# Contract Documents and Specifications

CITY OF EDINBURG

**Bid Number 2014-28**

Safe Room South Park Project
FEMA/Tx DPS Project Grant # DR-1791-342

Edinburg, Texas

2013-14
City Officials

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Richard H. Garcia, Mayor
Elias Longoria, Mayor Pro-Tem
J.R. Betancourt, Councilmember
Homer Jasso Jr., Councilmember
Richard Molina, Councilmember

Ramiro Garza Jr., City Manager
Ponciano N. Longoria, P.E., C.F.M., Director of Public Works

Prepared By:
Negrete & Kolar Architects
11720 North IH-35
Austin, Texas 78753

October 2013

415 W. University Dr. ▪ P.O. Box 1079 ▪ Edinburg, Texas 78540
Phone: (956)383-5661 ▪ Fax: (956)383-7111

# THE CITY OF EDINBURG
# SAFE ROOM SOUTH PARK SITE

# PROJECT MANUAL

BIDDING DOCUMENTS
CONDITIONS OF CONTRACT FOR CONSTRUCTION

SPECIFICATIONS

| Owner | City of Edinburg | Professional Seal |
|---|---|---|
| **Civil Engineer** | Gilbert J. Guerra, P.E.<br><br>Rio Delta Engineering<br>921 South Tenth Avenue<br>Edinburg, Texas 78539<br>(956) 380-5152<br>F(956) 380-5156 | STATE OF TEXAS<br>GILBERT J. GUERRA<br>90156<br>LICENSED<br>PROFESSIONAL ENGINEER<br>10/14/13<br>**RIO DELTA ENGINEERING**<br>**F-7628** |
| **Structural Engineer** | Jason P. South<br><br>Engineering System Solutions<br>4943 North 29th East, Ste. A<br>Idaho Falls, Idaho 83401<br>(208) 552-9874<br>F (208) 552-9302 | STATE OF TEXAS<br>JASON P. SOUTH<br>113484<br>LICENSED<br>PROFESSIONAL ENGINEER |
| **Architect** | David Negrete, AIA<br><br>Negrete & Kolar Architects, LLP<br>1601 East 7th Street, Suite 200<br>Austin, TX 78702<br>(512) 474-6526 | 10.15.2013<br>REGISTERED ARCHITECT<br>DAVID NEGRETE<br>11640<br>STATE OF TEXAS |

| | | |
|---|---|---|
| **Mechanical Engineer** | Justin R. Judy<br><br>Engineering System Solutions<br>4943 North 29th East, Ste. A<br>Idaho Falls, Idaho 83401<br>(208) 552-9874<br>F (208) 552-9302 | STATE OF TEXAS<br>JUSTIN R. JUDY<br>102826<br>LICENSED<br>PROFESSIONAL ENGINEER |
| **Electrical Engineer** | Kelden L. Boren<br><br>Engineering System Solutions<br>4943 North 29th East, Ste. A<br>Idaho Falls, Idaho 83401<br>(208) 552-9874<br>F (208) 552-9302 | STATE OF TEXAS<br>KELDEN L. BOREN<br>102858<br>LICENSED<br>PROFESSIONAL ENGINEER |
| **Plumbing Engineer** | Leo Munoz, PE<br><br>Trinity MEP Engineering<br>3533 Moreland Drive, Ste. A<br>Weslaco, TX 78596<br>(956) 973-0500<br>F (956) 351-5750 | 10.14.13<br>STATE OF TEXAS<br>LEONARDO MUNOZ<br>97437<br>LICENSED<br>PROFESSIONAL ENGINEER |

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THE CITY OF EDINBURG

**NOTICE TO BIDDERS**

The City of Edinburg is soliciting sealed bids to be received by the City Secretary's Office located at 415 W. University Drive, Edinburg, Texas 78541. City of Edinburg normal business days are Monday through Friday between the hours of 8:00 a.m. to 5:00 p.m. and shall be closed on recognized holidays.

Bids will be received until **3:00 p.m. Central Time**, on **Tuesday, November 12, 2013**, shortly thereafter all submitted bids will be gathered and taken to the Edinburg City Hall Community Room, 1st Floor, to be publicly opened and read aloud. Any bid received after the closing time will not be accepted and will be returned to the bidder unopened. It is the responsibility of the bidder to see that any bid submitted shall have sufficient time to be received by the City Secretary's Office prior to the bid opening date and time. The receiving time in the City Secretary's Office will be the governing time for acceptability of the bids. Bids will not be accepted by telephone or facsimile machine. All bids must bear original signatures and figures. The Bid shall be for:

**BID No. 2014-28**
**Safe Room South Park Site Project**
**FEMA/TX Dept. of Public Safety Grant #DR-1791-342**

The successful bidder must ensure that employees and applicants for employment are not discriminated against because of race, color, religion, sex, age, or national origin.

All contractors and/or subcontractors who are debarred, suspended or otherwise excluded from or ineligible for participation on federal assistance programs may not undertake any activity in part or in full under this project.

**THE CITY OF EDINBURG IS AN EQUAL EMPLOYMENT OPPORTUNITY EMPLOYER**

Small and minority firms are encouraged to submit bids on this project.

**Bidders receiving a "NOTICE TO BIDDERS" and/or "REQUEST FOR BIDS" notice in the mail or reading same in the newspaper are advised that the bidding documents can be downloaded from the City of Edinburg web page address: www.cityofedinburg.com, or may obtain copies of same by contacting:**

**Paper Sets: RGV Reprographics, LOCATED AT 519 SOUTH BROADWAY, McALLEN, TX 78501 by calling (956) 686-1525 or by e-mailing your request to the following e-mail address: anthony@rgvrepro.com**

**Electronic Sets on CD: Negrete & Kolar Architect, LLP, LOCATED AT 211 STUBBS, EDINBURG, tx 78539 by calling (956) 386-0611 or by e-mailing your request to the following e-mail address: rggarcia@nekoarch.com**

**If you have any questions or require additional information regarding this bid, please contact Mr. Ponciano N. Longoria, P.E., Director of Public Works, at (956) 388-8211.**

**If Hand-delivering Bids:** 415 West University Drive,
c/o City Secretary Department (1st Floor)

**If using Land Courier (i.e., FedEx, UPS):** City of Edinburg
c/o City Secretary
415 West University Drive
Edinburg, Texas 78541

**If Mailing Bids:** City of Edinburg
c/o City Secretary
P.O. Box 1079
Edinburg, TX 78540-1079

The City of Edinburg reserves the right to refuse and reject any or all bids and to waive any or all formalities or technicalities and to accept the bid deemed most advantageous to the City, and hold the bids for a period of **60** days without taking action.

**Bids must be submitted in an envelope sealed with tape and prominently marked on the lower left hand corner of the bid envelope with corresponding bid number and title.**

The project in general, includes, but is not limited to, the following:

**Work of the Project includes the demolition of portions of existing buildings, site demolition, a new brick masonry and thin shell concrete domed community FEMA 361 rated safe room, concrete unit masonry interior partitions, and related site work including flatwork and fencing. Each Contractor responsible for construction of the masonry and concrete aspects of the Safe Room shall be required to submit their qualifications to complete work and provide required acknowledgments, identifications, and qualifications to the authorities having jurisdiction as required by FEMA 361 and required by the Contract Documents. FEMA 361 can be downloaded at** www.fema.gov/media-library/assets/documents/3140?id_1657

The project shall be a complete and operational system capable of providing the functions intended. Plans, proposal forms, specifications, and contract documents may be obtained by interested parties in either electronic format (.pdf) on CD, or full paper sets. CDs and paper sets are made on demand only and will require production time from time of request.

CD Sets are available for **Twenty five Dollars and No Cents ($25.00)** **non-refundable**, per set on CD
Negrete & Kolar Architects, LLP
211 Stubbs
Edinburg, TX 787539
(956) 386-0611

Paper Sets are available for **One Hundred Sixty Five Dollars and No cents ($165.00)** **non refundable** for paper sets from:

RGV Reprographics
519 South Broadway
McAllen, TX 787501

(956) 686-1525

Copies of the plans and specifications may be examined without charge at the following locations:

City of Edinburg
Department of Public Works - 2nd Floor
415 W. University Drive
Edinburg, Texas 78541

A mandatory pre-bid conference will be held at **10:30 a.m., Monday, November 4, 2013** at the Edinburg City Hall Community Room, 1st Floor, located at 415 W. University Drive, Edinburg, Texas. All prospective bidders are required to attend.

If the contract amount is over twenty-five-thousand dollars ($25,000) for construction of the project, the successful bidder shall provide a bid guarantee, give a good and sufficient bond in the full amount of the contract price for the faithful performance of such contract, executed by a surety company authorized to do business in the State of Texas, in accordance with Article 5160, Vernon's Texas Civil Statutes, and amendments thereto. A payment bond in the full amount of the contract price to assure payment shall be required by law of all persons supplying labor and material in the execution of the project provided for in the contract documents.

A bid guarantee equivalent to five percent (5%) of the bid price will be required from each bidder. The "bid guarantee" shall consist of a firm commitment, such as a bid bond, certified check or other negotiable instrument accompanying a bid as assurance that the bidder will upon acceptance of his/her bid, execute such contractual documents as may be required within the time specified.

A performance bond on the part of the contractor for one-hundred percent (100%) of the contract price will be required. A "performance bond" is one executed in connection with a contract to secure fulfillment of all the contractor's obligations under such contract.

A payment bond on the part of the contractor for one-hundred percent (100%) of the contract price will be required. A "payment bond" is one executed in connection with a contract to assure payment, as required by law, of all persons supplying labor and material in execution of the work provided for in the contract documents.

Bidders are expressly advised to review the contract documents fully and insurance requirements of the proposed contract as to their legal requirements and the causes which may lead to the disqualification of a bidder and/or rejection of a bid proposal. No bid may be withdrawn within a period of sixty (60) days after the dated fixed for opening the bids. Unless all bids are rejected, the Owner will give Notice of Award of Contract to the successful bidder as soon as possible consistent with the time for a thorough analysis of bids submitted. Bidders are expected to inspect the site of work and to inform themselves regarding all local conditions which may affect their bid.

A bid guarantee, performance and payment bond will not be required for contracts zero to $25,000. The City will specify in the contract that no money will be paid to the contractor until the project has been completed and final acceptance has been made by the City.

Staff may waive insurance requirements for contracts $0 - $4,999.99, including but not limited to contracts for food, materials, supplies, and construction. Workers' Compensation in amounts which satisfy statutory coverage shall be required for construction projects.

The following insurance requirements will be included in all City contracts of $5,000 - $14,999.99. In contracts not involving building and construction projects, as that activity is defined in TEX. LABOR CODE §406.096, contractors may obtain alternative form of worker accident insurance with minimum limits of liability of $100,000 per claim.

| **Minimum Insurance Requirements** | |
|---|---|
| **Type of Coverage** | **Limits of Liability** |
| Worker's Compensation | Statutory Coverage |
| Comprehensive General Liability<br>(City named as additional insured)<br>Bodily Injury | $250,000 each person/$500,000 each occurrence |
| Property Damage | $100,000 each occurrence/$100,000 aggregate or $500,000 combined single limits |

The following insurance requirements will be included in all City contracts of $15,000 or more.

(1) The successful bidder will be required to carry the following insurance coverage and limits of coverage, as well as list the City as an additional insured to liability coverage as requested by the City. In addition, the successful bidder shall provide the City with evidence of coverage and furnish acceptable proof of payment of insurance premiums.

(2) The successful bidder will be required to secure and/or have insurance coverage in force with an admitted property and casualty insurance company licensed by the State of Texas to conduct business in the State of Texas.

(3) In contracts not involving building and construction projects, as that activity is defined in TEX. LABOR CODE §406.096, contractors may obtain alternative form of worker accident insurance with minimum limits of liability of $100,000 per claim.

| Minimum Insurance Requirements | |
|---|---|
| **Type of Coverage** | **Limits of Liability** |
| Worker's Compensation | Statutory Coverage |
| Employer's Liability | Bodily Injury by Accident:<br>$100,000 each accident<br><br>Bodily Injury by Disease:<br>$100,000 each employee/$500,000 policy limit |
| Comprehensive General Liability<br>Bodily Injury<br><br>Property Damage | <br>$250,000 each person/$500,000 each occurrence<br><br>$100,000 each occurrence/$100,000 aggregate or $500,000 combined single limits |
| Comprehensive Auto Liability<br>Bodily Injury<br><br>Property Damage | <br>$100,000 each person/$500,000 each occurrence<br><br>$100,000 each occurrence/$100,000 aggregate or $500,000 combined single limits |
| City's Protective Liability<br>Bodily Injury<br><br>Property Damage | <br>$250,000 each person/$500,000 each occurrence<br><br>$100,000 each occurrence/$100,000 aggregate or $500,000 combined single limits |

## INSTRUCTION TO BIDDERS

1. Copies of Bidding Documents

   Complete sets of the Bidding Documents in the number and for the sum, if any stated in the Notice to Bidders may be obtained from the Issuing Office. The sum will not be refunded to each document holder of record.

   Complete sets of Bidding Documents must be used in preparing Bids; neither Owner nor Architect assume responsibility for errors or misinterpretations resulting from use of incomplete set of bidding Documents.

   Owner and Architect in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids for the Work and do not offer a license or grant for any other use.

2. Qualifications of Bidders

   To demonstrate qualifications to perform the Work, each bidder must be prepared to submit within five (5) days after Bid opening upon Owner's request detailed written evidence such as financial data, previous experience, present commitments and other such data as may be called for in the Bidding Documents.

3. Examination of Contract Documents and Site

   It is the responsibility of each Bidder before submitting a Bid: To examine thoroughly the Contract Documents and other related data identified in the Bidding Documents;

   To visit the site to become familiar with and satisfy Bidder as to the general, local and site conditions that may affect cost, progress, performance or furnishing of the Work;

   To consider federal, state, and local Laws and Regulations that may affect cost progress, performance of furnishing of the Work;

   To study and carefully correlate Bidder's knowledge and observations with the Contract Documents and such other related data; and

   To promptly notify Architect of all conflicts, errors, ambiguities or discrepancies which the Bidder has discovered in or between the Contract Documents and such other related documents.

   Information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site based upon information and data furnished to Owner and Architect by owners of such Underground Facilities or others, and Owner and Architect do not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in Supplementary Conditions.

   Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Contract Documents due to differing or unanticipated conditions appear in the General Conditions.

Before submitting a Bid each Bidder will be responsible to obtain such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise, which may affect cost, progress, performance, or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Bidder and safety precautions and programs incident thereto or which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the Contract Documents.

On request, Owner will provide each Bidder access to the site to conduct such examinations, investigations, explorations, tests and studies, as each Bidder deems necessary for submission of a Bid. Bidder must fill all holes and clean up and restore site to its former conditions upon completion of such explorations, investigations, tests and studies or at the end of each day.

The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 3, that without exception the Bid is premised upon performing and furnishing the Work required by the Contract Documents and applying the specific means, methods, techniques, sequences or procedures of construction (if any) that may be shown or indicated or expressly required by the Contract Documents, that Bidder has given Architect written notice of all conflicts, errors, ambiguities and discrepancies that Bidder has discovered in the Contract Documents and the written resolutions thereof by Architect is acceptable to Bidder, and that the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

4. Availability of Lands for Work

The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by the Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by the Contractor. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Contract Documents.

5. Interpretations and Addenda

All questions about the meaning or intent of the Bidding Documents are to be directed to Architect. Interpretations or clarifications considered necessary by Architect in response to such questions will be issued by Addenda to all parties recorded by Architect as having received the Bidding Documents. Questions received less than seven (7) days prior to the date for opening of Bids may not be answered. Only questions answered by formal written Addenda will be binding. Oral or other interpretations or clarifications will be without legal effect.

6. Bid Security

Each Bid must be accompanied by Bid security made payable to the Owner in the amount of five (5) percent of Bidder's maximum bid price and in the form of a certified check or Bid Bond issued by a surety meeting the requirements of the Contract Documents and authorized in the State of Texas.

The Bid security of Successful Bidder will be retained until such Bidder has executed the Agreement, furnished the required contract security and met other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Agreement and furnish the required contract security within fifteen days after Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of the other Bidders whom the Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of the seventh day after the Effective Date of the Agreement, whereupon Bid security furnished by such Bidders will be returned.

7. Contract Times

The number of days within which, or the dates by which, the Work is to be substantially completed and ready for final payment are set forth in the Agreement or incorporated therein by reference to the attached Bid Form.

8. Liquidated Damages

Provisions for liquidated damages, if any, are set forth in the Agreement or incorporated therein by reference to the attached Bid Form.

9. Substitute and "Or-Equal" Items

The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or-equal" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to the Architect, application for such acceptance will not be considered by the Architect until after the Effective Date of the agreement. The procedure for submission of any such application by Contractor and consideration by the Architect is set forth in the General Conditions.

10. Subcontractors, Suppliers and Others

Within ten (10) days after Bid opening, the Contractor shall submit to the Owner a list of all Subcontractors, Suppliers, and other persons and organizations (including those who are to furnish the principal items of material and equipment) proposed for the Project. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, person or organization. The Owner or Architect, who after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, other person or organization, may request the apparent Successful Bidder provide an acceptable substitute without an increase in Bid price before the Notice of Award is given.

If the apparent Successful Bidder declines to make any such substitution, Owner may award contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers and other persons and organizations. The declining to make requested substitutions will not constitute grounds for sacrificing the Bid security of any Bidder. Any Subcontractor, Supplier, other person or organization listed and to whom Owner or Architect does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Architect, subject to revocation of such acceptance after the Effective date of the Agreement as provided in the General Conditions.

11. Bid Form

The Bid Form is included with the Bidding Documents; additional copies may be obtained from the Architect.

All blanks on the Bid Form must be completed by printing in black ink or by typewriter.

Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.

All names must be typed or printed in black ink below the signature.

The Bid shall contain an acknowledgement of receipt of all Addenda the numbers of which must be filled in on the Bid Form.
The address and telephone number of communications regarding the Bid must be shown.

Evidence of authority to conduct business as an out-of-state corporation in the State of Texas where the Work is to be performed shall be provided in accordance with above.

12. Submission of Bids

Bids shall be submitted at the time and place indicated in the Notice to Bidders and shall be enclosed in an opaque sealed envelope, marked with the Project title and number, and name and address of Bidder and accompanied by the Bid security and other required documents. If the Bid is sent through mail or other delivery system the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it.

13. Modifications and Withdrawal of Bids

Bids may be modified or withdrawn by an appropriate document duly executed (in a manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

All Bids opened and read aloud will not be withdrawn or modified.

14. Bids to Remain Subject to Acceptance

All Bids will remain subject to acceptance for sixty (60) days after the day of the Bid opening, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to that date.

15. Award of Contract

Owner reserves the right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, non-responsive, unbalanced or conditional Bids and to reject the Bid of any Bidder if

Owner believes that it would not be in the best interest of the Project to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by the Owner. Owner also reserves the right to waive all informalities not involving price, time or changes in Work and to negotiate contract terms with the Successful Bidder. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words. In evaluating Bids, Owner will consider the qualifications of Bidders, whether or not the Bids comply with the prescribed requirements, and such alternates, lump sum price, prices of any alternated and other data, as may be requested in the Bid Form or prior to the Notice of Award.

Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of Subcontractors, Suppliers, and other persons and organizations is required.

Owner may also consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to Notice of Award.

If contract is to be awarded, it will be awarded to the lowest Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interest of the Project.

16. Contract Security

The General Conditions and the Supplementary Conditions sets forth the Owner's requirements as to performance and payment Bonds. When the successful Bidder delivers the executed Agreement to Owner, it must be accompanied by the required performance and payment Bonds.

17. Signing of Agreement

When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within fifteen (15) days thereafter Contractor shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner with the required Bonds. Thereafter Owner shall deliver five (5) fully signed counterparts to Contractor, during the Preconstruction Conference. Each counterpart is to be accompanied by a complete set of Drawings with appropriate identification.

18. Pre-bid Conference

A pre-bid conference will be held at the City of Edinburg Conference Room. Representatives of Owner and Engineer will be present to discuss Project. Bidders are encouraged to attend and participate in the conference. Architect will transmit to all prospective Bidders of record such Addenda as Architect considers necessary in response to questions arising at the conference. <u>Oral statements may not be relied upon and will not be binding or legally effective</u>.

19. Sales and Use Taxes

The Bidder's attention is directed to the State of Texas Comptroller of Public Accounts Limited Sales Excise and Use Tax Rules and Regulations, paragraph 3, of Ruling No.9, Repairmen and Contractors (amended April 3,1972). Reference Article 20.01 (T). Upon compliance with certain conditions this

ruling provides for exemption for this tax of materials incorporated into work done for an exempt agency under a contract. The Owner is an exempt agency.

Any Bidder may elect to exclude this sales tax from his bid. If the Bidder submitting the lowest acceptable Bid for performing the Work on this Project elects to comply with the above ruling on any item included in this contract by obtaining any necessary permit or permits from the State of Comptroller allowing the purchase of material incorporation into this Project without having to pay the Limited Sales, Excise and Use Tax at the time of purchase, Bidder shall upon award of contract submit statement in satisfactory form in which his Bid prices to the Owner for materials are listed separately from all other charges, either by Bid item or by total as required by the Comptroller. This statement shall be included in and made a part of the contract.

The Owner will furnish the Bidder with its exemption certificate for those materials incorporated in the project for which the above required statement is submitted.

The Owner will make no further allowance for and will make no price adjustment above or below the originally Bid unit price on account of tax. It shall be the Bidder's sole responsibility, if he/she elects to exclude the sales tax from his/her bid, to comply with the aforementioned ruling No.9 and with any other applicable rules, regulations, or laws pertaining to the Texas Limited Sales, Excise and Use Tax which may now or at any time during the performance of this contract be in effect, and the Owner shall have no responsibility for any sales or use tax which the Bidder may be required to pay as the result of his failure or the Owner's failure to comply with said rules, regulations or laws, or as the result of the performance of the contract or any part thereof by the Bidder.

Bidders are cautioned that materials, which are not permanently incorporated into the work, are not eligible for exemption and are not to be included in the statement as "Materials" (example: fuels, lubricants, tools, forming materials, etc.).

The Bidder shall make his own determination as to tax liabilities for purchases made in other states.

20. Guarantee

The Bidder shall guarantee the work for a period of one (1) year after date of acceptance in writing by the Owner. During this period, the Contractor shall make any repairs and/or replacements of defective materials and corrections due to poor workmanship, all as may be required for full compliance with the Contract Documents. This guarantee shall apply to all matters reported by the Owner in writing within the said one (1) year period and this guarantee shall be covered by the extension of the Performance Bond.

**DOCUMENT 00 41 13**
**BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)**

To: City of Edinburg

Project: City of Edinburg Safe Room South Park Site

Date: .....

Submitted by: .....

(full name and address) .....

## 1.1 OFFER

Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Architect for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Lump Sum Price of:

$.....dollars, in lawful money of the United States of America.

We have included, the security Bid Bond as required by the Instruction to Bidders.

All applicable federal taxes are excluded and State of Texas taxes are excluded from the Bid Sum.

All Cash and Contingency Allowances described in Section 01 20 00 - Price and Payment Procedures are included in the Bid Sum.

The undersigned, as bidder(s), declares that the only person or parties interested in this proposal as principals are those named herein, that this proposal is made without collusion with any other person, firm or corporation; that he has carefully examined the Form of Contract, Notice to Bidders, General Conditions, Special Provisions, Measurement and Basis of Payment, specifications and the plans thereon referred to, and has carefully examined the locations, and conditions and classes of materials of the proposed work; and agrees that he will provide all the necessary labor, machinery, tools, and apparatus, and other items incidental to construction, and will do all the work and furnish all the materials called for in the contract and specifications in the manner prescribed therein and according to the requirements of the Engineer/Architect as therein set forth.

