a union trust fund, into an approved benefit plan, or paid directly on the paycheck as gross wages.

Wage benefits key: BHR=basic hourly rate; H&W=health and welfare; IAF=industry advancement fund; LEG=legal fund; L&M=labor/management fund; PEN=pension fund; SAF=safety; SUI=supplemental unemployment insurance; S&L=SUI & LEG combined; TRN=training; THR=total hourly rate; VAC=vacation

"General Decision Number: AK20230001 01/13/2023

Superseded General Decision Number: AK20220001

State: Alaska

Construction Types: Building and Heavy

Counties: Alaska Statewide.

BUILDING AND HEAVY CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

<p>If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
<p>If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:</p>	<ul style="list-style-type: none"> . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

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01/13/2023

ASBE0097-001 06/01/2021

	Rates	Fringes
Asbestos Workers/Insulator (includes application of all insulating materials protective coverings, coatings and finishings to all types of mechanical systems).....	\$ 38.68	21.57
HAZARDOUS MATERIAL HANDLER (includes preparation, wetting, stripping, removal scrapping, vacuuming, bagging, and disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....	\$ 37.38	19.55

BOIL0502-002 01/01/2021

	Rates	Fringes
BOILERMAKER.....	\$ 47.03	30.59

BRAK0001-002 07/01/2020

	Rates	Fringes
Bricklayer, Blocklayer, Stonemason, Marble Mason, Tile Setter, Terrazzo Worker.....	\$ 42.16	19.67
Tile & Terrazzo Finisher.....	\$ 35.99	19.67

CARP1281-001 09/01/2022

	Rates	Fringes
CARPENTER Including Lather and Drywall Hanging.....	\$ 43.34	28.86

CARP1501-001 09/01/2019

	Rates	Fringes
MILLWRIGHT.....	\$ 37.64	23.46

CARP2520-003 09/01/2022

	Rates	Fringes
Diver Stand-by.....	\$ 47.65	28.32
Tender.....	\$ 46.65	28.32
Working.....	\$ 87.45	28.32
Piledriver Piledriver; Skiff Operator and Rigger.....	\$ 38.34	26.51
Sheet Stabber.....	\$ 38.34	26.51
Welder.....	\$ 43.90	26.51

DEPTH PAY PREMIUM FOR DIVERS BELOW WATER SURFACE:

50-100 feet \$1.00 per foot
 101 feet and deeper \$2.00 per foot

ENCLOSURE PAY PREMIUM WITH NO VERTICAL ASCENT:

5-50 FEET \$1.00 PER FOOT/DAY
 51-100 FEET \$2.00 PER FOOT/DAY
 101 FEET AND ABOVE \$3.00 PER FOOT/DAY

SATURATION DIVING:

The standby rate applies until saturation starts. The saturation diving rate applies when divers are under pressure continuously until work task and decompression are complete. the diver rate shall be paid for all saturation hours.

WORK IN COMBINATION OF CLASSIFICATIONS:

Employees working in any combination of classifications within the diving crew (except dive supervisor) in a shift are paid in the classification with the highest rate for that shift.

 ELEC1547-004 04/01/2022

	Rates	Fringes
CABLE SPLICER.....	\$ 42.77	3% + 27.97
ELECTRICIAN.....	\$ 42.44	3% + 28.22

 ELEC1547-005 04/01/2022

Line Construction

	Rates	Fringes
CABLE SPLICER.....	\$ 62.29	3%+32.37
Linemen (Including Equipment Operators, Technician).....	\$ 61.29	3%+30.98
Powderman.....	\$ 59.29	3%+32.37
TREE TRIMMER.....	\$ 38.05	3%+27.01

 * ELEV0019-002 01/01/2023

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 65.83	37.335+a+b

FOOTNOTE: a. Employer contributes 8% of the basic hourly rate for over 5 year's service and 6% of the basic hourly rate for 6 months to 5 years' of service as vacation paid credit. b. Eight paid holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Veteran's Day; Thanksgiving Day; Friday after Thanksgiving, and Christmas Day

 ENGI0302-002 01/01/2022

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	\$ 43.53	25.95
GROUP 1A.....	\$ 45.29	25.95
GROUP 2.....	\$ 42.76	25.95