It is further agreed that lump sum prices may be increased to cover additional work ordered by the Owner or Architect, but not shown on the plans or required by the specifications, in accordance with the provisions of the General Conditions. Similarly, they may be decreased to cover deletion of work so ordered.

The 5% bid security accompanying this proposal shall be returned to the bidder, unless in case of the acceptance of the proposal the bidder shall fail to execute a contract and file a performance bond and payment bond within the fifteen (15) days after Notice of Award, in which case the bid security shall become the property of the OWNER, and shall be considered as payment for damages due to delay and other inconveniences suffered by the Owner on account of such failure of the bidder. It is understood that the Owner reserves the right to reject any or all bids.

## 1.2 ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for sixty days from the bid closing date.

If this bid is accepted by the Owner within the time period stated above, we will:

- Execute the Agreement within fifteen days of receipt of Notice of Award.

- Furnish the required not later than the execution of the agreement.

- Commence work within ten days after written Notice to Proceed of this bid.

If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the security deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

In the event our bid is not accepted within the time stated above, the required security deposit will be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

**1.3 CONTRACT TIME**

If this Bid is accepted, we will:

- Complete the Work by the 1st day of August 2014.

**1.4 ADDENDA**

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

Addendum # ..... Dated .....

Addendum # ..... Dated .....

Addendum # ..... Dated .....

Addendum # ..... Dated .....

**1.5 APPENDICES**

The Bid security in form of ..... is attached to and made a condition of the Bid:

In accordance with Instruction to Bidders, the following documents will be submitted within 24 hours of bid opening and made a condition of the Bid:

Bidder's qualifications statement and supporting data.
Document 00 43 00 including:
Appendix A - List of Subcontractors.

## 1.6 BID FORM SIGNATURES

The Corporate Seal of

.....
(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

.....
(Authorized signing officer Title)

(Seal)

.....
(Authorized signing officer Title)

(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF BID FORM – STIPULATED PRICE

**DOCUMENT 00 43 00**

**PROCUREMENT FORM SUPPLEMENTS**

To: The City of Edinburg

Project: City of Edinburg Safe Room South Park Site

Date: .....

Submitted by: .....
(full name and address) .....

In accordance with the Instructions to Bidders document and Document 00 41 13 Bid Form, we include the Appendices to Bid Form Supplements listed below. The information provided shall be considered an integral part of the Bid Form.

The following Appendices are attached to this document:

Appendix A - List of Subcontractors: Include names of major Subcontractors and portions of the Work each Subcontractor will perform.

BID FORM SUPPLEMENTS SIGNATURES

The Corporate Seal of

.....
(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

.....
(Authorized signing officer Title)

(Seal)

.....
(Authorized signing officer Title)

(Seal)

## APPENDIX A - LIST OF SUBCONTRACTORS

Herewith is the list of subcontractors referenced in the bid submitted by:

(Bidder) .....

To (Owner) [_____]

Dated ..... and which is an integral part of the Bid Form.

The following work will be performed (or provided) by subcontractors and coordinated by us:

| WORK SUBJECT | NAME |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

END OF DOCUMENT

**P E R F O R M A N C E  B O N D**

**STATUTORY PERFORMANCE BOND PURSUANT TO ARTICLE 2253 OF THE TEXAS LOCAL GOVERNMENT CODE AS AMENDED BY ACTS OF THE 1993, 73RD LEGISLATURE, CH. 268, § 1, EFF. SEPT. 1, 1993**

**********

KNOW ALL MEN BY THESE PRESENTS, THAT _____

_____

_____

_____

(hereinafter called the Principal(s), as Principal(s), and _____

_____

_____

_____

_____

(hereinafter called the Surety(s), as Surety(s), are held and firmly bound unto _____

_____

_____

_____

_____

_____

(hereinafter called the Obligee), in the amount of _____

_____Dollars ($_____)

for the payment whereof the said Principal and Surety bind themselves, and their heirs,

administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the

_____day of _____, 20_____, for the _____

_____

**P E R F O R M A N C E  B O N D Continued:**

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

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

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Statutory Performance Bond Pursuant To Article 2253 of the Texas Local Government Code as Amended by Acts of the 1993, 73rd Legislature, Ch. 268, § 1, Eff. Sept. 1, 1993, , and all liabilities on this bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, this instrument is executed in four counterparts, each one of which shall be deemed an original, this the _____day of _____A.D., 20____.

_____
Principal

**ATTEST:**

_____
(Principal) Secretary
(SEAL)

_____
Signature

_____
Witness as to Principal

_____
(Print/Type Name)

_____
(Address)

_____
(Address)

**ATTEST:**

_____
Surety

_____
(Surety) Secretary
(SEAL)

_____
Attorney-in-Fact (Signature)

_____
Witness as to Surety

_____
(Print/Type Name)

_____
(Address)

_____
(Address)

NOTE: Date of Bond must not be prior to date of Contract

(1) Correct name of Contractor; (2) A Corporation, a Partnership or an Individual, as case may be; (3) Correct name of Surety; (4) Correct name of Owner; (5) County or Parish and State; (6) Owner; (7) If Contractor is Partnership, all partners should execute bond.

# PAYMENT BOND

**STATUTORY PAYMENT BOND PURSUANT TO ARTICLE 2253 OF THE TEXAS LOCAL GOVERNMENT CODE AS AMENDED BY ACTS OF THE 1993, 73RD LEGISLATURE, CH. 268, § 1, EFF. SEPT. 1, 1993**

**********

KNOW ALL MEN BY THESE PRESENTS, that _____

_____

_____

_____

_____

(hereinafter called the Principal(s), as Principal(s), and _____

_____

_____

_____

_____

(hereinafter called the Surety(s), as Surety(s), are held and firmly bond unto _____

_____

_____

_____

_____

(hereinafter called the Obligee), in the amount of _____

_____Dollars ($_____)

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

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____ day of _____, 20_____, to

**P A Y M E N T  B O N D Continued:**

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

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

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Statutory Payment Bond Pursuant To Article 2253 of the Texas Local Government Code as Amended by Acts of the 1993, 73rd Legislature, Ch. 268, § 1, Eff. Sept. 1, 1993, , and all liabilities on this bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, this instrument is executed in four counterparts, each one of which shall be deemed an original, this the _____ day of _____ A.D., 20_____.

_____
Principal

**ATTEST:**

_____
(Principal) Secretary
(SEAL)

_____
Signature

_____
Witness as to Principal

_____
(Print/Type Name)

_____
(Address)

_____
(Address)

**ATTEST:** _____

_____
Surety

_____
(Surety) Secretary
(SEAL)

_____
Attorney-in-Fact (Signature)

_____
Witness as to Surety

_____
(Print/Type Name)

_____
(Address)

_____
(Address)

NOTE: Date of Bond must not be prior to date of Contract

(1) Correct name of Contractor; (2) A Corporation, a Partnership or an Individual, as case may be; (3) Correct name of Surety; (4) Correct name of Owner; (5) County or Parish and State; (6) Owner; (7) If Contractor is Partnership, all partners should execute bond.

# PART ONE

# BIDDING DOCUMENTS

# PART TWO

# CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

## SPECIAL PROVISIONS

**IN ALL CASES WHERE THESE <u>SPECIAL PROVISIONS</u> CONFLICT WITH THE TECHNICAL SPECIFICATION SECTIONS, GENERAL CONDITIONS OF THE AGREEMENT, SUPPLEMENTARY GENERAL CONDITIONS, CONTRACT CONDITIONS, OR ANY OTHER DOCUMENT CONTAINED HEREIN, THESE SPECIAL PROVISIONS SHALL GOVERN.**

1. The CONTRACTOR shall do all necessary excavation, trenching, demolition, grading, backfill, etc., to complete the project. All excavation is unclassified. All material removed such as concrete, broken pipe, excess backfill, etc., shall become the property of the CONTRACTOR and he shall be responsible for removing it from the site at no extra expense to the OWNER. Any existing material deemed salvageable by the ENGINEER or the OWNER shall be carefully removed and hauled to a designated location as directed by the OWNER or ENGINEER within the City at no extra expense to the OWNER.

2. The CONTRACTOR shall be limited only to area of construction as indicated in the Contract Documents except where work in rights of ways are required. The CONTRACTOR at no extra cost to the OWNER will correct any damages done to property outside these designated work areas to its original or better conditions. It is important that the CONTRACTOR be aware of the work limits so that no damage can result to those areas outside these limits.

3. All trees, plants, grass and shrubs, except those which will be affected by construction shall be protected at all times. The areas in and adjacent to the construction site shall be restored to their original conditions after necessary fine grading are completed. The CONTRACTOR shall provide new grass of the same type removed to restore damaged areas. Only quality sandy loam topsoil shall be used for filling the top four inches of those areas damaged or filled.

4. Existing lawns are to remain intact as far as practical. The CONTRACTOR shall duly restore such areas disturbed to as good as or better than original condition using the same type of grass, shrubs, or cover as the original. The CONTRACTOR shall be responsible for correcting any erosion that occurs at his cost without claim for extra compensation.

5. Damages done to existing utilities, power poles, fences, signs, mailboxes, driveways, culverts, pavement, drainage systems, etc. shall be repaired by the CONTRACTOR at no cost to the OWNER, and such costs shall be subsidiary to the various unit items in the Proposal.

6. The City of Edinburg shall provide all testing. Testing shall be paid by the OWNER on all necessary testing selected by ENGINEER, but re-testing shall be charged to the CONTRACTOR from his monthly estimates, and no additional compensation will be made or allowed for reworking the necessary defective work not meeting the specified work of the plans and specifications. Any re-testing required by no-passing results shall be paid for by the CONTRACTOR and shall be deducted from the contract amount. The OWNER, at its sole discretion, may require the CONTRACTOR to perform any necessary uncovering of any improvements to verify compliance with specifications by either visual observation or materials testing at no extra expense to the OWNER.

7. The CONTRACTOR shall furnish the Site Inspector and Observer, OWNER, and ENGINEER the names, address and telephone numbers of all personnel responsible for the work in case of Emergencies.

8. The successful CONTRACTOR shall attend a Pre-Construction Conference Meeting with the OWNER, ACHITECT, and other PUBLIC WORKS AND UTILITY DEPARTMENTS staff members at the date and time specified.

9. The CONTRACTOR shall submit to the ARCHITECT a proposed sequence of work outline with approximate completion dates to be reviewed at the pre-construction conference. During the course of construction, the ARCHITECT may request updates to the schedule indicating the start of the several part of the work and the estimated dates of completion of the several parts. Unless otherwise noted on the plans, the ARCHITECT may require modification of construction schedule to meet any CITY recognized or CITY sponsored events which may be affected by the CONTRACTOR'S activities without claim for extra compensation.

10. It is important that traffic be interrupted at a minimum during construction. A Traffic Control Plan (TCP), prepared by a Registered Professional Engineer, must be submitted by the CONTRACTOR and written approval must be issued by the ENGINEER and OWNER prior to any road closures. The OWNER may, at its sole discretion, require continuous operation of construction activities to minimize traffic interruption. The preparation and submittal of the TCP, its approval process, or continuous operation requirement shall not constitute a claim for additional compensation or time extension of the Project.

11. The CONTRACTOR is solely responsible for notifying the Public Works Department - Engineering Division, Police Department, Fire Department, School District, Emergency Services, and other interested entities at least 48 hours in advance of any OWNER approved road closures or detours.

12. All traffic control devices shall be in accordance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD), latest edition.

13. All work must be at the time of the Contractor's discretion and submitted to the City for General Advisement.. It is the CONTRACTOR'S sole responsibility to complete all work within the time specified in the Contract during the designated hours of operation.

14. The CONTRACTOR shall be responsible for construction staking for the entire project and shall be done in accordance with the Specifications. Staking shall be performed by a Registered Professional Land Surveyor or Professional Engineer of the State of Texas qualified to do such construction staking at no additional cost to the OWNER.

15. The Plans show approximate locations of existing utilities including gas lines, telephone lines, power lines, water lines, sewer lines, storm sewers and irrigation lines within the vicinity. The CONTRACTOR is responsible for locating all existing utilities and shall exercise extreme care in working in the vicinity of these lines. The CONTRACTOR shall notify the Utility Companies while working in the vicinity of the corresponding private or public utilities.

16. All existing lines, whether belonging to the City of Edinburg or Private shall remain in operation at all times unless designated for removal or replacement. Switchover time, re-connecting new service from existing lines or services (if any) shall be kept to a minimum.

Reconnections to existing water and sanitary sewer services shall at no additional cost to the OWNER.

17. The Contractor shall file and maintain a State of Texas Compliant Storm Water Pollution Prevention Plan specifically for this project.

18. .The CONTRACTOR is expected to conduct his work in such a manner as to minimize any soil erosion or sediment runoff from the construction site. CONTRACTOR shall provide ARCHITECT and OWNER an Erosion Control Plan (ECP) as part of a permit application to be completed and approved by the PUBLIC WORKS DEPARTMENT prior to commencement of work. Earth cuts and fills shall have smooth, flat side slopes, as generally indicated on the Plans, to preclude erosion of the soil. Such operations should be times consistent with the actual need for doing the work and only to leave raw, unprotected surfaces for a minimum of time. The preparation and submittal of the ECP or its approval process shall not constitute a claim for additional compensation or time extension of the Project.

19. Until acceptance by the ARCHITECT of any part of all of the material, as provided for in these specifications, it shall be under the charge and care of the CONTRACTOR, and he shall take every necessary precaution against injury or damage to any part of the material by action of the elements of the non-execution of the work. The CONTRACTOR shall rebuild, repair, restore and make good, at his own expense, all injuries or damage to any portion of the material occasioned by any of the above causes before its completion and acceptance.

20. In cases where the CONTRACTOR deems extra compensation is due him for work not clearly covered in the contract, or not ordered by the ARCHTECT as an extra item, the CONTRACTOR shall notify the ARCHITECT in writing of his intention to make claim for such extra compensation before he begins the work. The CONTRACTOR shall not proceed until the OWNER, ARCHITECT, and CONTRACTOR approves a written CHANGE ORDER. Failure on the part of the CONTRACTOR to give such notification or to afford the ARCHITECT proper facilities for keeping strict account of actual cost shall constitute a waiver of the claim for such extra compensation. The filing of such notice by the CONTRACTOR and the keeping of costs by the ARCHITECT shall not in any way be construed to prove the validity of the claim. When the work has been completed, the CONTRACTOR shall, within 10 days, file his claim for extra compensation with the ARCHITECT.

21. Upon the failure of the CONTRACTOR to repair satisfactorily or to remove and replace, if so directed, rejected, unauthorized, or condemned materials immediately after receiving written notice from the ARCHITECT, the OWNER may recover for such defective materials on the CONTRACTOR'S bond, or by action in a court having proper jurisdiction over such matters, or may employ labor and equipment and satisfactorily repair or remove and replace such work and charge the cost of the same to the CONTRACTOR, which cost will be deducted from any money due him.

22. The CONTRACTOR shall warrant all work for a period of not less that one (1) year from the date of final acceptance of the work by the City of Edinburg, except for those items of work specified to have extended warranties as noted in the Contract Documents.. CONTRACTOR is responsible for scheduling a final inspection in the presence of the OWNER, ARCHITECT, and CONTRACTOR, whereupon all items must be in accordance with plans and specifications prior to final acceptance.

23. The CONTRACTOR is solely responsible for familiarizing himself and following the 2007 Standards Manual latest addition for those items not specifically or clearly shown on the project plans or project specifications and performing the work in such a manner. The Manual can be purchased at the

ENGINEERING Department or downloaded from the City's website at www.cityofedinburg.com. No additional compensation will be made for items covered in the City's Standards.

24. All asphalt pavement repairs shall be completed as per the construction plans and specifications. The CONTRACTOR shall not leave any area requiring repairs in excess of 1,300 square yards or in excess of 30 days, whichever is less. The OWNER or ARCHITECT may require immediate asphalt pavement repair should traffic conditions warrant. Failure by the CONTRACTOR to make the necessary repairs within the time specified by the OWNER may result in corrective action by the OWNER including the employ of materials, labor and equipment to satisfactorily perform such work and charge the cost of the same to the CONTRACTOR, which cost will be deducted from any money due him.

| | | |
|---|---|---|
| **THE STATE OF TEXAS** | **§** | **AGREEMENT FOR THE CONSTRUCTION OFSAFEROOM SOUTH PARK SITE, 315 E. PALM DRIVE, EDINBURG** |
| **COUNTY OF HIDALGO** | **§** | |
| **SERVICE CONTRACT** | **§** | |

The **City of Edinburg** (hereinafter called "City"), and _____ (herein called "Contractor"), entered into an agreement for construction of Saferoom South Park Site.

## RECITALS

**WHEREAS,** the City desires to engage the Contractor for certain services in connection therewith; and,

**WHEREAS,** Contractor represents that it has the knowledge, ability, and personnel to properly provide services needed by the City;

**NOW, THEREFORE,** the City and Contractor do mutually agree as follows:

## SECTION I
## EMPLOYMENT OF CONTRACTOR

City agrees to employ Contractor to provide the following basic services as stated in the following sections and upon receipt of such satisfactory services, City agrees to pay Contractor as stated in the sections to follow.

## SECTION II
## BASIC SERVICES OF CONTRACTOR

The Contractor agrees to perform the work in connection therewith, of a brick and concrete dome FEMA Safe Room as described in the specifications and drawings of the Contract, at his/her (its or their) own proper cost and expense to furnish all the labor, insurance and other accessories and services necessary to complete the said tasks in accordance with the conditions and prices stated.

## SECTION III
## TIME OF PERFORMANCE

The Contractor shall be completed upon request of the City and at time certain of August 1, 2014. Contractor shall not be liable for any delay due to circumstance beyond its control.

## SECTION IV
## STANDARD OF PERFORMANCE

Contractor warrants to City that all labor furnished to perform the Work under the Contract Documents will be competent to perform the tasks undertaken, that the product of such labor will yield only first-class results, that materials and equipment furnished will be of good quality and new unless otherwise permitted by the Contract Documents, and that the Work will be of good quality, free from faults and defects, and in strict conformance with the Contract Documents. Any Work not strictly conforming to these requirements may be considered defective.

## SECTION V
## TERMS OF PAYMENT

City agrees to pay Contractor for services herein contracted for as follows:

A. Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

B. The period covered by each Application for Payment shall be one calendar month ending on the last day of the month:

C. Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

D. Applications for Payment shall indicate show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

E. Invoice shall be completed and processed in accordance with City regulations. Contractor shall submit Applications for Payment in accordance with the general Conditions. Application for Payment will be processed by the Architect and the Department of Public Works as provided in the General Conditions.

F. City shall authorize all payments made for services rendered. Payment terms shall be net thirty (30) days from receipt of invoice.

G. If changes in plans or specifications are necessary after the performance of the contract is begun or if it is necessary to decrease or increase the quantity of work to be performed or of materials, equipment, or supplies to be furnished, the governing body of the municipality must approve change orders before making the changes.

H. The total contract price may not be increased because of the changes unless additional money for increased costs is appropriated for that purpose from available funds or is provided for by the authorization of the issuance of time warrants.

## SECTION VI
## TIME OF COMPLETION

City and the Contractor recognize that time is of the essence of this agreement and that the City may suffer financial loss if the WORK is not completed within the time specified in Section III herein, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. Accordingly, instead of requiring any such proof, the City and the Contractor agree that not as a penalty, but as added expense for Engineering/Architectural supervision the Contractor shall pay the City for each day that expires after the time specified in Section III herein the amount corresponding below:

| FOR AMOUNT OF CONTRACT | COST PER DAY |
|---|---|
| $ 5,000.00 to $ 25,000.00 | $100.00 |
| $ 25,001.00 to $ 100,000.00 | $200.00 |
| $ 100,001.00 to $ 500,000.00 | $250.00 |
| $ 500,001.00 to $1,000,000.00 | $300.00 |
| $1,000,001.00 to $2,000,000.00 | $400.00 |
| **$2,000,001.00 to $3,000,000.00** | **$500.00** |
| $3,000,001.00 to $4,000,000.00 | $600.00 |
| $4,000,001.00 to $5,000,000.00 | $700.00 |
| $5,000,001.00 and over | $800.00 |

## SECTION VII
## SCHEDULE REQUIREMENTS

Whenever, in the opinion of City, the Work falls behind schedule, the Contractor shall, to the extent necessary to meet said schedule, increase its labor force and/or provide overtime, Saturday, and Sunday and/or holiday work, and shall have each Subcontractor do likewise, all at no additional cost to or compensation from City. Further, City shall have the right to offset against any amounts then or thereafter due to the Contractor, or to be reimbursed by the Contractor for, any additional costs City may

incur as a direct result of said increase in labor force or overtime, Saturday, Sunday, and/or holiday work.

## SECTION VIII
## WRITTEN NOTICE OF ISSUE

In the event that any issue arises relating to any of the provisions contained in this Agreement, including, but not limited to potential delays, change orders, time extensions, weather delays, etc. Contractor agrees to notify the City, in writing, immediately, relating to such issue and proposed resolution. Failure to give such notice shall constitute a waiver of any other remedies available to Contractor hereunder.

## SECTION IX
## NO DAMAGE FOR DELAY

In the event of any delay, not the fault of the Contractor, the Contractor shall be entitled to an extension of time for completion only, and shall not be entitled to any additional payment on account of such delay. Without limiting the foregoing, the Contractor shall not be entitled to payment or compensation of any kind from the City for direct, indirect or impact damages, and/or consequential damages, including but not limited to costs of acceleration arising because of hindrance or from any cause or whatsoever, whether such hindrances or delays be reasonable or unreasonable, foreseeable or unforeseeable, or avoidable or unavoidable; provided, however, that this provision shall not preclude recovery by the Contractor of damages for hindrances or delays due solely to fraud or bad faith on part of the City or his agents.

## SECTION X
## UNREASONABLE SITE INSPECTION REQUIREMENTS

The Contractor acknowledges that it has taken steps necessary to ascertain the nature and location of the Work and that it has investigated and satisfied itself as to the general and local conditions which can affect the Work and its costs. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered or difficulties or access insofar as this information is ascertainable from an inspection of the site, and available documents, including all information from exploratory work done by the City and its design consultants as well as from the Drawings and Specifications made a part of this Contract. The Contractor has the right to make any additional tests necessary to assure himself that the site conditions are satisfactory for the work contemplated.

## SECTION XI
## DUTY TO COORDINATE AMONG SEPARATE PRIME CONTRACTORS

The City reserves the right to engage separate contractors to perform aspects of

the Project other than the Work under this Agreement. In such case, contractor shall coordinate sequence and schedule its work together and in cooperation with such other contractors. In the event of any difficulties caused by any such other separate contractor, this contractor shall look solely for relief to such other contractors and shall not make claim against City.

## SECTION XII
## CONTRACT DOCUMENTS

The Contract Documents which comprise the entire agreement between City and Contractor concerning the WORK consist of this Agreement and the following attachments to this Agreement:

- Notice to Bidders
- Addenda
- Instructions to Bidders
- Bid Proposal Forms including the Bid, Bid Schedule(s), Information Required of Bidder, Bid Bond, and all required certificates and affidavits
- Special Provisions
- Agreement for Engineering/Architectural Construction
- Performance Bond
- Payment Bond
- General Conditions of Contract for Engineer/Architectural Construction
- Supplemental General Conditions
- Affidavit and Waiver of Lien Prime Contractor
- Release and Waiver by Subcontractor and Product Vendor
- Contractor's Affidavit as to Status of Lien
- Technical Specifications, as listed in the Table of Contents.
- Drawings
- Change Orders which may be delivered or issued after Effective Date of the Agreement and are not attached hereto.

There are no Contract Documents other than those listed in this Section VI. The Contract Documents may only be amended by Change Order as provided in the General Conditions.

## SECTION XIII
## ASSIGNMENT

No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation monies that may become due and monies that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under

the Contract Documents.

## SECTION XIV
## NON-APPROPRIATIONS

Not withstanding anything in the contract documents to the contrary, any and all payments which the City is required to make under this contract shall be subject to annual appropriation or other availability of funds, as certified by the Director of Finance.

If the City cannot appropriate sufficient funding, then either party has the right to terminate the contract by providing (10) ten days written notice to the other party.

Furthermore, execution of this contract does not automatically guarantee a renewal of contract upon expiration.

## SECTION XV
## MINIMUM INSURANCE REQUIREMENTS

In accordance with City ordinances, Contractor shall be required to hold the following minimum insurance coverage throughout the duration of this Agreement:

A. Workers Compensation-
In accordance with the State statute

B. Employer's Liability

| | |
|---|---|
| Bodily Injury by Accident: | $100,000 each accident |
| Bodily Injury by Disease: | $100,000 each employee |
| | $500,000 policy limits |

C. Comprehensive General Liability

| | |
|---|---|
| Bodily Injury | $250,000 each person |
| | $500,000 each occurrence |
| Property Damage | $100,000 each occurrence |
| | $100,000 aggregate |
| -or- | $500,000 combined single limits |

D. Comprehensive Auto Liability

| | |
|---|---|
| Bodily Injury | $250,000 each person |
| | $500,000 each occurrence |
| Property Damage | $100,000 each occurrence |
| | $100,000 each aggregate |
| -or- | $500,000 combined single limits |

E. City's Protective Liability

| | |
|---|---|
| Bodily Injury | $250,000 each person |
| | $500,000 each occurrence |
| Property Damage | $100,000 each occurrence |
| | $100,000 each aggregate |
| -or- | $500,000 combined single limits |

Evidence of the above insurance coverage shall be required prior to final execution of the agreement. The City shall be listed as an additional insured.

Contractor warrants that it is adequately insured and carries liability, workers compensation, and automobile insurance for injury to its employees and others incurring loss or injury as a result of the acts of Contractor or its employees.

Contractor shall not commence work under this agreement until all insurance requirements have been obtained and proof of such insurance shall have been provided to the City, nor shall Contractor allow any Sub-Contractor to commence work until all insurance as noted above has been so obtained and provided to the City. Approval of the insurance by City shall not relieve or decrease the liability of the Contractor.

## SECTION XVI
## TERMINATION OF CONTRACT

Either party to this agreement shall have the right to terminate this contract at any time after thirty (30) days' written notice.

## SECTION XVII
## SEVERABILITY

If any term or provision of this Agreement is held by a court of competent jurisdiction to be invalid, void, or unenforceable, the remainder of the provisions of this Agreement shall remain in full force and effect and shall in no way be affected, impaired or invalidated.

## SECTION XVIII
## ALTERNATE DISPUTE RESOLUTION/NEUTRAL PARTY

A. Any controversy, claim or dispute between the parties arising out of or relating to the provisions of this Agreement or the breach, termination or validity thereof shall, upon written request of either party, immediately be referred jointly for resolution of the controversy by non-binding mediation.

B. The mediation must be concluded within any period mutually agreed upon by the

parties but in no event no later than within forty-five (45) days after written notice is given by either party of its intent to proceed to mediation. Unless the parties expressly agree otherwise, each party shall bear its own costs, legal and expert fees incurred in the mediation, and evenly share the costs of the mediator. If, after proceeding in good faith the parties, with the assistance of a neutral mediator, do not resolve the dispute within the forty-five (45) day period, the parties may proceed in accordance with paragraph (C) below.

C. After exhausting the procedures set forth above, either party may initiate litigation to resolve the dispute. The Law of the State of Texas shall control the matter in controversy. Venue is mandatory in Hidalgo County, Texas.

## SECTION IXX
## NOTICE

All notices or other communications required under this Agreement may be affected either by personal delivery in writing or by Certified Mail, Return Receipt Requested. Notice shall be deemed to have been given when delivered or mailed to the parties at their respective addresses as set for the below or when mailed to the last address provided in writing to the other party by the addressee.

## SECTION XX
## HOLD HARMLESS CLAUSE

Contractor hereby agrees to indemnify and hold harmless and defend Lessor, its agents, employees, and officers from and against any claim, loss, damage, liability, and expense, including reasonable attorney's fees, incurred or suffered by it, by reason of any and all claims, demands, or causes of action asserted or that may be asserted, against any or all of the above named parties, whether alleging intentional or negligent acts or omissions, and whether seeking compensatory or punitive damages, and involving, arising out of, or in any manner relating to this Contract.

## SECTION XXI
## FEDERAL REQUIREMENTS

1. Title VI of the Civil Rights Act of 1964, Executive Order 11246 (Equal Employment Opportunity). The contractor shall not discriminate against any employee or applicant for employment on the basis of race, color, sex, religion, or national origin;

2. Secretary of Labor's Regulations (Part 3, and 5, Subtitle A, Title 29, CFR);

3. Section 9 Title I of the Housing and Community Development Act of 1974, as amended;

4. Certification of Compliance with Clean Air and Water Acts (Contracts in excess

of $100,000.);

## SECTION XXII
## MISCELLANEOUS

Any changes to this document must be approved by City and signed by both parties to the agreement.

EXECUTED by the parties in triplicate originals on this _____ day of _____, 2013.

**CITY OF EDINBURG:**

BY:_____
Ramiro Garza Jr., City Manager
City of Edinburg
415 W. University Dr.
Edinburg, Texas 78540
Phone: (956)383-5661
Fax: (956)383-7111

**ATTEST:**

BY:_____
Myra L. Ayala Garza, City Secretary

**APPROVED AS TO FORM:**

Gonzalez Palacios LLP
Attorneys at Law

_____
City Attorney

**(CONTRACTOR NAME)**

BY:_____
Name
Title
Contact information

**ATTACHMENTS:** Exhibit A: Scope of Work
Exhibit B: Certificates of Insurance

## Exhibit A: Scope of Work

**Scope of work is fully described in the Construction Documents consisting of Drawings and Specifications contained in the Project Manual titled City of Edinburg Contract Documents and Specifications, Safe Room South Park Site, attached hereto.**

## Exhibit B: Certificates of Insurance

DRAFT

# AIA® Document A201™ – 2007

## *General Conditions of the Contract for Construction*

**for the following PROJECT:**
*(Name and location or address)*
«City of Edinburg Safe Room - South Park Site»
«315 East Palm Drive, Edinburg, TX 78539»

**THE OWNER:**
*(Name, legal status and address)*
«City of Edinburg »« »
«415 West Universtiy Drive
Edinburg Texas 78541 »

**THE ARCHITECT:**
*(Name, legal status and address)*
« Negrete & Kolar Architects LLP »« »
«11720 North IH 35,
Austin Texas 78539 »

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**ADDITIONS AND DELETIONS:** The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 BASIC DEFINITIONS

#### § 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

#### § 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

#### § 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

#### § 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

#### § 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

#### § 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

#### § 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

#### § 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

### § 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

**§ 1.2.1** The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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**§ 1.2.2** Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

**§ 1.2.3** Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### § 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

### § 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### § 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

**§ 1.5.1** The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

**§ 1.5.2** The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

### § 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

## ARTICLE 2 OWNER

### § 2.1 GENERAL

**§ 2.1.1** The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

**§ 2.1.2** The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

### § 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

**§ 2.2.1** Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or

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the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

**§ 2.2.2** Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

**§ 2.2.3** The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

**§ 2.2.4** The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

**§ 2.2.5** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

### § 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

### § 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## ARTICLE 3 CONTRACTOR

### § 3.1 GENERAL

**§ 3.1.1** The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

**§ 3.1.2** The Contractor shall perform the Work in accordance with the Contract Documents.

**§ 3.1.3** The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

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## § 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

**§ 3.2.1** Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

**§ 3.2.2** Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

**§ 3.2.3** The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

**§ 3.2.4** If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

## § 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

**§ 3.3.1** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

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

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

## § 3.4 LABOR AND MATERIALS

**§ 3.4.1** Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other

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facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

**§ 3.4.2** Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

**§ 3.4.3** The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

### § 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

### § 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

### § 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

**§ 3.7.1** Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

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

**§ 3.7.3** If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

**§ 3.7.4 Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

**§ 3.7.5** If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume

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the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

### § 3.8 ALLOWANCES

**§ 3.8.1** The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

**§ 3.8.2** Unless otherwise provided in the Contract Documents,

- **.1** Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

**§ 3.8.3** Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

### § 3.9 SUPERINTENDENT

**§ 3.9.1** The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

**§ 3.9.2** The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

**§ 3.9.3** The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

### § 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

**§ 3.10.1** The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

**§ 3.10.2** The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

**§ 3.10.3** The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

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### § 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

### § 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

**§ 3.12.1** Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

**§ 3.12.2** Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

**§ 3.12.3** Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

**§ 3.12.4** Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

**§ 3.12.5** The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

**§ 3.12.7** The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

**§ 3.12.8** The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

**§ 3.12.9** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

**§ 3.12.10** The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be

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required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### § 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

### § 3.14 CUTTING AND PATCHING

**§ 3.14.1** The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

**§ 3.14.2** The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

### § 3.15 CLEANING UP

**§ 3.15.1** The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

**§ 3.15.2** If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

### § 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

### § 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

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### § 3.18 INDEMNIFICATION

**§ 3.18.1** To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

**§ 3.18.2** In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

## ARTICLE 4 ARCHITECT

### § 4.1 GENERAL

**§ 4.1.1** The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

**§ 4.1.2** Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

**§ 4.1.3** If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

### § 4.2 ADMINISTRATION OF THE CONTRACT

**§ 4.2.1** The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

**§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

**§ 4.2.3** On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

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**§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION**
Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

**§ 4.2.5** Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

**§ 4.2.6** The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

**§ 4.2.7** The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

**§ 4.2.8** The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

**§ 4.2.9** The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

**§ 4.2.10** If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

**§ 4.2.11** The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

**§ 4.2.12** Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

**§ 4.2.13** The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

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**§ 4.2.14** The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 DEFINITIONS

**§ 5.1.1** A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

**§ 5.1.2** A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### § 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

**§ 5.2.1** Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

**§ 5.2.2** The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

**§ 5.2.3** If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

**§ 5.2.4** The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

### § 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may

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be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

### § 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

**§ 5.4.1** Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

**§ 5.4.2** Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

**§ 5.4.3** Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

### § 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

**§ 6.1.1** The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

**§ 6.1.2** When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

**§ 6.1.3** The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

**§ 6.1.4** Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

### § 6.2 MUTUAL RESPONSIBILITY

**§ 6.2.1** The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

**§ 6.2.2** If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that

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the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

**§ 6.2.3** The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

**§ 6.2.4** The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

**§ 6.2.5** The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### § 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 GENERAL

**§ 7.1.1** Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

**§ 7.1.2** A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

**§ 7.1.3** Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

### § 7.2 CHANGE ORDERS

**§ 7.2.1** A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

### § 7.3 CONSTRUCTION CHANGE DIRECTIVES

**§ 7.3.1** A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

**§ 7.3.2** A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

**§ 7.3.3** If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

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**.4** As provided in Section 7.3.7.

**§ 7.3.4** If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

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

**§ 7.3.6** A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

**§ 7.3.7** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

**.1** Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

**.2** Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

**.3** Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

**.4** Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

**.5** Additional costs of supervision and field office personnel directly attributable to the change.

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

**§ 7.3.9** Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

**§ 7.3.10** When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

### § 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

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## ARTICLE 8 TIME

### § 8.1 DEFINITIONS

**§ 8.1.1** Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

**§ 8.1.2** The date of commencement of the Work is the date established in the Agreement.

**§ 8.1.3** The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

**§ 8.1.4** The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

### § 8.2 PROGRESS AND COMPLETION

**§ 8.2.1** Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

**§ 8.2.2** The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

**§ 8.2.3** The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

### § 8.3 DELAYS AND EXTENSIONS OF TIME

**§ 8.3.1** If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

**§ 8.3.2** Claims relating to time shall be made in accordance with applicable provisions of Article 15.

**§ 8.3.3** This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## ARTICLE 9 PAYMENTS AND COMPLETION

### § 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

### § 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

### § 9.3 APPLICATIONS FOR PAYMENT

**§ 9.3.1** At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

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**§ 9.3.1.1** As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

**§ 9.3.1.2** Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

**§ 9.3.2** Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

**§ 9.3.3** The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

### § 9.4 CERTIFICATES FOR PAYMENT

**§ 9.4.1** The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

**§ 9.4.2** The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

### § 9.5 DECISIONS TO WITHHOLD CERTIFICATION

**§ 9.5.1** The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;

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.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a separate contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

**§ 9.5.2** When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

**§ 9.5.3** If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

### § 9.6 PROGRESS PAYMENTS

**§ 9.6.1** After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

**§ 9.6.2** The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

**§ 9.6.3** The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

**§ 9.6.4** The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

**§ 9.6.5** Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

**§ 9.6.6** A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

**§ 9.6.7** Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

### § 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect,

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stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

### § 9.8 SUBSTANTIAL COMPLETION

**§ 9.8.1** Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

**§ 9.8.2** When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**§ 9.8.3** Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

**§ 9.8.4** When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

**§ 9.8.5** The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

### § 9.9 PARTIAL OCCUPANCY OR USE

**§ 9.9.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

**§ 9.9.2** Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

**§ 9.9.3** Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

### § 9.10 FINAL COMPLETION AND FINAL PAYMENT

**§ 9.10.1** Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the

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Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

**§ 9.10.2** Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

**§ 9.10.3** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

**§ 9.10.4** The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents; or
- **.3** terms of special warranties required by the Contract Documents.

**§ 9.10.5** Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

### § 10.2 SAFETY OF PERSONS AND PROPERTY

**§ 10.2.1** The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

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**§ 10.2.2** The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

**§ 10.2.3** The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

**§ 10.2.4** When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

**§ 10.2.5** The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

**§ 10.2.6** The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

**§ 10.2.7** The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

**§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY**
If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

**§ 10.3 HAZARDOUS MATERIALS**
**§ 10.3.1** The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

**§ 10.3.2** Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

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**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

**§ 10.3.5** The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

**§ 10.3.6** If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

### § 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

## ARTICLE 11 INSURANCE AND BONDS

### § 11.1 CONTRACTOR'S LIABILITY INSURANCE

**§ 11.1.1** The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- **.1** Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- **.2** Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- **.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- **.4** Claims for damages insured by usual personal injury liability coverage;
- **.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- **.6** Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- **.7** Claims for bodily injury or property damage arising out of completed operations; and
- **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

**§ 11.1.2** The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction

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of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

**§ 11.1.3** Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

**§ 11.1.4** The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

**§ 11.2 OWNER'S LIABILITY INSURANCE**

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

**§ 11.3 PROPERTY INSURANCE**

**§ 11.3.1** Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

**§ 11.3.1.1** Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

**§ 11.3.1.2** If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

**§ 11.3.1.3** If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

**§ 11.3.1.4** This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

**§ 11.3.1.5** Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or

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otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

**§ 11.3.2 BOILER AND MACHINERY INSURANCE**
The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

**§ 11.3.3 LOSS OF USE INSURANCE**
The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

**§ 11.3.4** If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

**§ 11.3.5** If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

**§ 11.3.6** Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

**§ 11.3.7 WAIVERS OF SUBROGATION**
The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

**§ 11.3.8** A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

**§ 11.3.9** If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the

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Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

**§ 11.3.10** The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

### § 11.4 PERFORMANCE BOND AND PAYMENT BOND

**§ 11.4.1** The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

**§ 11.4.2** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

## ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

### § 12.1 UNCOVERING OF WORK

**§ 12.1.1** If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

**§ 12.1.2** If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

### § 12.2 CORRECTION OF WORK

#### § 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

#### § 12.2.2 AFTER SUBSTANTIAL COMPLETION

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

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**§ 12.2.2.2** The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

**§ 12.2.2.3** The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

**§ 12.2.3** The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

**§ 12.2.4** The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

**§ 12.2.5** Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### § 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

## ARTICLE 13 MISCELLANEOUS PROVISIONS

### § 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

### § 13.2 SUCCESSORS AND ASSIGNS

**§ 13.2.1** The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

**§ 13.2.2** The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

### § 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

### § 13.4 RIGHTS AND REMEDIES

**§ 13.4.1** Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

**§ 13.4.2** No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

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### § 13.5 TESTS AND INSPECTIONS

**§ 13.5.1** Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

**§ 13.5.2** If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

**§ 13.5.3** If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

**§ 13.5.4** Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

**§ 13.5.5** If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

**§ 13.5.6** Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

### § 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

### § 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

### § 14.1 TERMINATION BY THE CONTRACTOR

**§ 14.1.1** The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency that requires all Work to be stopped;

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.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

**§ 14.1.2** The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

**§ 14.1.3** If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

**§ 14.1.4** If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

### § 14.2 TERMINATION BY THE OWNER FOR CAUSE

**§ 14.2.1** The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

**§ 14.2.2** When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

**§ 14.2.3** When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

**§ 14.2.4** If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

### § 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

**§ 14.3.1** The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

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**§ 14.3.2** The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

### § 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

**§ 14.4.1** The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

**§ 14.4.2** Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- **.3** except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

**§ 14.4.3** In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

## ARTICLE 15 CLAIMS AND DISPUTES

### § 15.1 CLAIMS

### § 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

### § 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

### § 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

### § 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

### § 15.1.5 CLAIMS FOR ADDITIONAL TIME

**§ 15.1.5.1** If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

**§ 15.1.5.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

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**§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES**
The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- **.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- **.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

**§ 15.2 INITIAL DECISION**
**§ 15.2.1** Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

**§ 15.2.2** The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

**§ 15.2.3** In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

**§ 15.2.4** If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

**§ 15.2.5** The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

**§ 15.2.6** Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

**§ 15.2.6.1** Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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**§ 15.2.7** In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

**§ 15.2.8** If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

**§ 15.3 MEDIATION**

**§ 15.3.1** Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

**§ 15.3.2** The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

**§ 15.3.3** The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

**§ 15.4 ARBITRATION**

**§ 15.4.1** If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

**§ 15.4.1.1** A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

**§ 15.4.2** The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

**§ 15.4.3** The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

**§ 15.4.4 CONSOLIDATION OR JOINDER**

**§ 15.4.4.1** Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

**§ 15.4.4.2** Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an

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additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

**§ 15.4.4.3** The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

DRAFT

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General Decision Number: TX130005 01/04/2013 TX5

Superseded General Decision Number: TX20120005

State: Texas

Construction Types: Building and Residential

Counties: Cameron and Hidalgo Counties in Texas.

BUILDING AND RESIDENTIAL CONSTRUCTION PROJECTS (including single family homes and garden apartments up to and including 4 stories).

| Modification Number | Publication Date |
|---|---|
| 0 | 01/04/2013 |

* SUTX1990-013 05/01/1990

| | Rates | Fringes |
|---|---|---|
| BOILERMAKER | | |
| RESIDENTIAL CONSTRUCTION ONLY | $ 16.35 | 2.315 |
| BRICKLAYER | | |
| RESIDENTIAL CONSTRUCTION ONLY | $ 7.25 | |
| CARPENTER (Including Drywall Hanging and Acoustical Ceiling Installation) | | |
| BUILDING CONSTRUCTION ONLY Excluding Batt Insulation | $ 7.25 | |
| CARPENTER | | |
| RESIDENTIAL CONSTRUCTION ONLY | $ 7.25 | |
| CEMENT MASON/CONCRETE FINISHER (Excluding Form Setting) | | |
| BUILDING CONSTRUCTION ONLY | $ 7.25 | |
| CEMENT MASON/CONCRETE FINISHER | | |
| RESIDENTIAL CONSTRUCTION ONLY | $ 7.25 | |
| ELECTRICIAN | | |
| BUILDING CONSTRUCTION ONLY | $ 8.30 | |
| Electricians: (Residential) | | |
| RESIDENTIAL CONSTRUCTION ONLY | $ 7.25 | |
| FLOOR LAYER: CARPET (SOFT) | | |

FLOOR
BUILDING CONSTRUCTION ONLY..$ 7.25
RESIDENTIAL CONSTRUCTION
ONLY.....$ 7.25

Insulation Installer
RESIDENTIAL CONSTRUCTION
ONLY.....$ 7.25

IRONWORKER, REINFORCING
RESIDENTIAL CONSTRUCTION
ONLY.....$ 7.25

Laborer, common
BUILDING CONSTRUCTION ONLY..$ 7.25

LABORER
RESIDENTIAL CONSTRUCTION
ONLY
Pipelayer.....$ 7.25
Unskilled.....$ 7.25

PAINTER (Including Drywall
Finishing, Taping, and
Bedding)
BUILDING CONSTRUCTION ONLY..$ 7.25

PAINTER
RESIDENTIAL CONSTRUCTION
ONLY.....$ 7.25

PIPEFITTER (Including HVAC
Work)
BUILDING CONSTRUCTION ONLY..$ 7.28 .12

Plasterer tender
BUILDING CONSTRUCTION ONLY..$ 7.25

PLASTERER
BUILDING CONSTRUCTION ONLY..$ 8.41
RESIDENTIAL CONSTRUCTION
ONLY.....$ 7.25

PLUMBER (Excluding HVAC Work)
BUILDING CONSTRUCTION ONLY..$ 7.50 .48

Plumbers and Pipefitters
RESIDENTIAL CONSTRUCTION
ONLY.....$ 8.20

Power equipment operators:
BUILDING CONSTRUCTION ONLY
Backhoe.....$ 7.25 .48
RESIDENTIAL CONSTRUCTION
ONLY
Backhoe.....$ 7.25
Grader.....$ 7.25

Loader.....$  7.25

ROOFER, Including Built Up,
Composition and Single Ply
Roofs
RESIDENTIAL CONSTRUCTION
ONLY.....$  7.25

Sheet metal worker
RESIDENTIAL CONSTRUCTION
ONLY.....$  7.25

Sheet Rock Installer
RESIDENTIAL CONSTRUCTION
ONLY.....$  7.25

SHEETMETAL WORKER (Including
HVAC duct Work)
BUILDING CONSTRUCTION ONLY..$  7.25

TILE SETTER
BUILDING CONSTRUCTION ONLY..$  7.25
RESIDENTIAL CONSTRUCTION
ONLY.....$  7.25

TRUCK DRIVER
BUILDING CONSTRUCTION ONLY..$  7.25
RESIDENTIAL CONSTRUCTION
ONLY.....$  7.25

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

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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)).

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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 union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with

characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The first four letters , PLUM, indicate the international union and the four-digit number, 0198, that follows 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. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the rates.

0000/9999: weighted union wage rates will be published annually each January.

Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union majority rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

---

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 Regional Office for the area in which the survey was conducted because those Regional Offices have 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.

==========

END OF GENERAL DECISION

**DOCUMENT 00 91 13**
**ADDENDA**

**ADDENDUM NUMBER [_____]**

DATE: [_____]

PROJECT: City of Edinburg Safe Room – South Park Site

PROJECT NUMBER: 1204

OWNER: City of Edinburg

ARCHITECT: Negrete & Kolar Architects, LLP

TO: Prospective Bidders

This Addendum forms a part of the Contract Documents and modifies the Bidding Documents dated October 15, 2013, Addendum Number _____ issued _____, and Addendum Number _____ issued _____, with amendments and additions noted below.

Acknowledge receipt of this Addendum in the space provided in the Bid Form. Failure to do so may disqualify the Bidder.