GROUP 3.....	\$ 42.76	25.95
GROUP 4.....	\$ 35.83	25.95
TUNNEL WORK		
GROUP 1.....	\$ 47.88	25.95
GROUP 1A.....	\$ 49.82	25.95
GROUP 2.....	\$ 47.04	25.95
GROUP 3.....	\$ 46.24	25.95
GROUP 4.....	\$ 39.41	25.95

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Asphalt Roller: Breakdown, Intermediate, and Finish; Back Filler; Barrier Machine (Zipper); Beltcrete with power pack and similar conveyors; Bending Machine; Boat Coxwains; Bulldozers; Cableways, Highlines and Cablecars; Cleaning Machine; Coating Machine; Concrete Hydro Blaster; Cranes-45 tons and under or 150 foot boom and under (including jib and attachments): (a) Hydralifts or Transporters, all track or truck type,(b) Derricks; Crushers; Deck Winches-Double Drum; Ditching or Trenching Machine (16 inch or over); Drilling Machines, core, cable, rotary and exploration; Finishing Machine Operator, Concrete Paving, Laser Screed, Sidewalk, Curb and Gutter Machine; Helicopters; Hover Craft, Flex Craft, Loadmaster, Air Cushion, All Terrain Vehicle, Rollagon, Bargecable, Nodwell, and Snow Cat; Hydro Ax: Feller Buncher and similar; Loaders (2 1/2 yards through 5 yards, including all attachments): Forklifts with telescopic boom and swing attachment, Overhead and front end, 2 1/2 yards through 5 yards, Loaders with forks or pipe clamps; Loaders, elevating belt type, Euclid and similar types; Mechanics, Bodyman; Micro Tunneling Machine; Mixers: Mobile type w/hoist combination; Motor Patrol Grader; Mucking Machines: Mole, Tunnel Drill, Horizontal/Directional Drill Operator, and/or Shield; Operator on Dredges; Piledriver Engineers, L. B. Foster, Puller or similar Paving Breaker; Power Plant, Turbine Operator, 200 k.w. and over (power plants or combination of power units over 300 k.w.); Scrapers-through 40 yards; Service Oiler/Service Engineer; Sidebooms-under 45 tons; Shot Blast Machine; Shovels, Backhoes, Excavators with all attachments, and Gradealls (3 yards and under), Spreaders, Blaw Knox, Cedarapids, Barber Greene, Slurry Machine; Sub-grader (Gurries, Reclaimer, and similar types); Tack tractor; Truck mounted Concrete Pumps, Conveyor, Creter; Water Kote Machine; Unlicensed off road hauler

GROUP 1A: Camera/Tool/Video Operator (Slipline), Cranes-over 45 tons or 150 foot (including jib and attachments): (a) Clamshells and Draglines (over 3 yards), (b) Tower cranes; Licensed Water/Waste Water Treatment Operator; Loaders over 5 yds.; Certified Welder, Electrical Mechanic, Camp Maintenance Engineer, Mechanic (over 10,000 hours); Motor Patrol Grader, Dozer, Grade Tractor, Roto-mill/Profiler (finish: when finishing to final grade and/or to hubs, or for asphalt); Power Plants: 1000 k.w. and over; Quad; Screed; Shovels, Backhoes, Excavators with all attachments (over 3 yards), Sidebooms over 45 tons; Slip Form Paver, C.M.I. and similar types; Scrapers over 40 yards;

GROUP 2: Boiler-fireman; Cement Hog and Concrete Pump Operator; Conveyors (except as listed in group 1); Hoist on steel erection; Towermobiles and Air Tuggers; Horizontal/Directional Drill Locator;Licensed Grade

Technician; Loaders, (i.e., Elevating Grader and Material Transfer Vehicle); Locomotives: rod and geared engines; Mixers; Screening, Washing Plant; Sideboom (cradling rock drill regardless of size); Skidder; Trenching Machine under 16 inches; Waste/ Waste Water Treatment Operator.

GROUP 3: "A" Frame Trucks, Deck Winches: single power drum; Bombardier (tack or tow rig); Boring Machine; Brooms-power; Bump Cutter; Compressor; Farm tractor; Forklift, industrial type; Gin Truck or Winch Truck with poles when used for hoisting; Grade Checker and Stake Hopper; Hoist, Air Tuggers, Elevators; Loaders: (a) Elevating-Athey, Barber Green and similar types (b) Forklifts or Lumber Carrier (on construction job site) (c) Forklifts with Tower (d) Overhead and Front-end, under 2 1/2 yds. Locomotives: Dinkey (air, steam, gas and electric) Speeders; Mechanics (light duty); Oil, Blower Distribution; Post Hole Diggers, mechanical; Pot Fireman (power agitated); Power Plant, Turbine Operator, under 200 k.w.; Pumps-water; Roller-other than Plantmix; Saws, concrete; Skid Steer with all attachments; Straightening Machine; Tow Tractor

GROUP 4: Rig Oiler/Crane Assistant Engineer; Parts and Equipment Coordinator; Swamper (on trenching machines or shovel type equipment); Spotter; Steam Cleaner; Drill Helper.

FOOTNOTE: Groups 1-4 receive 10% premium while performing tunnel or underground work. Rig Oiler/Crane Assistant Engineer shall be required on cranes over 85 tons or over 100 feet of boom.

IRON0751-003 07/01/2022

	Rates	Fringes
IRONWORKER		
BENDER OPERATOR.....	\$ 41.49	34.86
BRIDGE, STRUCTURAL,		
ORNAMENTAL,		
REINFORCING		
MACHINERY MOVER,		
RIGGER,		
SHEETER, STAGE		
RIGGER,		
BENDER OPERATOR.....	\$ 41.49	34.86
BRIDGE, STRUCTURAL,		
ORNAMENTAL, REINFORCING		
MACHINERY MOVER, RIGGER,		
SHEETER, STAGE RIGGER,		
BENDER OPERATOR.....	\$ 38.75	32.63
FENCE, BARRIER INSTALLER....	\$ 37.99	34.86
GUARDRAIL INSTALLERS.....	\$ 38.99	34.86
GUARDRAIL LAYOUT MAN.....	\$ 38.72	34.86
HELICOPTER, TOWER.....	\$ 42.49	34.86

LAB00341-001 04/01/2021

	Rates	Fringes
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LABORER (South of the 63rd
Parallel & West of Longitude
138 Degrees)

GROUP 1.....	\$ 32.00	31.11
GROUP 2.....	\$ 33.00	31.11
GROUP 3.....	\$ 33.90	31.11
GROUP 3A.....	\$ 37.18	31.11
GROUP 3B.....	\$ 40.97	28.40
GROUP 4.....	\$ 21.57	31.11
TUNNELS, SHAFTS, AND RAISES		
GROUP 1.....	\$ 35.20	31.11
GROUP 2.....	\$ 36.30	31.11
GROUP 3.....	\$ 37.29	31.11
GROUP 3A.....	\$ 40.90	31.11
GROUP 3B.....	\$ 45.07	28.40

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Workers (shovelman, plant crew); Brush Cutters; Camp Maintenance Laborer; Carpenter Tenders; Choke Setters, Hook Tender, Rigger, Signalman; Concrete Laborer (curb and gutter, chute handler, grouting, curing, screeding); Crusher Plant Laborer; Demolition Laborer; Ditch Diggers; Dump Man; Environmental Laborer (asbestos (limited to nonmechanical systems), hazardous and toxic waste, oil spill); Fence Installer; Fire Watch Laborer; Flagman; Form Strippers; General Laborer; Guardrail Laborer, Bridge Rail Installers; Hydro-Seeder Nozzleman; Laborers (building); Landscape or Planter; Laying of Decorative Block (retaining walls, flowered decorative block 4 feet and below); Material Handlers; Pneumatic or Power Tools; Portable or Chemical Toilet Serviceman; Pump Man or Mixer Man; Railroad Track Laborer; Sandblast, Pot Tender; Saw Tenders; Scaffold Building and Erecting; Slurry Work; Stake Hopper; Steam Point or Water Jet Operator; Steam Cleaner Operator; Tank Cleaning; Utiliwalk, Utilidor Laborer and Conduit Installer; Watchman (construction projects); Window Cleaner