This Addendum consists of _____ pages and the following Drawings:

| No. | Drawing Title | Issue Date |
|---|---|---|
| | | |

CHANGES TO ADDENDUM NUMBER ____ Issued _____

CHANGES TO THE PROJECT MANUAL

CHANGES TO THE DRAWINGS

APPROVAL OF ADDITIONAL PRODUCTS/SYSTEMS

**END OF DOCUMENT**

# DIVISION 1
## GENERAL REQUIREMENTS

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

**SECTION 01 10 00**

**SUMMARY**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

A. Contract description.

B. Work by Owner.

C. Owner supplied products.

D. Contractor's use of site [and premises].

E. Future work.

F. Work sequence.

G. Owner occupancy.

H. Specification Conventions.

**1.2 PROJECT DESCRIPTION**

A. Work of the Project includes the demolition of portions of existing buildings, site demolition, a new brick masonry and thin shell concrete domed community FEMA 361 rated safe room, and related site work including flatwork and fencing.

B. The construction of TSSI Safe Room per Contract Documents.

1. Each Contractor responsible for the construction of the masonry and concrete aspects of the Safe Room shall submit a written Statement of Responsibility to the authority having jurisdiction prior to the commencement of construction. The statement should contain the following:
   a. Acknowledgement of awareness of the special criteria contained in the Quality Assurance Plan.
   b. Acknowledgement that control will be exercised to obtain conformance with the Construction Documents.
   c. Procedure for exercising control within the Contractor's organization, and the method and frequency of reporting and the distribution of reports.
   d. Identification and qualifications of the persons exercising such control and their positions in the organization.
2. The Quality Assurance Plan is the sum of criteria and requirements contained in the drawings on sheets S0.1 and S0.2.
3. Bidders responsible for the selection of contractors constructing the masonry and concrete aspects of the dome shall also submit, to the Owner at the time of bidding, a statement of qualification of intended sub-contractors and that they are qualified to construct the masonry and concrete aspects of the dome.

C. The Work consists primarily of but is not necessarily limited to the following description as described and designated in the Contract Documents:

1. Demolition, removal, and disposal of existing site trees, roots, shrubs, vegetation, sub-surface obstructions and excess soils that are in conflict with the planned improvements.
2. Demolition of existing buildings and concrete slabs, sidewalks, and other accessory structures and equipment as indicated in the Contract Documents.
3. Concrete footings and building slabs, exterior brick masonry walls, and thin shell concrete dome roof assembly. Exterior doors and windows require FEMA 361 certification.
4. Interior CMU partitions, doors and frames, HVAC, electrical, emergency generator system, plumbing, fire protection systems, and other building systems.
5. Construction of the project in its entirety as described and indicated in the Contract Documents.

**1.3 CONTRACT DESCRIPTION**

A. Perform Work of Contract under stipulated sum contract with Owner in accordance with Conditions of Contract.

B. The Agreement, General Conditions of the Contract for the Construction, and all Addenda are a part of the Contract. The Contractor shall consult them in detail for instructions pertaining to the Work. The Contractor shall also consult all other divisions and sections of the Project Manual, and all Drawings in the execution of the Work of the Contract.

C. Provide all labor, materials, systems, equipment, items, articles, operations, and/or methods listed, implied, mentioned, or scheduled in the Contract Documents and/or necessary and/or required for the satisfactory completion of the work.

D. The listing in any individual part of the Contract Documents of the work, requirements, products, materials, equipment, methods, or other item or process required for the Work is <u>not intended to be conclusive</u>. The Contractor shall coordinate all portions of the Contract Documents and shall in totality provide all miscellaneous items of work and products necessary for the satisfactory completion of the Work described in the Contract Documents.

**1.4 WORK BY OWNER**

A. The Owner will award contracts for construction of site amenities and building renovations to be conducted concurrent with the work of this project.

B. Owner will remove and retain possession of the items indicated on site plan before start of work.

C. Remove and deliver to Owner the following items prior to start of work:
   1. Casework at existing library.
   2. Ball brackets at existing equipment storage.

**1.5 CONTRACTOR'S USE OF SITE AND PREMISES**

A. Limit use of site to allow:
   1. Owner occupancy.
   2. Work by Others.
   3. Use of site by the public outside boundary of work.

B. Contractor is expected to secure site occupied by his operations for safety, and security purposes with temporary fencing suitable for the purposes described.

**1.6 WORK SEQUENCE**

A. Sequence the Work to maintain dry building conditions with special attention regarding wall and ceiling cavities, as well as in a manner that eliminates retro fitting or re-working of the Work.

B. Do not engage in practices that will cover or conceal damp or wet conditions.

C. Assure dry and clean mechanical duct systems. Do not run any mechanical air handling equipment without filters and without necessary filter changes when engaged during the construction dry-in and finish-out phase.

D. Limit final pavement of On-site improvements until all the work of the project is ready for substantial completion. Condition of all concrete and asphalt pavement shall be in a "like new" condition when accepted by the Owner

**1.7 OWNER OCCUPANCY**

A. The Owner will occupy the site during the Safe Room Phase of construction. This will include areas of the park outside the scope of construction.

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

C. Schedule the Work to accommodate Owner occupancy.

**1.8 SPECIFICATION CONVENTIONS**

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## SECTION 01 20 00
## PRICE AND PAYMENT PROCEDURES

### PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Contingency allowances.

B. Structural materials allowances.

C. Testing and inspection allowances.

D. Schedule of values.

E. Applications for payment.

F. Change procedures.

G. Defect assessment.

### 1.2 SCHEDULE OF VALUES

A. Submit printed schedule on AIA Form G703 - Continuation Sheet for G702.

B. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.

C. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major specification Section. Identify material, labor, site mobilization, bonds and insurance.

D. Include in each line item, amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by unit cost to achieve total for each item.

E. Include separately from each line item, direct proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders, with each Application For Payment.

### 1.3 APPLICATIONS FOR PAYMENT

A. Submit three copies of each application on AIA Form G702 - Application and Certificate for Payment.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment. Provide dollar value in each column for each line item for portion of work performed and for stored products.

C. Submit updated construction schedule with each Application for Payment.

D. Payment Period: Submit at intervals stipulated in the Agreement.

E. Submit with transmittal letter as specified for Submittals in Section 01 33 00 - Submittal Procedures.

F. Substantiating Data: When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:

1. Current construction photographs specified in Section 01 33 00.
2. Partial release of liens from major subcontractors and vendors.
3. Affidavits attesting to off-site stored products.
4. Construction progress schedules, revised and current as specified.

### 1.4 CHANGE PROCEDURES

A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The Architect/Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on Architect developed form.

C. The Architect/Engineer may issue a Proposal Request or Notice of Change including a detailed description of proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change [with stipulation of overtime work required] [and] [the period of time during which the requested price will be considered valid]. Contractor will prepare and submit estimate within 10 calendar days.

D. Contractor may propose changes by submitting a request for change to Architect/Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation. Document requested substitutions in accordance with Section 01 60 00 - Product Requirements.

E. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for Change Order as approved by Architect/Engineer.

F. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under Construction Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material or Force Account Change Order.

G. Construction Change Directive: Architect may issue directive, on AIA Form G713 Construction Change Directive signed by Owner, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining

any change in Contract Sum/Price or Contract Time. Promptly execute change.

H. Time and Material or Force Account Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Architect/Engineer will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents. Provide full information required for evaluation of proposed changes to substantiate costs for changes in the Work.

I. Maintain detailed records of work done on Time and Material Force Account basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

J. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.

K. Change Order Forms: AIA G701.

L. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

M. Correlation Of Contractor Submittals:
   1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
   2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
   3. Promptly enter changes in Project Record Documents.

**1.5 DEFECT ASSESSMENT**

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Architect/Engineer, it is not practical to remove and replace the Work, the Architect/Engineer will direct appropriate remedy or adjust payment.

C. The defective Work may remain, but unit sum/price will be adjusted to new sum/price at discretion of Architect/Engineer and Owner.

D. Defective Work not accepted will not be funded. Work found to be defective after partial progress funding may be reduced to its appropriate level of value or to zero based on the evaluation of the Architect

E. Individual specification sections may modify these options or may identify specific formula or percentage sum/price reduction.

F. Authority of Architect and Owner to assess defects and identify payment adjustments, is final.

G. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from transporting vehicle.
   4. Products placed beyond lines and levels of required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling, and disposing of rejected products.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 30 00**

**ADMINISTRATIVE REQUIREMENTS**

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Field engineering.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Pre-installation meetings.

G. Cutting and patching.

H. Special procedures.

### 1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.

C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion [and for portions of Work designated for Owner's [partial] occupancy].

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

### 1.3 FIELD ENGINEERING

A. Employ Land Surveyor registered in the State of Texas.

B. Owner will locate and protect survey control and reference points. Promptly notify Architect of discrepancies discovered.

C. Control datum for survey is shown on Drawings.

D. Verify set-backs and easements; confirm drawing dimensions and elevations.

E. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

F. Submit copy of site drawing and certificate signed by Land Surveyor certifying elevations and locations of the Work are in conformance with Contract Documents. Such document shall be considered as the Survey for Owner's Property finance and record needs.

G. Maintain complete and accurate log of control and survey work as Work progresses.

H. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

I. Promptly report to Architect loss or destruction of reference point or relocation required because of changes in grades or other reasons.

J. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

### 1.4 PRECONSTRUCTION MEETING

A. Architect will schedule meeting after Notice to Proceed has been issued to the Contractor.

B. Attendance Required: Owner, Architect, Contractor, and major subcontractors.

C. The Agenda may include but is not limited to:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing parties in Contract, and Architect.
   6. Communication Procedures.
   7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   8. Scheduling.
   9. Use of premises by Owner and Contractor.
   10. Security and housekeeping procedures.
   11. Application for Payment procedures.
   12. Progress meeting frequency.

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

## 1.5 PROGRESS MEETINGS

A. Contractor shall schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

B. Contractor shall make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.

D. The Agenda may include but is not limited to:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Review of Application of Payment.
14. Other business relating to Work.

E. Contractor to record minutes and distribute copies within five days after meeting to participants, with one copy to Architect, Owner, and those affected by decisions made.

## 1.6 PRE-INSTALLATION MEETINGS

A. When required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific section.

B. Require attendance of parties directly affecting, or affected by, Work of specific section.

C. Notify Architect ten days in advance of meeting date.

D. Prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
2. Review coordination with related work.

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

# PART 2 PRODUCTS - NOT USED

# PART 3 EXECUTION

## 3.1 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Execute cutting, fitting, and patching including excavation and fill, necessary to complete Work, and to:
1. Fit the several parts together, to integrate with other Work.
2. Uncover Work to install or correct ill-timed Work.
3. Remove and replace defective and non-conforming Work.
4. Remove samples of installed Work for testing.
5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

C. Execute work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.

D. Cut masonry and concrete materials using masonry saw or core drill.

E. Restore Work with new products in accordance with requirements of Contract Documents.

F. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

G. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

H. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

I. Identify hazardous substances or conditions exposed during the Work to Architect/Engineer for decision or remedy.

## 3.2 SPECIAL PROCEDURES

A. Materials: As specified in product sections; match existing with new products [and salvaged products] for patching and extending work.

B. Employ skilled and experienced installer to perform alteration work.

C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

D. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

E. Remove debris and abandoned items from area and from concealed spaces.

F. Prepare surface and remove surface finishes to permit installation of new work and finishes.

G. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

H. Remove, cut, and patch Work in manner to minimize damage and to permit restoring products and finishes to [original] [or] [specified] condition.

I. Refinish existing visible surfaces to remain in renovated rooms and spaces, to [specified] [renewed] condition for each material, with neat transition to adjacent finishes.

J. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

K. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Architect/Engineer for review.

L. Where change of plane of ¼ inch or more occurs, submit recommendation for providing smooth transition to Architect/Engineer for review and request instructions from Architect/Engineer.

M. Trim existing doors to clear new floor finish. Refinish trim to specified condition.

N. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

O. Finish surfaces as specified in individual product sections.

**END OF SECTION**

**SECTION 01 33 00**

**SUBMITTAL PROCEDURES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

A. Submittal procedures.

B. Construction progress schedules.

C. Proposed products list.

D. Product data.

E. Shop drawings.

F. Samples.

G. Design data.

H. Test reports.

I. Certificates.

J. Manufacturer's instructions.

K. Manufacturer's field reports.

L. Erection drawings.

M. Construction photographs.

**1.2 SUBMITTAL PROCEDURES**

A. Develop a list of submittals and submittal schedule to inform the A/E team of when submittals are anticipated to be scheduled.

B. Transmit each submittal with Architect/Engineer accepted form.

C. Complete the submittal form in accordance with the Architect's Instructions. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

D. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

F. Schedule submittals to expedite Project, and deliver to Architect at business address. Coordinate submission of related items.

G. For each submittal for review, allow 15 working days for the Architect to process submittal excluding delivery time to and from Contractor.

H. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

I. Allow space on submittals for Contractor and Architect/Engineer review stamps.

J. When revised for resubmission, identify changes made since previous submission.

K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

L. Submittals not requested will not be recognized or processed.

**1.3 CONSTRUCTION PROGRESS SCHEDULES**

A. Submit preliminary outline Schedules within 15 days after date established in Notice to Proceed for coordination with Owner's requirements. After review, submit detailed schedules within 5 days modified to accommodate revisions recommended by Architect/Engineer.

B. Submit revised Progress Schedules with each Application for Payment, identifying changes since previous version.

C. Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

D. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

E. Submit as a minimum, computer generated horizontal bar chart with separate line for each major portion of Work or operation or with separate line for each section of Work, identifying first work day of each week. At the Contractors option, Contractor may submit a computer generated network analysis diagram using the critical path or PERT method, as outlined in AGC's "The Use of CPM in Construction."

F. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities, including mock-ups. Indicate early and late start, early and late finish, float dates, and duration.

G. Indicate estimated percentage of completion for each item of Work at each submission.

H. Submit separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished products and products identified under Allowances, and dates reviewed submittals will be required from Architect/Engineer. Indicate decision dates for selection of finishes.

I. Indicate delivery dates for Owner furnished products and products identified under Allowances.

J. Revisions To Schedules:
   1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
   2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

3. Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect [including effect of changes on schedules of separate contractors].

**1.4 PROPOSED PRODUCTS LIST**

A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

**1.5 PRODUCT DATA**

A. Product Data: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit number of copies Contractor requires, plus two copies Architect/Engineer will retain.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

**1.6 SHOP DRAWINGS**

A. Shop Drawings: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
   1. Include signed and sealed calculations to support design.
   2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
   3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submit number of opaque reproductions Contractor requires, plus two copies Architect/Engineer will retain.

E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

**1.7 SAMPLES**

A. Samples: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Samples For Selection as Specified in Product Sections:
   1. Submit to Architect/Engineer for aesthetic, color, or finish selection.
   2. Submit samples of finishes from full range of manufacturers' standard colors, textures, and patterns for Architect/Engineer selection. Submit samples from custom colors, textures and patterns where required by Specifications.

C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

D. Include identification on each sample, with full Project information.

E. Submit number of samples specified in individual specification sections; Architect/Engineer will retain one sample.

F. Reviewed samples which may be used in the Work are indicated in individual specification sections.

G. Samples will not be used for testing purposes unless specifically stated in specification section.

H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 70 00 - Execution and Closeout Requirements.

**1.8 DESIGN DATA**

A. Submit for Architect/Engineer's knowledge as contract administrator or for Owner.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

**1.9 TEST REPORTS**

A. Submit for Architect/Engineer's knowledge as contract administrator or for Owner.

B. Submit test reports for information for limited purpose of assessing conformance with

information given and design concept expressed in Contract Documents.

**1.10 CERTIFICATES**

A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

**1.11 MANUFACTURER'S INSTRUCTIONS**

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect/Engineer for delivery to Owner in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

**1.12 MANUFACTURER'S FIELD REPORTS**

A. When specified in individual specification sections, submit reports for Architect/Engineer's benefit as contract administrator or for Owner.

B. Submit report in duplicate within 10 days of observation to Architect/Engineer for information.

C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

**1.13 ERECTION DRAWINGS**

A. When specified in individual specification sections, submit drawings for Architect/Engineer's benefit as contract administrator or for Owner.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Architect/Engineer or Owner.

**1.14 CONSTRUCTION PHOTOGRAPHS**

A. Provide photographs of site and construction throughout progress of Work.

B. Each month submit photographs with Application for Payment.

C. Take site photographs from differing directions and five interior photographs of areas indicating relative progress of the Work, two (2) days maximum prior to submitting.

**PART 2 USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 40 00**

**QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

A. Quality control and control of installation.

B. Tolerances.

C. References.

D. Labeling.

E. Mock-up requirements.

F. Testing and inspection services.

G. Manufacturers' field services.

H. Examination.

I. Preparation.

**1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION**

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

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

C. When manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

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

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

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

**1.3 TOLERANCES**

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

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

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

**1.4 REFERENCES**

A. For products or workmanship specified by association, trade or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids, except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in reference documents.

**1.5 LABELING**

A. Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.

B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.

1. Model number.
2. Serial number.
3. Performance characteristics.

**1.6 MOCK-UP REQUIREMENTS**

A. Erect and maintain mock-ups and field samples as required by specifications, the A/E and the Project Manager

B. Request approval for the locations to construct required mock-ups or field samples for the Project Manager prior to proceeding with the fabrication.

C. Tests will be performed under provisions identified in this section and identified in respective product specification sections.

D. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

E. Accepted mock-ups shall be comparison standard for remaining Work.

F. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect.

**1.7 TESTING AND INSPECTION SERVICES**

A. Owner will employ and pay for specified services of an independent firm to perform testing and inspection.

B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Architect, Owner and TSSI.

C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Architect or Owner.

D. Reports will be submitted by independent firm to Architect, Contractor, and authority having jurisdiction, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
   1. Submit final report indicating correction of Work previously reported as non-compliant.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Architect and independent firm 24 hours prior to expected time for operations requiring services.
   2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Architect. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum.

**1.8 MANUFACTURERS' FIELD SERVICES**

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and other services as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations. Observer subject to approval of Architect.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Refer to Section 01 33 00 - Submittal Procedures, MANUFACTURERS' FIELD REPORTS article.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.1 EXAMINATION**

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

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

C. Examine and verify specific conditions described in individual specification sections.

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

**3.2 PREPARATION**

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

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

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

**3.3 SCHEDULE OF REFERENCES**

A. The following schedule of references and standards are for the Contractors information only. The schedule is not meant to be conclusive and the Contractor shall consult all individual parts of the Contract Documents for references to applicable standards:

**AA** **Aluminum Association**
818 Connecticut Avenue, N.W.
Washington, DC 20006

**AABC** **Associated Air Balance Council**
1000 Vermont Avenue, N.W.
Washington, DC 20005

**ACI** **American Concrete Institute**
Box 19150, Redford Station
Detroit, MI 48219

**ADC** **Air Diffusion Council**
230 North Michigan Avenue
Chicago, IL 60601

**AGC** **Associated General Contractors of America**
1957 E. Street, N.W.
Washington, DC 20006

**AI** **Asphalt Institute**
Asphalt Institute Building
College Park, MD 20740

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

**AISC** **American Institute of Steel Construction**
400 North Michigan Avenue, 8th Floor
Chicago, IL 60611

**AISI** **American Iron and Steel Institute**
1000 16th Street, N.W.
Washington, DC 20036

**AITC** **American Institute of Timber Construction**
333 W. Hampden Avenue
Englewood, CO 80110

**AMCA** **Air Movement and Control Association**

30 West University Drive
Arlington Heights, IL 60004

**ANSI** **American National Standards Institute**
1430 Broadway
New York, NY 10018

**APA** **American Plywood Association**
Box 11700
Tacoma, WA 98411

**ARI** **Air-Conditioning and Refrigeration Institute**
1501 Wilson Boulevard
Arlington, VA 22209

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

**ASME** **American Society of Mechanical Engineers**
345 East 47th Street
New York, NY 10017

**ASTM** **American Society for Testing and Materials**
1916 Race Street
Philadelphia, PA 19103

**AWI** **Architectural Woodwork Institute**
2310 South Walter Reed Drive
Arlington, VA 22206

**AWPA** **American Wood Preservers' Association**
7735 Old Georgetown Road
Bethesda, MD 20014

**AWS** **American Welding Society**
550 LeJeune Road, N.W.
Miami, FL 33135

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

**BIA** **Brick Institute of America**
11490 Commerce Park Drive
Reston, VA 22091

**CDA** **Copper Development Association**
57th Floor, Chrysler Building
405 Lexington Avenue
New York, NY 10174

**CLFMI** **Chain Link Fence Manufacturers Institute**
1101 Connecticut Avenue, N.W.
Washington, D.C. 20036

**CRSI** **Concrete Reinforcing Steel Institute**
933 Plum Grove Road
Schaumburg, IL 60195

**DHI** **Doors and Hardware Institute**
7711 Old Springhouse Road
McLean, VA 22102

**EJCDC** **Engineers Joint Contract Documents Committee American Consulting Engineers Council**
1015 15th Street, N.W.
Washington, DC 20005

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

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

**FM** **Factory Mutual System**
1151 Boston-Providence Turnpike
P.O. Box 688
Norwood, MA 02062

**FS** **Federal Specifications**
General Services Administration
Specifications and Consumer Information
Distribution Section (WFSIS)
Washington Navy Yard, Bldg. 197
Washington, D.C. 20407

**GA** **Gypsum Association**
1603 Orrington Avenue
Evanston, IL 60201

**ICBO** **International Conference of Building Officials**
5360 S. Workman Mill Road
Whittier, CA 90601

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

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

**MBMA** **Metal Building Manufacturer's Association**
1230 Keith Building
Cleveland, OH 44115

**ML/SFA** **Metal Lath/Steel Framing Association**
221 North LaSalle Street
Chicago, IL 60601

**NAAMM** **National Association of Architectural Metal Manufacturers**
221 North LaSalle Street
Chicago, IL 60601

**NCMA** **National Concrete Masonry Association**
P.O. Box 781
Herndon, VA 22070

**NEBB** **National Environmental Balancing Bureau**
8224 Old Courthouse Road
Vienna, VA 22180

**NEMA** **National Electrical Manufacturer's Association**
2101 'L' Street, N.W.
Washington, DC 20037

**NFPA** **National Fire Protection Association**
Battery March Park
Quincy, MA 02269

**NFPA** **National Forest Products Association**
1619 Massachusetts Avenue, N.W.
Washington, D.C. 20036

**NRCA** **National Roofing Contractors Association**
8600 Bryn Mawr Avenue
Chicago, IL 60631

**NSWMA** **National Solid Wastes Management Association**
1730 Rhode Island Avenue, N.W.
Washington, D.C. 20036

**NWMA** **National Woodwork Manufacturers Association**
205 W. Towhy Avenue
Park Ridge, IL 60068

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

**PS** **Product Standard**
U.S. Department of Commerce
Washington, DC 20203

**SDI** **Steel Deck Institute**
P.O. Box 9506
Canton, OH 44711

**SDI** **Steel Door Institute**
712 Lakewood Center North
14600 Detroit Avenue
Cleveland, OH 44107

**SIGMA** **Sealed Insulating Glass Manufacturers Association**
111 East Wacker Drive
Chicago, IL 60601

**SJI** **Steel Joist Institute**
1205 48th Avenue North Suite A
Myrtle Beach, SC 29577

**SMACNA** **Sheet Metal and Air Conditioning Contractor's National Association**
8224 Old Court House Road
Vienna, VA 22180

**SSPC** **Steel Structures Painting Council**
4400 Fifth Avenue
Pittsburgh, PA 15213

**TCA** **Tile Council of America, Inc.**
Box 326
Princeton, NJ 08540

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

**WCLIB** **West Coast Lumber Inspection Bureau**
6980 S.W. Varns Road
Box 23145
Portland, OR 97223

**WWPA** **Western Wood Products Association**
1500 Yeon Building
Portland, OR 97204

**END OF SECTION**

## SECTION 01 50 00
## TEMPORARY FACILITIES AND CONTROLS

### PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary heating.
   4. Temporary cooling.
   5. Temporary ventilation.
   6. Temporary water service.
   7. Temporary sanitary facilities.