GROUP 2: Burning and Cutting Torch; Cement or Lime Dumper or Handler (sack or bulk); Choker Splicer; Chucktender (wagon, airtrack and hydraulic drills); Concrete Laborers (power buggy, concrete saws, pumpcrete nozzleman, vibratorman); Culvert Pipe Laborer; Cured in place Pipelayer; Environmental Laborer (marine work, oil spill skimmer operator, small boat operator); Foam Gun or Foam Machine Operator; Green Cutter (dam work); Gunnite Operator; Hod Carriers; Jackhammer or Pavement Breakers (more than 45 pounds); Laying of Decorative Block (retaining walls, flowered decorative block above 4 feet); Mason Tender and Mud Mixer (sewer work); Pilot Car; Plasterer, Bricklayer and Cement Finisher Tenders; Power Saw Operator; Railroad Switch Layout Laborer; Sandblaster; Sewer Caulkers; Sewer Plant Maintenance Man; Thermal Plastic Applicator; Timber Faller, chain saw operator, filer; Timberman

GROUP 3: Alarm Installer; Bit Grinder; Guardrail Machine Operator; High Rigger and tree topper; High Scaler; Multiplate; Slurry Seal Squeegee Man

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers

GROUP 3B: Grade checker (setting or transferring of grade marks, line and grade)

GROUP 4: Final Building Cleanup

TUNNELS, SHAFTS, AND RAISES CLASSIFICATIONS

GROUP 1: Brakeman; Muckers; Nippers; Topman and Bull Gang; Tunnel Track Laborer

GROUP 2: Burning and Cutting Torch; Concrete Laborers; Jackhammers; Nozzleman, Pumpcrete or Shotcrete.

GROUP 3: Miner; Retimberman

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers.

GROUP 3B: Grade checker (setting or transferring of grade marks, line and grade)

Tunnel shaft and raise rates only apply to workers regularly employed inside a tunnel portal or shaft collar.

LAB00942-001 04/01/2022

	Rates	Fringes
Laborers: North of the 63rd Parallel & East of Longitude 138 Degrees		
GROUP 1.....	\$ 33.00	31.37
GROUP 2.....	\$ 34.00	31.37
GROUP 3.....	\$ 34.90	31.37
GROUP 3A.....	\$ 38.18	31.37
GROUP 3B.....	\$ 41.97	29.00
GROUP 4.....	\$ 22.57	31.37
TUNNELS, SHAFTS, AND RAISES		
GROUP 1.....	\$ 36.20	31.37
GROUP 2.....	\$ 37.40	31.37
GROUP 3.....	\$ 38.39	31.37
GROUP 3A.....	\$ 42.00	31.37
GROUP 3B.....	\$ 46.17	29.00

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Workers (shovelman, plant crew); Brush Cutters; Camp Maintenance Laborer; Carpenter Tenders; Choke Setters, Hook Tender, Rigger, Signalman; Concrete Laborer (curb and gutter, chute handler, grouting, curing, screeding); Crusher Plant Laborer; Demolition Laborer; Ditch Diggers; Dump Man; Environmental Laborer (asbestos (limited to nonmechanical systems), hazardous and toxic waste, oil spill); Fence Installer; Fire Watch Laborer; Flagman; Form Strippers; General Laborer; Guardrail Laborer, Bridge Rail Installers; Hydro-Seeder Nozzleman; Laborers (building); Landscape or Planter; Laying of Decorative Block (retaining walls, flowered decorative block 4 feet and below); Material Handlers; Pneumatic or Power Tools; Portable or Chemical Toilet Serviceman; Pump

Man or Mixer Man; Railroad Track Laborer; Sandblast, Pot Tender; Saw Tenders; Scaffold Building and Erecting; Slurry Work; Stake Hopper; Steam Point or Water Jet Operator; Steam Cleaner Operator; Tank Cleaning; Utiliwalk, Utilidor Laborer and Conduit Installer; Watchman (construction projects); Window Cleaner

GROUP 2: Burning and Cutting Torch; Cement or Lime Dumper or Handler (sack or bulk); Choker Splicer; Chucktender (wagon, airtrack and hydraulic drills); Concrete Laborers (power buggy, concrete saws, pumpcrete nozzleman, vibratorman); Culvert Pipe Laborer; Cured in place Pipelayer; Environmental Laborer (marine work, oil spill skimmer operator, small boat operator); Foam Gun or Foam Machine Operator; Green Cutter (dam work); Gunnite Operator; Hod Carriers; Jackhammer or Pavement Breakers (more than 45 pounds); Laying of Decorative Block (retaining walls, flowered decorative block above 4 feet); Mason Tender and Mud Mixer (sewer work); Pilot Car; Plasterer, Bricklayer and Cement Finisher Tenders; Power Saw Operator; Railroad Switch Layout Laborer; Sandblaster; Sewer Caulkers; Sewer Plant Maintenance Man; Thermal Plastic Applicator; Timber Faller, chain saw operator, filer; Timberman

GROUP 3: Alarm Installer; Bit Grinder; Guardrail Machine Operator; High Rigger and tree topper; High Scaler; Multiplate; Slurry Seal Squeegee Man

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers

GROUP 3B: Grade checker (setting or transferring of grade marks, line and grade)

GROUP 4: Final Building Cleanup

TUNNELS, SHAFTS, AND RAISES CLASSIFICATIONS

GROUP 1: Brakeman; Muckers; Nippers; Topman and Bull Gang; Tunnel Track Laborer

GROUP 2: Burning and Cutting Torch; Concrete Laborers; Jackhammers; Nozzleman, Pumpcrete or Shotcrete.

GROUP 3: Miner; Retimberman

GROUP 3A: Asphalt Raker, Asphalt Belly dump lay down; Drill Doctor (in the field); Drillers (including, but not limited to, wagon drills, air track drills; hydraulic drills); Powderman; Pioneer Drilling and Drilling Off Tugger (all type drills); Pipelayers.

GROUP 3B: Grade checker (setting or transferring of grade marks, line and grade)

Tunnel shaft and raise rates only apply to workers regularly employed inside a tunnel portal or shaft collar.

PAIN1959-001 07/01/2022

NORTH OF THE 63RD PARALLEL

	Rates	Fringes
PAINTER		
BRUSH/ROLLER PAINT OR WALL COVERER.....	\$ 36.08	25.45
TAPING, TEXTURING, STRUCTURAL PAINTING, SANDBLASTING, POT TENDER, FINISH METAL, SPRAY, BUFFER OPERATOR, RADON MITIGATION, LEAD BASED PAINT ABATEMENT, HAZARDOUS MATERIAL HANDLER.....	\$ 36.60	25.45

PAIN1959-002 12/01/2021		

SOUTH OF THE 63RD PARALLEL

	Rates	Fringes
PAINTER		
General Painter.....	\$ 32.64	25.95
Industrial Painter.....	\$ 32.74	25.95
Taper / Paper & Vinyl Hanger.....	\$ 32.64	25.95