B. Construction Facilities:
   1. Field offices and sheds.
   2. Vehicular access.
   3. Parking.
   4. Progress cleaning and waste removal.
   5. Project identification.
   6. Traffic regulation.
   7. Fire prevention facilities.

C. Temporary Controls:
   1. Barriers.
   2. Enclosures and fencing.
   3. Security.
   4. Water control.
   5. Dust control.
   6. Erosion and sediment control.
   7. Noise control.
   8. Pest control.
   9. Pollution control.
   10. Rodent control.

D. Removal of utilities, facilities, and controls.

### 1.2 TEMPORARY ELECTRICITY

A. Contractor shall provide and pay for power service required from utility source as needed for construction operation. Utilize Owner's existing power service.

B. Provide temporary electric feeder from existing building electrical service at location as directed by Architect/Engineer. Do not disrupt Owner's use of service.

C. Complement existing power service capacity and characteristics as required for construction operations.

D. Provide power outlets, with branch wiring and distribution boxes located as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment.

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

F. Permanent convenience receptacles may be utilized during construction.

### 1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain lighting for construction operations to achieve minimum lighting levels which will ensure safety and maintain the specified levels of quality and craftsmanship.

B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.

D. Maintain lighting and provide routine repairs.

### 1.4 TEMPORARY HEATING

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

B. Prior to operation of permanent equipment for temporary heating purposes, verify installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in product sections.

### 1.5 TEMPORARY COOLING

A. Provide and pay for cooling devices and cooling as needed to maintain specified conditions for construction operations.

B. Prior to operation of permanent equipment for temporary cooling purposes, verify installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

### 1.6 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

### 1.7 TEMPORARY WATER SERVICE

A. Connect to existing water source as available. Otherwise, provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations.

B. Extend branch piping with outlets located so water is available by hoses with threaded

connections. Provide temporary pipe insulation to prevent freezing.

**1.8 TEMPORARY SANITARY FACILITIES**

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.

**1.9 FIELD OFFICES AND SHEDS**

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

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

C. Do not use permanent facilities for field offices or for storage.

D. Construction: Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations with steps and landings at entrance doors.
   1. Construction: Structurally sound, secure, weather tight enclosures for office and storage spaces. Maintain during progress of Work; remove at completion of Work.
   2. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.
   3. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.
   4. Storage Spaces: Heating and ventilation as needed to maintain products in accordance with Contract Documents; lighting for maintenance and inspection of products.

E. Storage Areas And Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01 60 00 - Product Requirements.

F. Preparation: Fill and grade sites for temporary structures sloped for drainage away from buildings.

G. Installation:
   1. Install office spaces ready for occupancy 15 days after date fixed in Notice of Award.

H. Maintenance And Cleaning:
   1. Maintain approach walks free of mud, water, and snow.

I. Removal: At completion of Work for entire project remove buildings, foundations, utility services, and debris. Restore areas.

**1.10 VEHICULAR ACCESS**

A. Construct temporary access roads from public thoroughfares to serve construction area, of width and load bearing capacity to accommodate unimpeded traffic for construction purposes.

B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

C. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.

D. Location as indicated on Drawings or approved by Owner.

E. Provide unimpeded access for emergency vehicles. Maintain 20 feet wide driveways with turning space between and around combustible materials.

F. Provide and maintain access to fire hydrants and control valves free of obstructions.

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

**1.11 PARKING**

A. Provide temporary surface parking areas to accommodate construction personnel.

B. Locate as approved by Owner.

C. Use of [designated areas of] existing parking facilities used by construction personnel is [not] permitted.

D. Do not allow heavy vehicles or construction equipment in parking areas.

E. Do not allow vehicle parking on existing pavement.

F. Permanent Pavements And Parking Facilities:
   1. Bases for permanent roads and parking areas may be used for construction traffic.
   2. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.
   3. Use of permanent parking structures is permitted

G. Maintenance:
   1. Maintain traffic and parking areas in sound condition.
   2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

H. Removal, Repair:
   1. Remove temporary materials and construction when permanent paving is usable before Substantial Completion.
   2. Remove underground work and compacted materials to depth of 2 feet; fill and grade site as specified.
   3. Repair permanent facilities damaged by use, to specified condition.

I. Mud From Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

**1.12 PROGRESS CLEANING AND WASTE REMOVAL**

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing spaces.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

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

**1.13 PROJECT IDENTIFICATION**

A. Project Identification Sign:
1. One painted identification sign , 4'x8', 6' above ground, and content shown on Drawings, location designated.
2. Content:
   a. Project title, logo and name of Owner as indicated on Contract Documents.
   b. Names and titles of authorities.
   c. Names and titles of Architect/Engineer and Consultants.
   d. Name of Prime Contractor .
3. Graphic Design, Colors, Style of Lettering: Designated by Architect.

B. Project Informational Signs:
1. No other signs are allowed without Owner permission except those required by law.

C. Design sign and structure to withstand 60 miles/hr wind velocity.

D. Sign Painter: Experienced as professional sign painter for minimum three years.

E. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

F. Sign Materials:
1. Structure and Framing: structurally adequate.
2. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inches thick, standard large sizes to minimize joints.
3. Rough Hardware: Galvanized.
4. Paint and Primers: Exterior quality.

G. Installation:
1. Install project identification sign within 15 days after date fixed by Notice to Proceed.
2. Erect at location of high public visibility adjacent to main entrance to site.
3. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
4. Install sign surface plumb and level, with butt joints. Anchor securely.
5. Paint exposed surfaces of sign, supports, and framing.

H. Maintenance: Maintain signs and supports clean, repair deterioration and damage.

I. Removal: Remove signs, framing, supports, and foundations at completion of Project and restore area.

**1.14 TRAFFIC REGULATION**

A. Signs, Signals, And Devices:
1. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by authority having jurisdiction.
2. Traffic Cones and Drums, Flares and Lights: As approved by authority having jurisdiction.
3. Flagperson Equipment: As required by authority having jurisdiction.

B. Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

C. Flares And Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

D. Haul Routes:
1. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.

E. Traffic Signs And Signals:
1. Provide signs at approaches to site and on site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
2. Provide, operate, and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
3. Relocate as Work progresses, to maintain effective traffic control.

F. Removal:
1. Remove equipment and devices when no longer required.
2. Repair damage caused by installation.
3. Remove post settings to depth of 2 feet.

**1.15 FIRE PREVENTION FACILITIES**

A. Prohibit smoking with buildings under construction and demolition. Designate area on site where smoking is permitted. Provide approved ashtrays in designated smoking areas.

B. Establish fire watch for cutting and welding and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.

C. Portable Fire Extinguishers: NFPA 10; 10 pound capacity, 4A-60B: C UL rating.

1. Provide one fire extinguisher at each stair on each floor of buildings under construction and demolition.
2. Provide minimum one fire extinguisher in every construction trailer and storage shed.
3. Provide minimum one fire extinguisher on roof during roofing operations using heat producing equipment.

**1.16 BARRIERS**

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way.

C. Provide protection for plants designated to remain. Replace damaged plants.

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

**1.17 ENCLOSURES AND FENCING**

A. Construction: Contractor's option Commercial grade chain link fence.

B. Provide 6 feet high fence around construction site; equip with vehicular and pedestrian gates with locks.

C. Exterior Enclosures:
1. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
2. Provide temporary roofing as specified in Section 07 52 00.

**1.18 SECURITY**

A. Security Program:
1. Protect Work and existing premises from theft, vandalism, and unauthorized entry.
2. Initiate program at project mobilization.
3. Maintain program throughout construction period until Owner acceptance precludes need for Contractor security.

B. Entry Control:
1. Restrict entrance of persons and vehicles into Project site and existing facilities.
2. Owner will control entrance of persons and vehicles related to Owner's operations.

**1.19 WATER CONTROL**

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

**1.20 DUST CONTROL**

A. Execute Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

**1.21 EROSION AND SEDIMENT CONTROL**

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize surface area of bare soil exposed at one time.

C. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

**1.22 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

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

B. Remove underground installations to minimum depth of 2 feet. Grade site as indicated on Drawings.

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

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 60 00**

**PRODUCT REQUIREMENTS**

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

### 1.2 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Furnish new materials, machinery, components, equipment, fixtures, and systems to be installed in and form a part of the Work unless specified otherwise.

C. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

D. Furnish interchangeable components from same manufacturer for components being replaced.

### 1.3 PRODUCT DELIVERY REQUIREMENTS

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

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

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

### 1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

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

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

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

E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

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

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

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

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

### 1.5 PRODUCT OPTIONS

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

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

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

### 1.6 PRODUCT SUBSTITUTION PROCEDURES

A. Architect will consider requests for Substitutions only within 30 days after date established in Notice to Proceed. Approval of Substitutions will be at the sole discretion of the Architect and the Owner. The Architect's decision will be final.

B. Substitutions may be considered when a product becomes unavailable or if, in the opinion of the Architect, its use would adversely impact the construction schedule, through no fault of Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that Bidder/Contractor:

1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
2. Will provide same warranty for Substitution as for specified product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or

Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
   2. Submit shop drawings, product data, technical information, certified test results attesting to the proposed Product equivalence, and any other information necessary or requested by the Architect to allow a review and determination of equivalence without additional research by the Architect. All information and data submitted shall be in a format similar to that of the information available to the Architect on the specified product in order to allow comparison. Burden of proof is on the proposer.
   3. Architect will notify Contractor in writing of decision to accept or reject request.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## SECTION 01 70 00
## EXECUTION AND CLOSEOUT REQUIREMENTS

### PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Closeout procedures.
B. Final cleaning.
C. Starting of systems.
D. Demonstration and instructions.
E. Testing, adjusting and balancing.
F. Protecting installed construction.
G. Project record documents.
H. Operation and maintenance data.
I. Manual for materials and finishes.
J. Manual for equipment and systems.
K. Spare parts and maintenance products.
L. Product warranties and product bonds.
M. Maintenance service.

### 1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.
B. Provide submittals to Architect that are required by authorities having jurisdiction.
C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
D. Owner will occupy portions of building as specified in Section 01 10 00 - Summary.

### 1.3 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
D. Replace filters of operating equipment.
E. Clean debris from roofs, gutters, downspouts, and drainage systems.
F. Clean site; sweep paved areas, rake clean landscaped surfaces.
G. Remove waste and surplus materials, rubbish, and construction facilities from site.

### 1.4 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.
B. Notify Architect seven days prior to start-up of each item.
C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
E. Verify wiring and support components for equipment are complete and tested.
F. Execute start-up under supervision of applicable [manufacturer's representative] [Contractors' personnel] in accordance with manufacturers' instructions.
G. Submit a written report in accordance with Section 01 33 00 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

### 1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
F. Required instruction time for each item of equipment and system is specified in individual sections.

### 1.6 TESTING, ADJUSTING AND BALANCING

A. Owner will appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing.
B. Reports will be submitted by independent firm to Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

**1.7 PROTECTING INSTALLED CONSTRUCTION**

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

**1.8 PROJECT RECORD DOCUMENTS**

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

G. Submit documents to Architect/Engineer with claim for final Application for Payment for the Safe Room Construction Phase.

**1.9 OPERATION AND MAINTENANCE DATA**

A. Submit data bound in 8-1/2 x 11 inch text pages, three D side ring [capacity expansion] binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Originals of warranties and bonds.

**1.10 MANUAL FOR MATERIALS AND FINISHES**

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy to be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit three sets of revised final volumes in final form within 10 days after final inspection.

E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

H. Additional Requirements: As specified in individual product specification sections.

I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

**1.11 MANUAL FOR EQUIPMENT AND SYSTEMS**

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit three sets of revised final volumes in final form within 10 days after final inspection.

E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; by label machine.

G. Include color coded wiring diagrams as installed.

H. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.

I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

J. Include servicing and lubrication schedule, and list of lubricants required.

K. Include manufacturer's printed operation and maintenance instructions.

L. Include sequence of operation by controls manufacturer.

M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

N. Include control diagrams by controls manufacturer as installed.

O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.

P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

R. Include test and balancing reports as specified in Section 01 40 00 - Quality Requirements.

S. Additional Requirements: As specified in individual product specification sections.

T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

**1.12 SPARE PARTS AND MAINTENANCE PRODUCTS**

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

**1.13 PRODUCT WARRANTIES AND PRODUCT BONDS**

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time Of Submittals:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
   2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

**1.14 MAINTENANCE SERVICE**

A. Furnish service and maintenance of components indicated in specification sections for three year from date of Substantial Completion and during warranty period.

B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

# PART THREE

# SPECIFICATIONS

# DIVISION 2
## EXISTING CONDITIONS

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

**SECTION 02 41 16**

**STRUCTURE DEMOLITION**

**PART 1 GENERAL**

**1.1 SUMMARY**

A. Section Includes:
   1. Demolishing designated structures.
   2. Demolishing designated foundations.
   3. Demolishing designated slabs-on-grade.
   4. Demolishing, Disconnecting and capping designated utilities.
   5. Demolishing, Filling designated underground tanks.
   6. Removing designated items for reuse and Owner's retention.
   7. Protecting items designated to remain.
   8. Removing demolished materials.

B. Related Sections:
   1. Section 02 41 19 - Selective Structure Demolition: Demolishing designated components.

**1.2 SUBMITTALS**

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of barricades, fences, and temporary work.

C. Design Data: Submit calculations for bracing, shoring, and underpinning signed and sealed by professional engineer.

D. Existing Building Documentation: Submit the following for existing buildings indicated to remain.
   1. Survey indicating position and elevation of exterior building features.
   2. Photographic survey indicating conditions before, during, and after demolition work.

E. Submit copy of permits required by regulatory agencies for demolition and sidewalk and street closings.

**1.3 CLOSEOUT SUBMITTALS**

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of capped utilities and subsurface obstructions.

C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

**1.4 QUALITY ASSURANCE**

A. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, runoff control, and disposal,

B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.

C. Obtain required permits from authorities having jurisdiction.

D. Perform Work in accordance with State and Municipality standard.

E. Maintain one copy of each document on site.

**1.5 QUALIFICATIONS**

A. Demolition Firm: Company specializing in performing work of this section with minimum ten (10) years experience.

B. Design shoring, bracing, and underpinning under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.

**1.6 PRE-INSTALLATION MEETINGS**

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

**1.7 SEQUENCING**

A. Section 01 10 00 - Summary: Requirements for sequencing.

**1.8 SCHEDULING**

A. Section 01 30 00 - Administrative Requirements01 32 16 - Construction Progress Schedule: Requirements for scheduling.

B. Schedule Work to before site excavation work.

C. Describe demolition removal procedures and schedule.

**1.9 PROJECT CONDITIONS**

A. Buildings indicated to be demolished will be vacated before start of Work.

B. Owner assumes no responsibility for actual condition of buildings to be demolished.

C. Notify Architect/Engineer upon discovery of hazardous materials.

D. Do not sell demolished materials on-site.

E. Maintain existing sidewalks to greatest extent possible, except where indicated for removal.

**PART 2 PRODUCTS**

**2.1 FILL MATERIALS**

A. Fill Material: Type fill as specified in structural and civil drawings.

**PART 3 EXECUTION**

**3.1 EXISTING BUILDING DOCUMENTATION**

A. Document condition of adjacent structure indicated to remain.

B. Make arrangements with building owners and occupants to survey interior and exterior of existing buildings.

C. Employ land surveyor as specified in Section 01 30 00 - Submittal Procedures to provide following documentation:
   1. Survey building exterior for position and elevation of principal elements before and after completion of demolition.
   2. Monitor buildings for movement during demolition operations. Notify Architect/Engineer of measured movement.

D. Employ commercial photographer to provide following graphic documentation:
   1. Photographically document existing building exterior before beginning demolition and after completing demolition.
   2. Take one overall photograph of each exterior wall. Take detail photographs to show full height of building facade at maximum size on negative.
   3. Photographs: Submit two sets of prints.
      a. Identify photographs with date, time, orientation, and project identification.

**3.2 EXAMINATION**

A. Examine existing buildings indicated to be demolished before demolition.

B. Determine where removals may result in structural deficiency or unplanned building collapse during demolition. Coordinate demolition sequence and procedures to prevent structures from becoming unstable.

C. Determine where demolition may affect structural integrity or weather resistance of adjacent buildings indicated to remain.
   1. Identify measures required to protect buildings from damage.
   2. Identify remedial work including patching, repairing, bracing, and other work required to leave buildings indicated to remain in structurally sound and weathertight and watertight condition.

D. Verify hazardous material abatement is complete before beginning demolition.

**3.3 PREPARATION**

A. Call Local Utility Line Information service not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Notify affected utility companies before starting work and comply with utility's requirements.

C. Do not close or obstruct roadways, sidewalks, hydrants without permits.

D. Erect, and maintain temporary barriers and security devices at locations indicated, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.

E. Protect existing landscaping materials, trees, structures, and park equipment indicated to remain.

F. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.

**3.4 DEMOLITION REQUIREMENTS**

A. Use of explosives is not permitted.

B. Conduct demolition to minimize interference with adjacent structures, and occupancies.

C. Cease operations immediately when adjacent structures appear to be in danger. Notify Architect/Engineer. Do not resume operations until directed.

D. Conduct operations with minimum interference to public or private accesses to occupied adjacent structures. Maintain protected egress and access from adjacent structures at all times.

E. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

F. Sprinkle Work with water to minimize dust. Provide hoses and water connections required for this purpose.

**3.5 DEMOLITION**

A. Disconnect and cap designated utilities to street connection from building line. Identify utilities at termination of demolition. Record termination or capped location on Record Documents.

B. Remove foundation walls and footings to minimum of two feet below finished grade within area of new construction.

C. Remove concrete slabs-on-grade.

D. Remove underground tanks, components, and piping from site.

E. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect in accordance with requirements of Section 01 60 00 - Product Requirements.

F. Backfill areas excavated open pits and holes resulting from demolition in accordance with Structural Drawings.

G. Rough grade and compact areas affected by demolition to to accommodate subsequent construction operations.

H. Continuously clean-up and remove demolished materials from site. Do not allow materials to accumulate in building or on site.

I. Do not burn or bury materials on site. Leave site in clean condition.

**3.6 SCHEDULES**

A. Items to be removed and delivered to Owner;

1. Casework at existing "library".
2. Ball storage appurtenances at existing "equipment storage".

**END OF SECTION**

# DIVISION 3
## CONCRETE

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# SECTION 031000 - CONCRETE FORMWORK

## PART 1 - GENERAL

SECTION INCLUDES:

Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

Openings for other work.

Form accessories.

Form stripping.

RELATED SECTIONS

Section 032000 - Concrete Reinforcement.

Section 033000 - Cast-in-Place Concrete.

REFERENCES

ACI 347- Recommended Practice For Concrete FORMWORK.

PS-1 - Construction and Industrial Plywood.

DESIGN REQUIREMENTS

Design, engineer and construct FORMWORK, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension, as indicated on plans.

QUALITY ASSURANCE

Perform Work in accordance with ACI 347.

Maintain one copy of each document on site.

QUALIFICATIONS

Design FORMWORK under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located in the State of Texas.

REGULATORY REQUIREMENTS

Conform to applicable code for design, fabrication, erection and removal of FORMWORK.

DELIVERY, STORAGE, AND HANDLING

Deliver, store, protect and handle products to site under provisions of the Contract.

Store off ground in ventilated and protected manner to prevent deterioration from moisture.

COORDINATION

Coordinate work under provisions of the Contract.

Coordinate this Section with other Sections of work, which require attachment of components to FORMWORK.

If FORMWORK is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Engineer before proceeding.

## PART 2 - PRODUCTS

WOOD FORM MATERIALS

Form Materials: At the discretion of the Contractor.

PREFABRICATED FORMS

Preformed Steel Forms: Minimum 16-gauge matched, tight fitting stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes required; and as indicated on plans.

FORMWORK ACCESSORIES

Form Ties: Snap-off type, galvanized metal, fixed or adjustable length, with waterproofing washer, free of defects that could leave holes in concrete surface.

Form Release Agent: Colorless mineral oil, which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

Corners: Filleted and chamfered, rigid plastic or wood strip type, size as indicated on plans using maximum possible lengths.

Dovetail Anchor Slot: Galvanized steel, 22-gauge thick, foam filled or non-filled as indicated on plans, release tape sealed slots, anchors for securing to concrete FORMWORK.

Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain FORMWORK in place while placing concrete.

Water stops: Rubber or Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F (46 degrees C) to plus 175 degrees F (79 degrees C) working temperature range, width indicated on plans, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

**PART 3 - EXECUTION**

EXAMINATION

Verify lines, levels and centers before proceeding with FORMWORK. Ensure that dimensions agree with Drawings.

EARTH FORMS

Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

ERECTION FORMWORK

Erect FORMWORK, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

Provide bracing to ensure stability of FORMWORK. Shore or strengthen FORMWORK subject to over stressing by construction loads.

Arrange and assemble FORMWORK to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

Align joints and make watertight. Keep form joints to a minimum.

Provide fillet and chamfer strips on external corners.

APPLICATION FORM RELEASE AGENT

Apply form release agent on FORMWORK in accordance with manufacturer's recommendations.

Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings, which are effected by the agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

INSERTS, EMBEDDED PARTS, AND OPENINGS

Provide formed openings where required for items to be embedded in or passing through concrete work.

Locate and set in place items, which will be cast directly into concrete.

Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

Install water stops continuous without displacing reinforcement. Heat seal joints watertight.
Provide temporary ports or openings in FORMWORK where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

Close temporary openings with watertight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

FORM CLEANING

Clean and remove foreign matter within forms as erection proceeds.

Clean formed cavities of debris prior to placing concrete.

Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

During cold weather, remove ice and debris from within forms. Do not use de-icing salts or water to clean out forms, unless FORMWORK and concrete construction proceed within heat enclosure. Use compressed air or other means to remove foreign matter.

FORMWORK TOLERANCES

Construct FORMWORK to maintain tolerances required by ACI 301.

Camber slabs and beams ¼ inch per 10 feet in accordance with ACI 301 and as indicated on plans.

FIELD QUALITY CONTROL

Inspect erected FORMWORK, shoring, and bracing to ensure that work is in accordance with FORMWORK design, and that supports, fastenings, wedges, ties, and items are secure.

FORM REMOVAL

Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

## SECTION 03 10 10
## UNDER SLAB VAPOR BARRIER

### PART 1 GENERAL

#### 1.1 SUMMARY

A. Section Includes:
   1. Vapor barrier, seam tape and mastic for installation under concrete slabs.

B. Related Requirements:
   1. Section 03 30 00 – Cast-In-Place Concrete.
   2. Section 31 31 16 – Termite Treatment.

#### 1.2 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM E96 - Standard Test Method for Water Vapor Transmission of Materials.
   2. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls or as Ground Cover.
   3. ASTM E1643 – Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
   4. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil and Granular Fill Under Concrete Slabs.

#### 1.3 SYSTEM DESCRIPTION

A. Vapor Barrier (Under Slab): Shall conform to ASTM E1745, Class A and shall have a maximum water vapor permeance of 0.0095 perms when tested in accordance with ASTM E96. Vapor Barrier shall be no less than 15 mils thick.

#### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on vapor barrier, seam tape and mastic.

C. Manufacturer's Instructions: Manufacturer's installation instructions.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS AND MATERIALS

A. Stego Industries LLC., 887-464-7834
   1. Stego Wrap – 15 mil.

B. Raven Industries, 605-336-2750;
   1. VaporBlock -15 mil.

#### 2.2 ACCESSORIES

A. Seam tape: as recommended by manufacturer.

B. Mastic: as recommended by manufacturer.

### PART 3 EXECUTION

#### 3.1 PREPARATION

A. Verify that substrate conditions are acceptable for product installation in accordance with manufacturer's instructions.