PAIN1959-003 12/01/2021		

NORTH OF THE 63RD PARALLEL

	Rates	Fringes
GLAZIER.....	\$ 41.16	28.16

PAIN1959-004 07/01/2019		

	Rates	Fringes
FLOOR LAYER: Carpet.....	\$ 28.75	14.44

PAIN1959-006 12/01/2021		

SOUTH OF THE 63RD PARALLEL

	Rates	Fringes
GLAZIER.....	\$ 41.37	27.25

PLUM0262-002 07/01/2022		

East of the 141st Meridian

	Rates	Fringes
Plumber; Steamfitter.....	\$ 41.32	27.62

PLUM0367-002 07/01/2021		

South of the 63rd Parallel

	Rates	Fringes
Plumber; Steamfitter.....	\$ 41.00	27.95

PLUM0375-002 07/01/2021

North of the 63rd Parallel

	Rates	Fringes
Plumber; Steamfitter.....	\$ 42.91	31.25

* PLUM0669-002 01/01/2023

	Rates	Fringes
SPRINKLER FITTER.....	\$ 51.51	30.22

ROOF0189-006 04/01/2021

	Rates	Fringes
ROOFER.....	\$ 44.62	17.63

SHEE0023-003 08/01/2022

South of the 63rd Parallel

	Rates	Fringes
SHEET METAL WORKER.....	\$ 45.35	29.19

SHEE0023-004 07/01/2022

North of the 63rd Parallel

	Rates	Fringes
SHEET METAL WORKER.....	\$ 50.83	29.03

TEAM0959-003 04/01/2021

	Rates	Fringes
TRUCK DRIVER		
GROUP 1.....	\$ 41.94	26.12
GROUP 1A.....	\$ 43.21	26.12
GROUP 2.....	\$ 40.68	26.12
GROUP 3.....	\$ 39.86	26.12
GROUP 4.....	\$ 39.28	26.12
GROUP 5.....	\$ 38.52	26.12

GROUP 1: Semi with Double Box Mixer; Dump Trucks (including rockbuggy and trucks with pups) over 40 yards up to and including 60 yards; Deltas, Commanders, Rollogans and similar equipment when pulling sleds, trailers or similar equipment; Boat Coxswain; Lowboys including attached trailers and jeeps, up to and including 12 axles; Ready-mix over 12 yards up to and including 15 yards); Water Wagon (250 Bbls and above); Tireman, Heavy Duty/Fueler

GROUP 1A: Dump Trucks (including Rockbuggy and Trucks with pups) over 60 yards up to and including 100 yards; Jeeps (driver under load)

GROUP 2: Turn-O-Wagon or DW-10 not self-loading; All Deltas, Commanders, Rollogans, and similar equipment; Mechanics; Dump Trucks (including Rockbuggy and Trucks with pups) over 20 yards up to and including 40 yards; Lowboys including

attached trailers and jeeps up to and including 8 axles; Super vac truck/cacasco truck/heat stress truck; Ready-mix over 7 yards up to and including 12 yards; Partsman; Stringing Truck

GROUP 3: Dump Trucks (including Rockbuggy and Trucks with pups) over 10 yards up to and including 20 yards; batch trucks 8 yards and up; Oil distributor drivers; Oil Distributor Drivers; Trucks/Jeeps (push or pull); Traffic Control Technician

GROUP 4: Buggymobile; Semi or Truck and trailer; Dumpster; Tireman (light duty); Dump Trucks (including Rockbuggy and Truck with pups) up to and including 10 yards; Track Truck Equipment; Grease Truck; Flat Beds, dual rear axle; Hyster Operators (handling bulk aggregate); Lumber Carrier; Water Wagon, semi; Water Truck, dual axle; Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted "A" Frame manufactured rating over 5 tons; Bull Lifts and Fork Lifts with Power Boom and Swing attachments, over 5 tons; Front End Loader with Forks; Bus Operator over 30 passengers; All Terrain Vehicles; Boom Truck/Knuckle Truck over 5 tons; Foam Distributor Truck/dual axle; Hydro-seeders, dual axle; Vacuum Trucks, Truck Vacuum Sweepers; Loadmaster (air and water); Air Cushion or similar type vehicle; Fire Truck/Ambulance Driver; Combination Truck-fuel and grease; Compactor (when pulled by rubber tired equipment); Rigger (air/water/oilfield); Ready Mix, up to and including 7 yards;

GROUP 5: Gravel Spreader Box Operator on Truck; Flat Beds, single rear axle; Boom Truck/Knuckle Truck up to and including 5 tons; Pickups (Pilot Cars and all light duty vehicles); Water Wagon (Below 250 Bbls); Gin Pole Truck, Winch Truck, Wrecker, Truck Mounted "A" Frame, manufactured rating 5 tons and under; Bull Lifts and Fork Lifts (fork lifts with power broom and swing attachments up to and including 5 tons); Buffer Truck; Tack Truck; Farm type Rubber Tired Tractor (when material handling or pulling wagons on a construction project); Foam Distributor, single axle; Hydro-Seeders, single axle; Team Drivers (horses, mules and similar equipment); Fuel Handler (station/bulk attendant); Batch Truck, up to and including 7 yards; Gear/Supply Truck; Bus Operator, Up to 30 Passengers; Rigger/Swamper

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons

resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an

interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"