#### 3.2 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Lay sheet smoothly, stretch and weight edges, lap joints 12 inches and seal with tape as specified by vapor barrier manufacturer. Turn barrier up 6 inches at walls and at all pipes, abutments, etc. Tape and seal at penetrations and edges.

C. At grade beams, extend vapor barrier down sides of beam trenches and footing excavations to within 4 inches of trench bottom and secure to sides of trench. Do not extend barrier across bottom of beam.

#### 3.3 PATCHING

A. Patch and repair all punctures with a minimum overlap of 6 inches in all directions and tape around entire perimeter of repair.

**END OF SECTION**

# SECTION 032000 – CONCRETE REINFORCEMENT

## PART 1 – GENERAL

SECTION INCLUDES

Furnish all labor, materials, tools, equipment, and related items required to fabricate and place reinforcement for cast-in-place concrete including reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

RELATED SECTIONS

Section 031000 – Concrete Formwork

Section 033000 – Cast-in-Place Concrete

REFERENCES

ACI 301 – Structural Concrete for Buildings

ACI 318 – Building Code Requirements for Reinforced Concrete

ACI SP 66 – American Concrete Institute Detailing Manual

ANSI/ASTM A82 – Cold Drawn Steel Wire for Concrete Reinforcement

ANSI/ASTM A184 – Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

ANSI/ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement

ANSI/ASTM A496 – Deformed Steel Wire Fabric for Concrete Reinforcement

ANSI/ASTM A497 – Welded Deformed Steel Wire Fabric for Concrete Reinforcement

ANSI/AWS D1.4 – Structural Welding Code for Reinforcing Steel

ANSI/AWS D12.1 – Reinforcing Steel Welding Code

ASTM A615 – Deformed and Plain Billet Steel Bars for Concrete Reinforcement

ASTM A616 – Rail Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A617 – Axle Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A704 – Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement

ASTM A706 – Law-Alloy Steel Deformed Bars for Concrete Reinforcement

ASTM A767 – Zinc-Coated (Galvanized) Bars for Concrete Reinforcement

ASTM A775 – Epoxy-Coated Reinforcing Steel Bars

ASTM D3963 – Epoxy-Coated Reinforcing Steel

AWS D12.1 – Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction

CRSI – Concrete Reinforcing Steel Institute Manual of Practice

CRSI 63 – Recommended Practice for Placing Reinforcing Bars

CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature

SUBMITTALS

Submit under provisions of the Contract and as requested by the Engineer

Shop Drawings: Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices. Including splicing and laps of rod and shapes.

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

QUALITY ASSURANCE

Perform work in accordance with CRSI 63, 65 and Manual of Practice; ACI 301; ACI SP 66; ACI 318; ANSI/ASTM A184.

Submit certified copies of mill test report of reinforcement materials analysis.

Provide Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

Allowable tolerances: Fabricating Sheared length – plus or minus one inch Stirrups and ties – plus or minus one-half inch Members more than eight inches but not over two feet deep – plus or minus one-half inch Members more than two feet deep – plus or minus one inch

Crosswise of members – space evenly within two inches of stated separation Lengthwise of members – plus or minus two inches

COORDINATION

Coordinate work under provisions of the Contract.

Coordinate with placement of formwork, formed openings and other Work.

**PART 2 – PRODUCTS**

REINFORCEMENT

Reinforcing Steel: ASTM A615, 40 or 60 ksi yield grade; billet steel bars, domestic manufacturer, plain finish and as indicated on plans.
Reinforcing Steel Mat: ASTM A704, ASTM A615, 40 or 60 ksi yield grade; steel bars or rods, plain finish and as indicated on plans.
Stirrup Steel: ANSI/ASTM A82, plain finish and as indicated on plans.

Welded Steel Wire Fabric: ASTM A185 Plain Type; in flat sheets or coiled rolls; plain finish and as indicated on plans.

ACCESSORY MATERIALS

Tie Wire: Minimum 16-gauge black annealed steel type.

Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel or stainless steel type; size and shape as required.

FABRICATION

Fabricate concrete reinforcing in accordance with CRSI Manual of Practice; ACI SP 66; ACI 318; ANSI/ASTM A184.

Weld reinforcement reinforcing in accordance with ANSI/AWS D1.4; ANSI/AWS D12.1.

Galvanized or Epoxy Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with manufacturer's instructions.

Locate reinforcing splices not indicated on Drawings, at point of minimum stress. Review location of splices with Engineer.

**PART 3 – EXECUTION**

PLACEMENT

Place, support and secure reinforcement against displacement. Do not deviate from required position.

Do not displace or damage vapor barrier.

Accommodate placement of formed openings.

Maintain concrete cover around reinforcing as indicated on plans.

FIELD QUALITY CONTROL

Field inspection may be performed under provisions of the Contract.

## PART 1 – GENERAL

SECTION INCLUDES

Cast-in-place concrete for curb and gutter, and valley gutter as indicated on plans.

RELATED SECTIONS

Section 031000 - Concrete Formwork: Formwork and accessories

Section 032000 – Concrete Reinforcement

REFERENCES

ACI 301 – Structural Concrete for Buildings

ACI 302 – Guide for Concrete Floor and Slab Construction

ACI 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

ACI 305R – Hot Weather Concreting

ACI 306R – Cold Weather Concreting

ACI 308 – Standard Practice for Curing Concrete

ACI 3 – Building Code Requirements for Reinforced Concrete

ANSI/ASTM D1190 – Concrete Joint Sealer, Hot-Poured Elastic Type

ANSI/ASTM D1751 – Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

ANSI/ASTM D1752 – Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM C33 – Concrete Aggregates

ASTM C94 – Ready-Mixed Concrete

ASTM C150 – Portland Cement

ASTM C260 – Air Entraining Admixtures for Concrete

ASTM C330 – Light Weight Aggregates for Structural Concrete

ASTM C494 – Chemicals Admixtures for Concrete

ASTM C618 – Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

SUBMITTALS

Submit under provisions of the Contract and as requested by Engineer.

Product Data: Provide data on joint devices, attachment accessories, admixtures and mix design.

Samples: Submit two 6-inch long samples of expansion/contraction joint and control joint.

Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

PROJECT RECORD DOCUMENTS

Submit under provisions of the Contract.

Accurately record actual locations of embedded utilities and components, which are concealed from view.

QUALITY ASSURANCE

Perform Work in accordance with ACI 301.

Maintain one copy of each document on site.

Acquire cement and aggregate from same source for all work.

Conform to ACI 305R when concreting during hot weather.

Conform to ACI 306R when concreting during cold weather.

COORDINATION

Coordinate work under provisions of the Contract.

Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

## PART 2 – PRODUCTS

CONCRETE MATERIALS

Cement: ASTM C150, Type I – Normal; Type IA – Air Entraining; Type II – Moderate; Type IIA – Air Entraining; Type III – High Early Strength; Type IIIA – Air Entraining; Type IV – Low Heat of Hydration; Type V – Sulphate Resistant; Portland type and as indicated on plans.

Fine Aggregates: ASTM C33; clean, hard, durable, uncoated, natural sand free from silt, loam or clay.

Coarse Aggregates: ASTM C33; hard, durable,

uncoated, crushed, stone gradation sized in accordance with size No. 57 unless otherwise approved in mix design. Maximum aggregate size in accordance with ACI 318.

Water: Clean and free from oil, acid, alkalines, or other impurities not detrimental to concrete.

ADMIXTURES

Air Entrainment: ASTM C260

Chemical: ASTM C494, Type A – Water Reducing; Type B – Retarding; Type C – Accelerating; Type D – Water Reducing and Retarding; Type E – Water Reducing and Accelerating; Type F – Water Reducing, High Range; Type G – Water Reducing, High Range and Retarding admixture.

Fly Ash: ASTM C618; maximum 2% loss on ignition.

JOINT DEVICES AND FILLER MATERIALS

Joint Filler Type A: ASTM D1751; ASTM D994; Asphalt impregnated fiberboard or felt, ¼ inch thick; tongue and groove profile; as indicated on plans.

Joint Filler Type B: ASTM D1752; Closed cell; polyvinyl chloride; molded vinyl; foam, resiliency recovery of 95% if not compressed more than 50 % of original thickness; as indicated on plans.

Joint Filler Type C: ASTM D1752; Pre-molded sponge rubber, fully compressible with recovery rate of minimum 95%; as indicated on plans.

Construction Joint Devices: Integral galvanized steel or extruded plastic; to required thickness, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge; as indicated on plans.

Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient elastomeric; vinyl; neoprene; filler strip with a Shore A hardness of 35 to permit plus or minus 25% joint movement with full recovery; extruded aluminum or vinyl cover plate, or longest manufactured length at each location, flush or recessed mounted; color as selected or indicated on plans.

Sealant: ASTM D1190; Hot applied, rubber; synthetic rubber; asphalt; polymer based asphalt; coal tar and rubber; compound.

CONCRETE MIX

Mix concrete in accordance with ACE 304. Deliver concrete in accordance with ASTM C94.

Provide concrete to the following mix design:

Strength: Concrete is classified and specified by ultimate compressive strength of at age 28 days.

Proportions: Proportions of cement, aggregate, and water to attain required plasticity and compressive strength shall be in accordance with ACI 318. Do not make changes in proportions without Engineer's approval.

Concrete to yield following characteristics:

3,000 psi at 28 days, minimum slump 1.5 inches, and maximum slump 5 inches

As indicated on plans.

Use accelerating admixtures in cold weather only when approved by Engineer.

Use of admixtures will not relax cold weather placement requirements.

Use calcium chloride only when approved by Engineer.

Use set retarding admixtures during hot weather only when approved by Engineer.

Add air-entraining agent to normal weight concrete mix for work exposed to exterior.

**PART 3 – EXECUTION**

EXAMINATION

Verify site conditions under provisions of Contract.

Verify that reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

PREPARATION

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

In locations where new concrete is doweled to existing work, drill holes in existing concrete; insert steel dowels and pack solid with non-shrink grout.

PLACING CONCRETE

Place concrete in accordance with ACI 304; ACI 301; or ACI 318.
Notify Engineer minimum 24 minimum 24 hours prior to commencement of operations.

Ensure reinforcement, inserts, embedded parts, formed

joint fillers, joint devices and related appurtenances are not disturbed during concrete placement.

Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

Install joint devices in accordance with manufacturer's instructions.

Install construction joint device in coordination with concrete placement sequence. Set top to required elevations.

Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

Place concrete continuously between predetermined expansion, control, and construction joints.

Do not interrupt successive placement; do not permit cold joints to occur.

CONCRETE FINISHING

Curb and gutter and concrete valley gutters will be finished to a light broom finish. Sidewalks shall be finished to a light broom finish. All exposed edges shall be rounded with a finishing concrete edger.

CURING AND PROTECTION

Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

FIELD QUALITY CONTROL

Field inspection and testing may be performed in accordance with ACI 301 and under provisions of the Contract or upon request of the Engineer.

Provide free access to Work and cooperate with appointed firm.

Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.

Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

Three concrete test cylinders will be taken for every 100 cubic yards or less of each class of concrete placed.

One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

One slump test will be taken for each set of test cylinders taken.

PATCHING

Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

Patch imperfections as directed and in accordance with ACI 301.

DEFECTIVE CONCRETE

Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

The Engineer will determine repair or replacement of defective concrete.

Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

**END OF SECTION**

# SECTION 03 35 00
# CONCRETE FINISHING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Finishing concrete floors and floor toppings.
   2. Floor surface treatment.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Prepared concrete floors ready to receive finish; control and formed expansion and contraction joints and joint devices.
   2. Section 03 35 23 - Exposed Aggregate Concrete Finishing: Exposed aggregate finish.
   3. Section 03 35 43 – Polished Concrete Finishing
   4. Section 03 39 00 - Concrete Curing.
   5. Section 07 90 00 - Joint Protection.
   6. Section 07 95 00 - Expansion Control.

### 1.2 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.

B. ASTM International:
   1. ASTM E1155 - Standard Test Method for Determining $F_F$ Floor Flatness and $F_L$ Floor Levelness Numbers.

C. California Department of Health Services:
   1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on concrete hardener, sealer, and curing compounds; compatibilities, and limitations.

### 1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit data on maintenance renewal of applied coatings.

### 1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1.

### 1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Applicator/Installer: Company specializing in performing work of this section with minimum three years documented experience.

### 1.7 MOCK-UP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup.

B. Construct mock-up area under conditions similar to those which will exist during actual placing, 10 feet long by 10 feet wide, with specified finishes, and coatings applied.

C. Locate where directed by Architect/Engineer.

D. Incorporate accepted mockup as part of Work.

### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver materials in manufacturer's packaging including application instructions.

### 1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Temporary Lighting: Minimum 200 W light source, placed 8 feet above floor surface, for each 425 sq ft of floor being finished.

C. Temporary Heat: Ambient temperature of 50 degrees F minimum.

D. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

### 1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with concrete floor placement and concrete floor curing.

## PART 2 PRODUCTS

### 2.1 COMPOUNDS - HARDENERS AND SEALERS

A. Clear Sealer: Type SL-UT.
   1. Manufacturers:
      a. Scofield Systems; Cementone Clear Sealer.
      b. Triangle Coatings: W1-01 White Mountain Crystal Seal.
      c. Substitutions: Section 01 60 00 - Product Requirements.
   2. VOC: < 100 g/L.
   3. For application at exposed concrete that is not stained.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify floor surfaces are acceptable to receive the Work of this section.

### 3.2 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.

B. Wood float surfaces receiving quarry tile, ceramic tile, with full bed setting system.

C. Steel trowel surfaces receiving carpeting, resilient flooring, thin set quarry tile, thin set ceramic tile.

D. Steel trowel surfaces which are scheduled to be exposed.

E. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8 inch per foot nominal and as indicated on Drawings.

F. Broom finish at exterior concrete

### 3.3 FLOOR SURFACE TREATMENT

A. Apply dry shake hardener as scheduled on floor and other concrete surfaces.

B. Imprint concrete with stamping patterns as scheduled on floor and other concrete surfaces.

C. Apply chemical stain as scheduled on floor and other concrete surfaces.

D. Apply slip resistant finish as scheduled on floor and other concrete surfaces.

1. Mix slip resistant material into sealer to be applied, or broadcast over first coat of sealer while still wet and top coat with sealer, according to manufacturer's instructions.

E. Apply sealer as scheduled on floor surfaces.

### 3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Measure for $F_F$ and $F_L$ tolerances for floors in accordance with ASTM E1155, within 48 hours after slab installation.

C. Finish concrete to achieve the following tolerances:

1. Under Glazed Tile on Setting Bed: $F_F$ 25 (specified overall) $F_F$ 17(minimum local) and $F_L$ 20 (specified overall) $F_L$ 15 (minimum local).
2. Under Resilient, Thin-set Flooring, Carpet Finishes, and areas not outlined otherwise in this article: $F_F$ 35 (specified overall) $F_F$ 24 (minimum local) and $F_L$ 25 (specified overall) $F_L$ 17 (minimum local).
3. Exposed to View and Foot Traffic: $F_F$ 45 (specified overall) $F_F$ 30 (minimum local) and $F_L$ 35 (specified overall) $F_L$ 24 (minimum local).
4. Areas where polished concrete finishing is scheduled: $F_F$ 50 (specified overall) $F_F$ 45 (minimum local) and $F_L$ 30 (specified overall) and $F_L$ 25 (minimum local).
5. Exposed to view in utility areas (mechanical, electrical, general storage): $F_F$ 25 (specified overall) $F_F$ 17(minimum local) and $F_L$ 20 (specified overall) $F_L$ 15 (minimum local).
6. Correct slab surface when actual $F_F$ or $F_L$ number for floor installation measures less than required.

D. Correct defects in defined traffic floor by grinding, removal and replacement of defective Work, or other methods approved by Architect. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

### 3.5 SCHEDULES

A. Reference finish schedule and floor finish plan for more information.

**END OF SECTION**

**SECTION 03 35 01**

**CONCRETE THIN SHELL CONSTRUCTION**

## PART 1 GENERAL

### 1.1 SUMMARY

A. This specification is written for air formed concrete dome thin shell construction including Air Form, poly urethane insulation, reinforcement, shotcrete materials, mixture design, placement procedures, and finishes.

B. Note the specifications given here within are subject to modification and or alteration by the
Engineer of Record in coordination with the Owner.

### 1.2 RELATED REQUIREMENTS

A. ACI 334.3 R05 "Construction of Concrete Shells Using Inflated Forms"

B. ACI 318 cpt 19 "Shells and Folded Plate Memebers"

C. ACI 506 "Guide to Shotcrete"

D. ACI 506 2-95 "Specification for Shotcrete"

### 1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash; subject to compliance with requirements.

B. "Air Form" is defined as an inflated pre-engineered air supported fabric to which insulation, rebar, and shotcrete is attached or applied, as taken from ACI 334.3R-05.

### 1.4 SUBMITTALS

A. Submittals shall be given to the owner's representative as designated in the contract and the designer for review. Items to be submitted a minimum of 20 days prior to the execution of the work unless noted otherwise. Allow 10 days for review and comment. Rejected submittals shall be corrected and returned w/in 10 working days unless noted otherwise.

B. Product Data: For each type of product indicated.

C. Air Form Shop Drawings, Design Basis and Calculations: Prepared and sealed by or under the supervision of a qualified professional engineer registered in the State of Texas for detailing fabrication and assembly. The shop drawings shall clearly indicate shop notes, pattern drawings, assembly drawings, and connection details.

D. Qualification Data: For Air Form Fabricator, Air Form installer, Polyurethane applicators, Shotcrete nozzle men, and testing agency.

E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
   2. Air Form Fabric. Polyester yarn stress strain curves and breaking strength results. Fabric stress strain cures and breaking strength results.

F. Material Certificates: Manufacture's specifications and batch or product ID numbers or codes. For each of the following:
   1. Cementitious materials.(product ID code not required)
   2. Admixtures. (product ID code not required)
   3. Poly Urethane Foam.
   4. Steel reinforcement and accessories.
   5. Curing compounds. (product ID code not required)
   6. Air Form Fabric.
   7. Repair materials. (product ID code not required)
   8. Air Form Polyurethane Primer Product

G. Field quality-control test and inspection reports.
   1. Air form profile on major axis measured 24 hours after inflation and after interior working pressure has been achieved submitted to designer for approval prior to poly urethane application. The method of measurement shall be capable of +/- 2 inch tolerance. The method used shall be included in the documentation.
      a. Reinforcing Placement Inspection reports.
      b. Shotcrete Placement Inspection reports.

H. Qualifications and data as defined in 1.5 Quality Assurance, to be submitted to the Prime Contractor for review by the Design Professional of Record and Owner in conjunction with the Subcontractor Listing Form. Prime Contractor shall acknowledge compliance with these requirements at the time of bidding. Qualification Statement to be submitted with the bid.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: For the construction of an air formed concrete thin shell dome; the contractor shall be qualified and employ project personnel experienced and qualified

as ACI- certified shotcrete nozzle men, polyurethane applicators, Air Form installers, Iron workers, post tension tendon installers, and thin shell contractors in accordance with ACI 334.3R-05 and has experience with a project of similar size and shape with regard to the geometry as specified in the bid documents. As a basis of qualification for the contractor the contractor shall submit prior successful project information regarding installation (including erection plan, safety plan, as built photos, drawings, etc., on at least one project for review.

B. Installer Qualifications: Concrete Thin Shell Construction Plan; As part of the bid submittal to be used as a basis of contractor qualification with regard to the air formed concrete dome, the contractor shall present a construction plan regarding the means and methods of this work. The plan shall be reviewed for acceptance with the owner's representative and the Structural Engineer. The plan shall include but not be limited to erection, shoring, insulation, reinforcing, shotcreting, and finishing procedures. As a basis for qualification of a bid the designer and the owner's representative will evaluate the completeness and thoroughness of the plan with respect to general industry standards of care for means and methods of construction.

C. Air Form Fabricator Qualifications: As a basis for qualification of fabrication the fabricator shall submit prior successful project information (including; pattering drawings, calculations, material info, design basis, fabrication drawings, air form profile, photos, etc.) on at least one project of a similar size and shape for review. Regarding the design of the Air Form the Thin Shell Contractor shall be responsible for the design and fabrication. The design shall be Prepared and sealed by or under the supervision of a qualified professional engineer registered in the State of Texas. A design basis shall be prepared and clearly indicated in the design calculations. All loading variables considered in the design shall be listed in the design basis. Loading conditions shall in include but not be limited to the following: Maximum design wind speed, maximum internal pressure, recommended working internal pressure, minimum safe working pressure. The patterning of the air form shall set weft axis in the hoop direction and the warp axis in the meridional direction. Gores shall run in the principal meridional direction. The patterning plan shall be verified with M-panel software version 14 or later by Meliar Design prior to fabrication and the results coordinated for approval with the Design Professional 10 days prior to beginning of fabrication. A design report from M-panel listing all design variables shall be included. Patterning of the air form may be completed using other software packages in lieu of the software specified. The software used for patterning of the air form must be able to export the patterning plan to 3D dwg format for verification and approval by the Design Team. Available software packages include but are not limited to the following: ForTen, www.forten32.com , inTens,www.tensys.com . Air Form Gores shall be cut Using Fully Automated CNC Equipment as described in 3.1 D. herein.

D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

E. Testing Agency Qualifications: An independent agency, acceptable to the Designer, qualified according to ACI 506.4R-94 and ACI 506.2-95.
   1. Personnel performing shotcrete inspection shall be certified or experienced with ACI 506.4R-94 and have a minimum prior experience of evaluation shotcrete on at least 3 prior projects of a similar type or be pre-approved by the structural engineer.

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
   3. ACI 506, "Guide to shotcrete" and ACI 506 .2-95 Specification for Shotcrete.
   4. ACI 334.3R-05 "Construction of Concrete Shells Using Inflated Forms"

H. Concrete Testing Service: Engage a qualified independent testing agency to perform concrete tests in accordance with ACI 318 chapter 5.

I. The Air Form Fabricator shall supply patch, repair, maintenance, warranty, and penetration means and methods procedure manual prior to inflation.

**1.6 PRE-INSTALLATION CONFERENCE:**

A. Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings.
   1. Ten days prior to Air Form inflation or tasks as outlined here within review construction plan submitted by the thin shell contractor specifically regarding the following: Air form installation, poly urethane preparation and application, shotcrete and reinforcing installation, thin shell concrete thickness control and finish requirements. Opening block out procedure and plan, opening shoring and stabilization procedure and plan. Prior to shotcrete placement review design mixture and examine procedures for ensuring quality of concrete materials. Review mock up sample to determine if any modifications are required. Require representatives of each entity directly concerned with the tasks outlined above and the concrete thin shell to attend, including the following:
      a. Owners Representative and or Construction Manager.
      b. Independent testing agency responsible for concrete testing and shotcrete inspection as needed.
      c. Ready-mix concrete manufacture as needed.
      d. Thin shell contractor superintendent and or project manager.
      e. Designer as needed.

**1.7 DELIVERY, STORAGE, AND HANDLING**

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Air Form: Deliver, store, and handle Air Form to prevent tearing or scuffing.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Form-Facing Materials
   1. Forms for block outs wood, metal, PVC, shall be approved by the designer prior to installation. Contractor shall create a shop drawing depicting the block out and submit to the designer for approval.
   2. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
   3. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

C. Steel Reinforcement
   1. Reinforcing Bars: ASTM A 615, ASTM A706 (weldable) Grade 60, deformed.

D. Reinforcement Accessories
   1. Joint Dowel Bars: Product: "Speed Dowel" or equal ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
   2. 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
   3. Standard Practice," of greater compressive strength than concrete and as follows:
      a. 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.

E. Concrete Materials
   1. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
      a. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
      b. Fly Ash: ASTM C 618, Class F.
   2. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded.
      a. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
      b. Maximum Coarse-Aggregate Size: 1/4 inch nominal.

c. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Water: ASTM C 94 and potable. F.

F. Admixtures
1. Air-Entraining Admixture: ASTM C 260.
2. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
a. Water-Reducing Admixture: ASTM C 494, Type A.
b. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
c. Super Plasticizing Admixture: ASTM C 1017, Type II.

G. Curing Materials
1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
3. Water: Potable.

H. Related Materials
1. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
2. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a
a. Type A shore durometer hardness of 80 per ASTM D 2240.
3. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
4. 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:

I. Repair Materials
1. Cement Binder: ASTM C 150, 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 4000 psi at 28 days when tested according to ASTM C 109.

J. Concrete Mixtures, General
1. 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.
a. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
b. Cementitious Materials: Use fly ash at the contractor's option to reduce the total amount of Portland cement, which would otherwise be used, by not less than 25 to 35 percent.
2. Admixtures: Use admixtures according to manufacturer's written instructions.
a. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
c. 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 water-cementitious materials ratio below 0.50.

K. Concrete Mixtures for Building Elements
1. Concrete thin shell: Proportion normal-weight concrete mixture as follows:
a. Minimum Compressive Strength: 4000 psi at 28 days.
b. Maximum Water-Cementitious Materials Ratio: 0.45.
c. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
d. Air Content: 4-5%

L. Fabricating Reinforcement
1. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

M. Concrete Mixing
1. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.
2. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F,

reduce mixing and delivery time to 60 minutes.

N. Polyurethane Primer Product: "Bay Block FR" as manufactured by Baer Co. Install at 300 sq ft/gallon.

O. Polyurethane Product: See section 07210

P. Air Form
   1. The Air Form shall be fabricated with Basis-of-Design Product: Mehler Texnologies Valmex FR 1000 Mehatop F Type III PVDF Lacquer Coated Top and Bottom Color Sand Stone, 85.
   2. Equivalent products by the following manufacturers may be used as approved by the designer prior to the fabrication of the air form:
      a. Ferrari
      b. Hiraoka
      c. Seaman Corporation
      d. Verseidag

## PART 3 EXECUTION

### 3.1 MANUFACTURER

A. Air form size and shape shall be shall be manufactured from shop drawings prepared, reviewed and approved for construction.

B. Air Form Shop Drawings shall clearly indicate shop notes, pattern drawings, assembly drawings, and connection details. Fabrication shall not begin until shop drawings have been approved by the designer.

C. The Air form fabricator shall comply with the following: Cutting of the patterned Air Form fabric pieces shall be done using a fully automated CNC cutting machine. The verified patterning plan shall be in electronic format compatible with a CNC cutting machine. In addition to the patterned shape to be cut out, the electronic file shall also provide information for weld match lines indicating the required seam width and vertical alignment.

D. In the event the fabricator chooses to use another method for cutting the fabric a detailed means and methods procedure shall be submitted for review and approval by the Design Professional prior to fabrication. Fabrication tolerance data shall be included with this material.

E. The CNC cutting machine shall be capable of outputting the information contained in the electronic cut file as mentioned in the previous section as either knifed line for the piece edge or a penned line indicating a weld match line. Match lines shall indicate the weld width and vertical alignment with tick marks along the length of the seam. Measurements across the cut pattern width shall be within a 4 mm tolerance of the shop drawings. The overall cut length of the pattern shall be within a 25 mm tolerance of the shop drawings.

F. Welding of the cut fabric pieces shall be performed using high frequency welding technology. The welding equipment shall be in good working order and have had maintenance check performed by the manufacturer or certified technician within a year's time. The welder shall utilize an energy management program to insure a proper full penetration weld. The sealing bar shall be the full width of the required weld. The actual weld width alignment shall be within 2 mm of the design width indicated by the match line and shop drawings.

G. Seam strength testing shall be performed as part of the fabricator's QC program. Weld tests. A weld test includes a pull test and a peel test. Tests shall be performed before starting each gore seam of the Air Form, any time settings on the machine are changed, and anytime deemed necessary by the QC personnel. Tests shall be performed on welded fabric samples from the same fabric rolls as the Air Form fabrication. The pull test specimens shall be two inches in width with the seam horizontally across the center, perpendicular to the long direction. A minimum of three individual specimens shall be tested and the average of the three test results shall be used to indicate the seam strength. This shall be completed each time pull test is completed. In addition to the ultimate break strength, the QC report shall indicate whether the failure occurred in the seam or in the fabric. The peel test specimens shall be 2 inches wider than the weld seam and long enough to comply with the testing equipment requirement. One peel test is required for each Weld test noted above. The maximum and minimum values recorded during the peel test shall be reported. The equipment used to perform the tests shall be maintained and calibrated prior to the start of the fabrication for this specific project. A calibration report shall be included in the test results.

### 3.2 CONSTRUCTION

A. Air Form Installation and Inflation
   1. The Air From shall be installed by qualified installers with experience and in accordance with ACI 334.3R-05. Installer shall protect Air Form during installation from rips, tears, and or dirt, grime, deleterious material accumulation, by preparing the footprint of the thin shell site with plastic or suitable covering over open earth areas and equipment or

material there within. Sharp or pointed edges shall be covered.

B. Polyurethane Primer
   1. Prior to application the Air Form shall be clean and free from dirt or debris.
   2. Install at a rate of 300 sf/gallon per manufacture recommendations.

C. Polyurethane Installation
   1. Install poly urethane in accordance with ACI 334.3R-05 and the Polyurethane specification in section 072100.
   2. Applicator shall have a minimum experience of 500 hours in similar circumstances using similar equipment.
   3. Polyurethane thickness shall be placed or trimmed to a +/- 1/2 inch tolerance.

D. Reinforcing Installation
   1. Install reinforcing in accordance with ACI 334.3R-05.
   2. Pre-mat reinforcing shall be used in accordance with ACI 334.3R-05.
   3. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   4. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
   5. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Wire ties with ends directed into concrete, not toward exposed concrete surfaces.
   6. Place and embeds and other items required for adjoining work that is attached to or supported by the thin shell concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

E. Shotcrete Placement
   1. Before placing Shotcrete, verify that installation of the Air Form, polyurethane, reinforcement, and embedded items is complete and that required inspections have been performed.
   2. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Structural Engineer.
   3. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
   4. Deposit shotcrete in accordance with ACI 334.3R-05 and ACI 506.

F. Finishing Concrete Thin Shell Surfaces
   1. Interior Shotcrete Finish: Thickness control measures shall be taken to insure a tolerance of – 10% and + 20% of the specified design thickness in accordance with the design documents. Thin shell interior finish texture shall be consistent throughout. Care shall be taken with the final shotcrete layers sprayed with regard to consistency in aggregate, cement type, moisture content, etc, to insure a consistent curing pattern. The final finish will consist of one to two ¼ inch layers of a final shotcrete coat using a mix design similar to the approved mix design with the exception of the use of mortar sand (per ASTM C 270) without any course aggregate. The final finish shall be submitted on the mock up panel for acceptance by the Designer and the Owner. Acceptance of the final interior finish shall be by the Design Professional in writing and shall use the mock up panel as a basis of evaluation.

G. Concrete Protecting and Curing
   1. 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 301 for hot-weather protection during curing.

H. Concrete Surface Repairs
   1. Defective Concrete: Repair and patch defective areas when approved by Designer.
   2. Every effort shall be made in repaired areas to match and blend repaired area finish to the finish level depicted throughout the remainder of the shell.
   3. Perform structural repairs of concrete, subject to Structural Engineers approval, using methods outlined by the Structural Engineer.

**3.3 FIELD QUALITY CONTROL**

A. Testing and Inspecting: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections shall be done in accordance with the notes specified in the design documents located in the General Structural Notes.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. 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 will provide 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.

2. Slump: ASTM C 143; 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.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for 150 cubic yards placed.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each 150 cubic yards placed.
6. Compression Test Specimens: ASTM C 31.
   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; 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 Structural Engineer and Owner's representative, concrete manufacturer, and Contractor within 72 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 Structural Engineer 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 Structural Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Structural Engineer.
13. Additional testing and inspection may be required at the request of the Design Professional. This action may be necessary if there is evidence of defective workmanship or material. If it is independently determined that this testing was required due to a defective workmanship or material issue the contractor shall reimburse the owner for such testing and inspection costs.
14. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION

# DIVISION 4
## MASONRY

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

**SECTION 04 05 03**

**MASONRY MORTARING AND GROUTING**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes mortar and grout for masonry.

B. Related Sections:
1. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.
2. Section 08 12 14 - Standard Steel Frames: Grouting steel door frames.

### 1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
1. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
2. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
3. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
4. ASTM C150 - Standard Specification for Portland Cement.
5. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
6. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
7. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
8. ASTM C476 - Standard Specification for Grout for Masonry.
9. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
10. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
11. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
12. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
13. ASTM C1329 - Standard Specification for Mortar Cement.
14. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Color Selectors: Submit a color selector of all colors in manufacturer's series. Selectors shall be comprised of mortar.

C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

D. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

E. Test Reports:
1. Submit reports on mortar indicating conformance of component mortar materials to requirements of ASTM C270 and test and evaluation reports to ASTM C780 for aggregate ratio and water content, air content, consistency and compressive strength.
2. Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to ASTM C1019.

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

### 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

### 1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

## PART 2 PRODUCTS

### 2.1 MORTAR AND MASONRY GROUT

A. Manufacturers:
1. Alamo Cement Company.
2. CTS Cement Manufacturing Co.
3. Essroc.
4. Glen-Gery.
5. Holcim Ltd.
6. LaFarge Corp.
7. Lehigh Portland Cement.
8. The Quikrete Companies.
9. Solomon Colors Model: Mortar Color Series X.
10. TXI.
11. Substitutions: Section 01 60 00 - Product Requirements.

### 2.2 COMPONENTS

A. Portland Cement: ASTM C150, Type I, gray color.

B. Mortar Aggregate: ASTM C144, standard masonry type. Clean, dry, protected against dampness, freezing, and foreign matter.

C. Hydrated Lime: ASTM C206, Type S.

D. Grout Aggregate: ASTM C404, fine and coarse.
E. Water: Clean and potable.
F. Mortar Color: Mineral oxide pigment color as selected manufactured by Solomon Colors, Inc.
G. Water Repellant Admixture: Liquid, integral, water repellant, bond enhancing admixture, WR Grace Dry Block II Mortar Admixture.

**2.3 MIXES**

A. Mortar Mixes
   1. Mortar For Structural Masonry: ASTM C270, Type S using Proportion specification.
   2. Mortar For Non-Structural Masonry: ASTM C270, Type S using Proportion specification.
   3. Pointing Mortar: ASTM C270, Type N using Proportion specification.
   4. Masonry Cement is not permitted.
B. Mortar Mixing:
   1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
   2. Achieve uniformly damp sand immediately before mixing process.
   3. Add [mortar color to achieve uniformity of mix and coloration.
   4. Add water repellent admixture for all exterior masonry assemblies and all interior masonry assemblies comprised of ground faced (burnished) CMU.
   5. Re-temper only within two hours of mixing.
C. Grout Mixes:
   1. Grout for Non-Structural Masonry: 3,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 Coarse grout.
   2. Grout for Structural Masonry: 3000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 Coarse grout.
   3. Application:
      a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
      b. Fine Grout: For grouting other spaces.
D. Grout Mixing:
   1. Mix grout in accordance with ASTM C94/C94M, modified to use ingredients complying with ASTM C476.
   2. Add admixtures; mix uniformly.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
B. Request inspection of spaces to be grouted.

**3.2 INSTALLATION**

A. Install mortar and grout in accordance with ACI 530.1 Specifications for Masonry Structures.

**3.3 FIELD QUALITY CONTROL**

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
B. Testing Frequency: One set of specified tests for every 5,000 sf of completed wall area.
C. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength.
D. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump.
E. Test flexural bond strength of mortar and masonry units to ASTM C1357; test in conjunction with masonry unit sections specified.
F. Test compressive strength of mortar and masonry to ASTM C1314; test in accordance with masonry unit sections specified.

**3.4 SCHEDULES**

A. Exterior Perimeter Wall: Brick masonry with Type S mortar with Type N pointing mortar.
B. Interior Structural Walls: Concrete Unit masonry with Type S mortar with Type N pointing mortar.
C. Interior Nonstructural Walls: Concrete Unit masonry with Type S mortar with Type N pointing mortar.

**END OF SECTION**

**SECTION 04 20 00**

**UNIT MASONRY**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes brick, concrete masonry units; decorative concrete masonry; anchorage, and accessories; Includes interior and exterior, load bearing and non-load bearing.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Concrete Foundation.
2. Section 04 05 03 - Masonry Mortaring and Grouting: Mortar and grout.
3. Section 05 50 00 - Metal Fabrications: Product requirements for loose steel lintels, and fabricated steel items, for placement by this section.
4. Section 07 62 00 - Sheet Metal Flashing and Trim: Product requirements for reglets for flashings for placement by this section.
5. Section 07 71 23 – Gutters and Downspouts.
6. Section 07 90 00 - Joint Protection: Rod and sealant at control and expansion joints.
7. Section 08 12 14 – Standard Steel Frames: Product requirements for door frame/window anchors for placement by this section.
8. Section 08 43 13 – Aluminum-framed Storefronts.
9. Section 10 28 00 – Toilet, Bath, and Laundry Accessories.
10. Section 10 44 00 – Fire Protection Specialties.

### 1.2 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

### 1.3 REFERENCES

A. American Concrete Institute:
1. ACI 315 – Details and Detailing of Concrete Reinforcement.
2. ACI 530 - Building Code Requirements for Masonry Structures.
3. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
1. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
5. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
7. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.
8. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
9. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
10. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
11. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
12. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units.
13. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
14. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
15. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

### 1.4 PERFORMANCE REQUIREMENTS

A. Clay Masonry Compressive Strength (f'm): 3,000 psi; determined by unit strength method.
1. Clay Masonry Units: 3000 psi minimum net area compressive strength.

B. Concrete Masonry Compressive Strength (f'm): 1,500 psi; determined by unit strength method.
1. Concrete Masonry Units: 1,500 psi minimum net area compressive strength.

C. Consult structural drawings for additional information regarding performance requirements.

### 1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Product Data:
1. Submit data for masonry units and fabricated wire reinforcement, wall ties, anchors and other accessories.

2. Indicate initial rate of absorption for clay and shale brick.

C. Shop Drawings:
1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Include wall elevations indicating size and location of reinforcing, and length and location of reinforcing bar laps.
3. Fabricating Flashing: Detail corner units, end dam units, and other special conditions for fabricated flashings.

D. Samples: Submit four samples of decorative block and brick units to illustrate color, texture and extremes of color range.

E. Submit detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

F. Manufacturer's Certificate: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry Units:
a. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Reinforcing bars.
4. Joint reinforcement.

G. Mix Designs: For each type of mortar and grout. Include description of type and portions of ingredients.
1. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

H. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.

**1.6 QUALITY ASSURANCE**

A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

**1.7 QUALIFICATIONS**

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

**1.8 MOCKUP**

A. Section 01 40 00 - Quality Requirements: Mockup requirements.

B. Construct masonry wall mockup, minimum 8 feet long by 6 feet high, including masonry, mortar and accessories, wall openings, and flashings.
1. A mockup is required for each type of exterior wall, and interior walls not scheduled to be painted.
2. Mock-up shall include all typical joints and transitions, including sill, head or top of wall, and where adjoining dissimilar materials. If the mock-up is to be erected within the project's wall construction, the Contractor shall erect the mock-up to whatever size is required to illustrate all typical joints and transitions, but shall be at minimum the size indicated above.

C. Locate where directed by Architect/Engineer.

D. Accepted mockup in the building construction may be incorporated as completed Work.

**1.9 PRE-INSTALLATION MEETINGS**

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

C. Required attendees: Owner, Architect, Structural Engineer, General Contractor, and Masonry sub-contractor.

**1.10 DELIVERY, STORAGE, AND HANDLING**

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept glazed units on site. Inspect for damage.

C. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

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

E. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

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

**1.11 ENVIRONMENTAL REQUIREMENTS**

A. Section 01 60 00 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

**1.12 COORDINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate masonry work with installation of window and door anchors.

**1.13 MASONRY UNITS – GENERAL**

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

**PART 2 PRODUCTS**

**2.1 CLAY MASONRY ASSEMBLIES**

A. Manufacturers:
   1. Elgin Butler.
   2. Endicott Clay Products.
   3. Interstate Brick.
   4. I-XL.
   5. Mutual Materials.
   6. Summit Brick Company.
   7. Substitutions: Section 01 60 00 - Product Requirements.

**2.2 CONCRETE MASONRY ASSEMBLIES**

A. Manufacturers:
   1. Featherlite Building Products Corporation.
   2. Headwaters Construction Materials.
   3. Innovative Block of South Texas, LTD.
   4. Jewell Concrete.
   5. Southwest Concrete Products.
   6. Texas Building Products.
   7. Substitutions: Section 01 60 00 - Product Requirements.
   8.

**2.3 MASONRY COMPONENTS**

A. Hollow Brick: ASTM C652, Grade SW, Type HBX;
   1. Colors: Interstate Brick as design basis, pattern as indicated on drawings.
      a. Ochre Buff
      b. Copperstone
      c. Monterrey
      d. Bronzestone
      e. Ironstone
   2. Brick Size and Shape: Nominal size of 10x4x16 inches and 8x4x16 inches, as indicated in the drawings. Furnish special units for lintels and chamfered corners for units at wall corners and end of walls.

B. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90; medium weight,
   1. Concrete Masonry Unit Size and Shape: Nominal modular size of 8x8x16 inches. Furnish special units for 90 degree corners, bond beams, lintels, and chamfered corners for units at wall corners and end of walls.

C. Hollow Non-Load Bearing Concrete Masonry Units (CMU): ASTM C129; medium weight.
   1. Concrete Masonry Unit Size and Shape: Nominal modular size of 8x8x16 inches. Furnish special units for 90 degree corners, bond beams, lintels, and chamfered corners for units at wall corners and end of walls.

D. Decorative Concrete Masonry Units: ASTM C90; medium weight with Dry Block Block Admixture, manufactured by WR Grace; to the following design:
   1. Ground face (Burnished).
   2. Color: Texas Building Products Navajo Tan as design basis.
   3. Concrete Masonry Unit Size and Shape: Nominal modular size of 8x8x16 inches. Furnish special units for 90 degree corners, bond beams, lintels, and chamfered corners for units at wall corners and end of walls.

**2.4 ACCESSORIES**

A. Single Wythe Joint Reinforcement: ASTM A951/A951M; truss type; steel; 0.148 inch diameter side rods with 0.148 inch diameter cross ties; hot dip galvanized.

B. Reinforcing Steel:
   1. #3 Bar: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars, uncoated finish.
   2. #4 Bar or larger: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars, uncoated finish.

C. Mortar and Grout: As specified in Section 04 05 03.

D. Draining Flashing System: Stainless steel flashing system with polyester non-woven mesh drainage medium bonded to stainless steel

with polyester non-woven mesh drainage inserts.
1. Mortar Net - BlockNet.
2. Substitutions: Section 01 60 00 - Product Requirements.

E. Lap Sealant: Silyl terminated polyether type as specified in Section 07 90 00.

F. Preformed Control Joints: Rubber, Neoprene, or Polyvinyl chloride material. Furnish with corner and tee accessories, heat or cement fused joints as appropriate for material used. For use in CMU construction.

G. Joint Filler for expansion joints: Closed cell polyvinyl chloride, polyethylene, polyurethane, or rubber oversized 50 percent to joint width; self expanding; 3 inch wide x by maximum lengths. For use in Brick construction and as isolation joints at interior locations. Reference section 07 90 00 for compressible sealants required in exterior and fire-rated construction.

H. Nailing Strips: Specified in Section 06 10 00.

I. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

**2.5 MIXES**

A. Mix mortar and grout ingredients in accordance with Section 04 05 03.

**2.6 SOURCE QUALITY CONTROL**

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Test brick efflorescence in accordance with ASTM C67. Brick rated greater than "slightly effloresced" is not acceptable.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.

C. Verify items provided by other sections of work are properly sized and located.
1. Verify that foundations are within tolerances specified.
2. Verify that reinforcing dowels are properly placed.
3. Verify built-in items are in proper location, and ready for roughing into masonry work. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

**3.2 PREPARATION**

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

C. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

**3.3 INSTALLATION-GENERAL**

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

B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

C. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

D. Build chases and recesses to accommodate items specified in this and other Sections.

E. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

F. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

G. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
1. Mix units from several pallets or cubes as they are placed.

H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more

than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

**3.4 LAYING MASONRY WALLS**

A. Coursing of Concrete Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

B. Coursing of Brick Units:
1. Bond: Running.
2. Coursing: Two units and mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

C. Coursing of Prefinished Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

D. Placing And Bonding:
1. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
2. Lay solid masonry units in full bed of mortar, with full head joints.
3. Lay hollow masonry units with face shell bedding on head and bed joints.
4. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
5. Remove excess mortar as work progresses.
6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
8. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled and only at the area where base will be applied, cavity insulation vapor retarder adhesive is applied, or bitumen dampproofing is applied.
9. Isolate masonry from vertical structural framing members with movement joint.
10. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.
11. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
12. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
13. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
14. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

E. Joint Reinforcement And Anchorage - Single Wythe Masonry:
1. Install horizontal joint reinforcement in first joint from foundation, then16 inches oc thereafter. For structural walls, reference structural drawings for additional information.
2. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place masonry joint reinforcement in horizontal joints on either side of openings at 8" oc vertically. Extend minimum 16 inches each side of opening.
4. Place joint reinforcement continuous in first [and second] joint below top of walls.
5. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere.
6. Lap joint reinforcement ends minimum 6 inches.
7. Provide for continuity of horizontal joint reinforcement at corners with prefabricated L-shaped units, and at T

perpendicular intersections with prefabricated T-shaped units.
8. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.
9. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

F. Masonry Flashings: Single-Wythe Masonry Walls
1. BlockNet: Install per manufacturer's instructions. At base of wall, install at block lug or foundation.
2. Field cut standard length flashings in half to splay flashing around the circular perimeter. Join pieces per manufacturer's instructions.

G. Grouted Components:
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
2. Reference structural drawings for grout requirements.
3. Reference structural plans for reinforcing steel requirements.

H. Reinforced Masonry: All exterior walls, load bearing walls, and walls otherwise indicated on the architectural and/or structural drawings as structural walls.
1. Lay masonry units with cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
2. Place reinforcement bars as indicated on Drawings.
3. Splice reinforcement in accordance with Section 03 20 00 and the structural drawings. Lap splices bar diameters required by code and as indicated on the drawings, the greater requirement prevailing. Lap splices must be securely tied with wire top at top and bottom of splice. Do not grout untied splices.
4. Support and secure reinforcement from displacement with rebar positioners.
5. Place and consolidate grout fill without displacing reinforcing.
6. Place grout in accordance with ACI 530.1 Specification for Masonry Structures.
7. Install in accordance with requirements outlined in the structural drawings.

I. Control Joints:
1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
   a. Exterior Walls except at circular drum walls: 24 feet on center and within 24 inches on one side of each interior and exterior corner.
   b. Interior Walls: 24 feet on center.
   c. At changes in wall height.
2. Do not continue horizontal joint reinforcement through control and expansion joints.
3. Install preformed control joint device in continuous lengths. Seal butt and corner joints.
4. Size control joint in accordance with Section 07 90 00 for sealant performance.
5. Form expansion joint by installing expansion joint material.

J. Built-In Work:
1. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Do not build in materials subject to deterioration.

K. Cutting And Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain Architect/Engineer's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

**3.5 ERECTION TOLERANCES**

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

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

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

G. Maximum Variation for Steel Reinforcement:
1. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.
2. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
3. Plus or minus 1 inch when distance is between 8 and 24 inches.
4. Plus or minus 1-1/4 inch when distance is greater than 24 inches.

5. Plus or minus 2 inches from location along face of wall.

**3.6 FIELD QUALITY CONTROL**

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Testing of Mortar and Grout: In accordance with Section 04 05 03.

**3.7 CLEANING**

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

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

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

**3.8 PROTECTION OF FINISHED WORK**

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect exposed external corners subject to damage.

C. Protect base of walls from mud and mortar splatter.

D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

**3.9 SCHEDULES**

A. Exterior Wall: Single wythe 10" structural brick units. Reference structural drawings.

B. Equipment enclosrues: Single wythe 10" structural brick units with 8" structural brick units turned on their sides to act as ventilation units. Reference structural drawings.

C. Screen wall at electrical transformer: Single wythe 8" structural brick units.

D. Interior Partitions: Single wythe 8" concrete masonry units.

E. Interior Partitions: Single wythe 8" burnished concrete masonry units. Reference drawings for locations where single side burnished and double side burnished.

F. Reference Drawings for more information.

**END OF SECTION**

# DIVISION 5
## METALS

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

**SECTION 05 50 00**

**METAL FABRICATIONS**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes shop fabricated metal items.
   1. Lintels.
   2. Ledge and shelf angles.
   3. Structural supports for miscellaneous attachments.
   4. Wall protection plates and corner guards.
   5. Anchor bolts for sill plates.
   6. Gates

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
   2. Section 04 20 00 - Unit Masonry: Execution requirements for lintels and embedded anchors and attachments for metal fabrications specified by this section in masonry.
   3. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts.
   4. Section 05 21 00 - Steel Joist Framing: Structural joist bearing plates, including anchorage.
   5. Section 05 31 13 - Steel Floor Decking: Bearing plates and angles for metal deck bearing, including anchorage.
   6. Section 09 90 00 - Painting and Coating: Field applied paint finish.

### 1.2 REFERENCES

A. American Architectural Manufacturers Association:
   1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
   2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
   4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   6. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
   7. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   8. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
   9. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
   10. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   11. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   12. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   13. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
   14. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   15. ASTM F436 - Standard Specification for Hardened Steel Washers.
   16. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

C. American Welding Society:
   1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
   2. AWS D1.1 - Structural Welding Code - Steel.
   3. AWS D1.6 - Structural Welding Code - Stainless Steel.

D. National Ornamental & Miscellaneous Metals Association:
   1. NOMMA Guideline 1 - Joint Finishes.

E. SSPC: The Society for Protective Coatings:
   1. SSPC - Steel Structures Painting Manual.
   2. SSPC SP 1 - Solvent Cleaning.
   3. SSPC SP 10 - Near-White Blast Cleaning.
   4. SSPC Paint 15 - Steel Joist Shop Paint.

5. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

**1.3 SUBMITTALS**

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

**1.4 QUALITY ASSURANCE**

A. Finish joints in accordance with NOMMA Guideline 1.

**1.5 QUALIFICATIONS**

A. Design and prepare shop drawings under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.

B. Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

**1.6 DELIVERY, STORAGE, AND HANDLING**

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather.

**1.7 FIELD MEASUREMENTS**

A. Verify field measurements.

**PART 2 PRODUCTS**

**2.1 MATERIALS - STEEL**

A. Structural W-Shapes: ASTM A992/A992M.

B. Structural Shapes: ASTM A36/A36M.

C. Channels and Angles: ASTM A36/A36M.

D. Steel Plate: ASTM A36/A36M; Grade 50.

E. Hollow Structural Sections: ASTM A500/A500M, Grade B.

F. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40.

G. Sheet Steel: ASTM A653/A653M, Grade 33 Structural Quality, galvanized with G90 coating class.

H. Bolts: ASTM A307; Grade A or B, or ASTM A325; Type 1 when indicated.
   1. Finish: Unfinished for interior applications, Hot dipped galvanized for exterior applications.

I. Nuts: ASTM A563 heavy hex type.
   1. Finish: Unfinished for interior applications, Hot dipped galvanized for exterior applications.Washers: ASTM F436; Type 1.
   2. Finish: Unfinished for interior applications, Hot dipped galvanized for exterior applications.

J. Welding Materials: AWS D1.1; type required for materials being welded.

K. Shop Primer: SSPC Paint 15, Type 1, red oxide.

L. Touch-Up Primer: Match shop primer.

M. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic.

**2.2 LINTELS**

A. Lintels: Steel sections, size and configuration as indicated on Drawings, length to allow 8 inches minimum bearing on both sides of opening.
   1. Exterior Locations: Galvanized. Interior Locations: Prime paint, one coat.

**2.3 LEDGE AND SHELF ANGLES**

A. Ledge and Shelf Angles, Channels and Plates Not Attached to Structural Framing: For support of metal decking, joists and masonry; galvanized where exposed to the exterior.

**2.4 ANCHOR BOLTS**

A. Anchor Rods: ASTM F1554; Grade 55, weldable.

B. Shape: Straight.

C. Furnish with nut and washer; unfinished.

**2.5 FABRICATION**

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Exposed Welded Joints: NOMMA Guideline 1 Joint Finish [ 2 ].

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

F. Reference Structural Drawings for more information.

**2.6 FACTORY APPLIED FINISHES - STEEL**

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime paint items with one coat except where galvanizing is specified.

D. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication.

E. Galvanizing for Fasteners, Connectors, and Anchors:
   1. Hot-Dipped Galvanizing: ASTM A153/A153M.
   2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

**2.7 FABRICATION TOLERANCES**

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive Work.

**3.2 PREPARATION**

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

**3.3 INSTALLATION**

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

C. Field weld components indicated on Drawings and shop drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval of Architect/Engineer prior to site cutting or making adjustments not scheduled.

F. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

**3.4 ERECTION TOLERANCES**

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story or for every 12 ft in height whichever is greater, non-cumulative.

C. Maximum Offset From Alignment: 1/4 inch.

D. Maximum Out-of-Position: 1/4 inch.

**3.5 FIELD QUALITY CONTROL**

A. Welding: Inspect welds in accordance with AWS D1.1.

**3.6 SCHEDULE**

A. Refer to Structural and Architectural Drawings for specific applications.

**END OF SECTION**

# DIVISION 6
## WOOD AND PLASTICS AND COMPOSITES

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

**SECTION 06 41 00**

**ARCHITECTURAL WOOD CASEWORK**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Custom casework.
      a. Transparent finished casework.
   2. Cabinet hardware.

B. Related Requirements:
   1. Section 04 20 00 – Unit Masonry: Substrate backing walls.
   2. Section 06 61 19 – Quartz Surfacing Fabrications: Applied countertops and trim.
   3. Section 09 90 00 - Painting and Coating: Site finishing of cabinet exterior and interior.
   4. Division 22: Plumbing.
   5. Division 26: Electrical.

### 1.2 REFERENCE STANDARDS

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.
   2. ANSI A156.9 - Cabinet Hardware.
   3. ANSI A208.2 – Medium Density Fiberboard (MDF) for Interior Applications.

B. APA-The Engineered Wood Association:
   1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

C. Architectural Woodwork Institute:
   1. AWI AWS - Architectural Woodwork Standards.

D. ASTM International:
   1. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   4. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

E. Hardwood Plywood and Veneer Association:
   1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

F. National Electrical Manufacturers Association:
   1. NEMA LD 3 - High Pressure Decorative Laminates.

G. National Fire Protection Association:
   1. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

H. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168[-January 7, 2005] - Adhesive and Sealant Applications.

I. U.S. Department of Commerce National Institute of Standards and Technology:
   1. DOC PS 20 - American Softwood Lumber Standard.

### 1.3 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
   1. Submit data on fire retardant treatment materials and application instructions.
   2. Submit data on high pressure decorative laminates. Include color selectors.
   3. Submit data for hardware accessories.

C. Shop Drawings:
   1. Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

D. Samples:
   1. Submit two, 8 x 10 inch size samples, illustrating cabinet finish.

E. Qualification Statements:
   1. Submit fabricator and installer experience qualifications.

### 1.5 QUALITY ASSURANCE

A. Perform work in accordance with AWI AWS, Section 10 and Section 11; Custom Grade.

B. Surface Burning Characteristics: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM.

### 1.6 QUALIFICATIONS

A. Fabricator: Company specializing in fabricating products specified in this section with minimum three years documented experience.

### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect units from moisture damage.

C. Maintain storage space relative humidity within ranges indicated in AWI AWS Section 2.

### 1.8 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. During and after installation of Work of this section, maintain same temperature and

humidity conditions in building spaces as will occur after occupancy.
1. Maintain relative humidity within ranges indicated in AWI AWS Section 2.

**1.9 EXISTING CONDITIONS**

A. Verify field measurements prior to fabrication. Indicate field measurements on shop drawings.

**PART 2 PRODUCTS**

**2.1 CUSTOM CASEWORK**

A. Transparent Finished Custom Casework: Face framed construction; flush overlay style; AWI AWS Section 10; Custom Grade.
1. Exterior and Interior Exposed Surfaces: Birch lumber and plywood.
2. Semi-Exposed Surfaces: Birch lumber and plywood.
3. Door and Drawer Matching: Sequenced.

B. Casework Construction Details:
1. Drawer Side Joinery: Multiple dovetailed.
2. Drawer and Door Edge Profile: Square with thin applied band.
3. Toe Base Finish: Match cabinet face finish.
4. Grain Direction: Vertical.

C. Quartz Surfacing Counter Tops: As specified in section 06 61 19.

**2.2 WOOD TREATMENT**

A. Fire Retardant Treatment: Chemically treated and pressure impregnated, having flame spread of 25 or less when tested in accordance with ASTM E 84 and showing no evidence of significant progressive combustion when test is continued for an additional 20 minute period, Interior Type.

B. Provide identification on fire retardant treated material.

C. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

D. Moisture Content after Treatment: Redried.
1. Lumber: Maximum 19 percent.
2. Plywood: Maximum 15 percent.

**2.3 FABRICATION**

A. Fabricate casework to AWI AWS Section 10 Custom Grade.

B. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

C. Fit exposed plywood edges with matching veneer edging. Use one piece for full length only.

D. Door and Drawer Fronts: 3/4 inch thick.

E. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

F. Fabricate cabinets and counter tops with cutouts for plumbing fixtures, inserts, appliances, outlet boxes, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

**2.4 FINISHES**

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI AWS Section 5; Custom Grade; Stained Transparent Type:
1. System 5; Conversion varnish.

**2.5 ACCESSORIES**

A. Fasteners and Anchors:
1. Fasteners: ASTM B695, Class 55 mechanically galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Nails and Staples: ASTM F1667.

B. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; standard finish in concealed locations and US 26D finish in exposed locations.

C. Concealed Joint Fasteners: Threaded steel.

D. Grommets: Plastic material for cut-outs.

E. Shelf Standards and Rests: Formed aluminum channels and rests, cut for fitted rests spaced at 1/2 inch centers; satin finish. Knape & Vogt 255AL and 256AL.

F. Shelf Standards and Brackets: Formed steel brackets, formed for attachment with lugs; White finish. Knape & Vogt 82/182.

G. Drawer and Door Pulls: Extruded aluminum pull, full width of drawer, satin finish. "U" shaped pull, 3-1/2 inch centers. Stanley 4483-1/2 solid aluminum.

H. Sliding Cabinet Door Pulls: Extruded aluminum pull, full width of drawer, satin finish. "U" shaped pull, 3-1/2 inch centers. Stanley 4483-1/2 solid aluminum.

I. Cabinet Locks: Keyed cylinder, cam lock two keys for each lock, master keyed, bronze with satin finish. CompX-National C8103-26D.

J. Catches: Magnetic. Stanley 810160 (SP41 class) and 810190 (SP46 class).

K. Catches: Clip type. Amerock B-P3675-2G.

L. Drawer Slides: Galvanized steel construction, ball bearings separating tracks, full extension type. Knape & Vogt 1300, 1805.

M. Hinges: Pivot type, steel with nickel finish. Amerock Marathon 2606-14.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify adequacy of backing and support framing.

C. Verify location and sizes of utility rough-in associated with work of this section.

### 3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Prime paint surfaces of casework items and assemblies to be in contact with cementitious materials.

### 3.3 INSTALLATION

A. Install casework in accordance with AWI AWS Section 10 Custom Grade.

B. Install casework in accordance with AWI AWS Section 11 Custom Grade.

C. Set and secure casework and counter tops in place; rigid, plumb, and level.

D. Use fixture attachments in concealed locations for wall mounted components.

E. Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.

F. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

G. Secure cabinet and counter bases to floor using appropriate angles and anchorages.

H. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

I. Site glaze glass materials using Interior Dry method specified in Section 08 80 00.

### 3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Conform to AWI AWS Section 10 requirements for the following:
   1. Smoothness.
   2. Gaps.
   3. Flushness.
   4. Flatness.
   5. Alignment

### 3.5 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust moving or operating parts to function smoothly and correctly in accordance with AWI AWS chapter 10.

### 3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

### 3.7 ATTACHMENTS

A. Lavatory countertops, stain transparent finish with quartz countertop as specified in Section 06 61 19:
   1. Rooms 151, 153, 161, 164

B. Reference drawings for more information.

**END OF SECTION**

**SECTION 06 61 19**

**QUARTZ SURFACING FABRICATIONS**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes quartz fabrications.
   1. Quartz Countertops.
   2. Quartz Trim.
   3. Setting materials and accessories.

B. Related Sections:
   1. Section 04 20 00 – Unit Masonry: Substrate for attachment.
   2. Section 06 41 00 - Architectural Wood Casework: Cabinets with quartz counter top and backsplash.
   3. Section 07 90 00 - Joint Protection: Perimeter sealant to adjacent construction.
   4. Section 22 40 00 - Plumbing Fixtures: Plumbing drains and fixture trim.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM C170 – Standard Test Method for Compressive Strength of Dimension Stone.
   2. ASTM C880 – Standard Test Method for Flexural Strength of Dimension Stone.
   3. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.

### 1.3 PERFORMANCE REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for purpose specified and indicated.

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, methods of support, integration of plumbing and electrical components, and anchorages.

C. Product Data: Submit data on specified component products. Include color selector from manufacturer's full line.

D. Samples: Submit two samples representative of counter top, 4x4 inch in size illustrating color, texture, and finish.

E. Manufacturer's Installation Instructions: Submit preparation of opening required, rough-in sizes; tolerances for item placement, temporary bracing of components, and setting instructions.

### 1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit list of approved cleaning materials and procedures required; list of substances harmful to component materials, Include instructions for stain removal, and surface and gloss restoration.

### 1.6 QUALITY ASSURANCE

A. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

### 1.7 QUALIFICATIONS

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

B. Fabricator: specializing in fabricating products specified in this section with minimum three years documented experience and approved by the manufacturer.

### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Observe manufacturer's recommendations to prevent chipping or breakage.

C. Do not allow finished surfaces to rub during shipping or handling.

D. Store in racks in near vertical position.

E. Store in clean, dry, interior area.

F. Maintain temperature between 40 and 100 degrees F.

### 1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Verify field measurements are as indicated on shop drawings.

### 1.10 SEQUENCING

A. Section 01 10 00 - Summary: Work sequence.

B. Sequence work to coordinate with the work of Section 06 41 00.

### 1.11 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish ten year manufacturer warranty for each type of unit against product defects.

## PART 2 PRODUCTS

### 2.1 QUARTZ FABRICATIONS

A. Manufacturers:
1. Caesarstone.
2. Cambria - Classic
3. Dupont - Zodiaq.
4. Hanwha L&C – HanStone Classics.
5. Introsul – Sultrex.
6. Okite.
7. Silestone – Galactic Series
8. Substitutions: Section 01 60 00 - Product Requirements.

### 2.2 COMPONENTS

A. Quartz: Pure crushed quartz aggregate to comprise at least 93% of the finished product.

B. Resin: Polyester binding resin up to 7% of the finished product.

C. Panel properties:
1. ANSI A124.3.4.2.1 Stain resistance: Pass
2. ANSI A124.6.5.3 Wear and Cleanability: Pass
3. ASTM C170 Compressive Strength: 21,000 psi minimum.
4. ASTM C880 or D790 Flexural Strength: 5,300 psi minimum.
5. ASTM E84: Class A.

D. Adhesive: Manufacturer's recommended type. Joint adhesives shall be cartridge dispensed in color to match material.

E. Accessories as necessary and recommended by manufacturer.

### 2.3 FABRICATION

A. Fabricate components to greatest extent practical to sizes and shapes as indicated or required.

B. Form joints between components using manufacturer's required or recommended joint adhesive.

C. Radius to ease corners and edges.

D. Cut holes for sinks, faucets, grommets for wiring, and other accessories. Ease edges.

E. Tolerances:
1. Thickness of panel: 1/8 inch.
2. Panel face dimension: 1/16 inch.
3. Rectangular Face variation: 1/16 inch maximum out of square.

### 2.4 SHOP FINISHING

A. Color: Color as selected from manufacturer's full range.

B. Texture: As selected from manufacturer's full options.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify dimensions by field measurement prior to installation.

C. Verify existing conditions under Section 06 41 00 are ready for the work of this section.

D. Verify existing conditions under provisions of Sections 22 40 00 and 26 05 03.

E. Verify joint preparation and affected dimensions are acceptable.

### 3.2 PREPARATION

A. Clean surfaces to receive fabrications. Remove loose and foreign matter that could interfere with adhesion.

B. Protect finish surfaces from scratching by masking where necessary.

C. Provide anchoring devices for installation [and embedding].

D. Provide templates and rough-in measurements.

### 3.3 INSTALLATION

A. Align work plumb and level.

B. Rigidly anchor to substrate to prevent misalignment.

C. Install per manufacturer's recommendations.

D. Form and fill joints between quartz panels with manufacturer's recommended sealant with maximum1/8 inch gap.

E. Seal to adjacent construction in accordance with Section 07 90 00.

### 3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Indicated Dimension: 1/8 inch.

C. Maximum Offset From Indicated Position: 1/8 inch.

### 3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean exposed surfaces.

### 3.6 SCHEDULES

A. Countertops and backsplashes:
1. Rooms 151, 153, 161, 164.

B. Reference drawings for more information.

**END OF SECTION**

# DIVISION 7
## THERMAL AND MOISTURE PROTECTION

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

## SECTION 07 19 00

## WATER REPELLENTS

### PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes water repellent coating applied to exterior and interior clay brick and concrete masonry surfaces.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Concrete surfaces.
2. Section 04 20 00 - Unit Masonry: Clay Brick, Concrete Masonry surfaces.
3. Section 07 90 00 - Joint Protection.

### 1.2 REFERENCES

A. ASTM International:

1. ASTM D1653 - Standard Test Method for Water Vapor Transmission of Organic Coating Films.
2. ASTM D5703 - Standard Practice for Preparatory Surface Cleaning for Clay Brick Masonry.
3. ASTM E514 - Standard Test Method for Water Penetration and Leakage Through Masonry.
4. ASTM G154 - Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

### 1.3 SYSTEM DESCRIPTION

A. Applied Penetrant: Material to restrict moisture absorption in material being treated as recommended by manufacturer for specific substrate.

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit details of product description, tests performed, limitations to coating, and chemical properties including percentage of solids.

C. Manufacturer's Installation Instructions: Submit special procedures and conditions requiring special attention, and cautionary procedures required during application.

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

### 1.5 QUALIFICATIONS

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

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

### 1.6 MOCKUP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup.

B. Prepare nominal surface 36 x 36 inch (1 x 1 m) in size.

C. Prepare brick surface 36 x 36 inch (1 x 1 m) in size, in accordance with ASTM D5703.

D. Testing: Test mockup with 5/8 inch (16 mm) garden hose with spray nozzle located approximately 10 feet (3 m) from wall and aimed upward so water strikes at 45 degree downward angle.

1. Do not begin testing until mockup has fully cured, minimum 20 days unless longer period recommended by manufacturer.
2. Run water continuously for minimum three hours and observe back side of mockup for water penetration and leakage.
3. When leakage is detected make changes as needed and retest; retest until no leakage is detected.

E. Locate where directed by Architect/Engineer.

F. Incorporate accepted mockup as part of Work.

### 1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect coating liquid from freezing.

### 1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply coating when surface temperature is lower than 40 degrees F (4 degrees C) or higher than 90 degrees F (32 degrees C).

C. Do not apply coating when wind velocity exceeds manufacturer recommendations.

## PART 2 PRODUCTS

### 2.1 WATER REPELLENTS

A. Manufacturers:

1. Sure Klean Weather Seal/Prosoco, Siloxane WB Concentrate as basis of design.
2. Evonik Degussa Corporation, Model Protectosil Aqua-Trete EM.
3. Hydrozo, Model Clear Double 7 VOC.
4. Substitutions: Section 01 60 00 - Product Requirements.

### 2.2 COMPONENTS

A. Siloxane Water Repellent: Siloxane or Siloxane blend penetrating type water repellent.

1. Moisture Vapor Transmission: Maximum 28.33 perms or 50% compared to untreated surfaces, ASTM D1653.
2. Resistance to Accelerated Weathering: No loss in repellency after 2,500 hours, ASTM G154.
3. Reduction of Leakage: Minimum 97 percent water penetration and leakage, ASTM E514.
4. Apply to clay brick, concrete masonry, and concrete.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of coating.

### 3.2 PREPARATION

A. Delay Work until masonry mortar and concrete substrate is cured minimum of 60 days.

B. Remove loose particles and foreign matter.

C. Remove oil or foreign substance with chemical solvent which will not affect coating.

D. Scrub and rinse surfaces with water and let dry.

### 3.3 APPLICATION

A. Apply water repellant according to manufacturer's instructions.

B. Apply at rate of as recommended by manufacture by roller or airless spray.

C. Apply in the number of continuous, uniform coats as recommended by the manufacturer for the substrate to which product is applied.

### 3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect adjacent surfaces not scheduled to receive coating. Take specific care for glazed and aluminum surfaces.

C. Protect landscaping, property, and vehicles.

D. When applied to unscheduled surfaces, remove immediately by methods as instructed by coating manufacturer.

### 3.5 SCHEDULES

A. Exterior Masonry: Two coat application, clear.

B. Interior Masonry: Two coat application, clear, at the inside face of the exterior brick wall at the following rooms:

1. 151 Women's Restroom
2. 161 Men's Restroom
3. 162 Men's Shower
4. 164 Women's Restroom
5. 165 Women's Shower.

**END OF SECTION**

**SECTION 07 21 00**

**BUILDING INSULATION**

## PART 1 GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Cavity-wall insulation.
   2. Concealed building insulation.
   3. Sound attenuation insulation.
   4. Air Form Spray Applied Polyurethane Insulation.

B. Related Sections include the following:
   1. Division 03350, Description of Concrete thin shell Assembly.
   2. Division 7 Section "Through-Penetration Firestop Systems" for insulation installed as part of a perimeter fire-resistive joint system.
   3. Division 9 Section "Gypsum Board Assemblies" for installation in metal-framed assemblies of insulation specified by referencing this Section.
   4. Division 220700 Section "Plumbing Insulation."
   5. Division 230700 Section "HVAC Insulation."

### 1.2 RELATED REQUIREMENTS

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

B. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
   1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
   2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

### 1.3 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

### 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 insulation products.

C. Research/Evaluation Reports: For Polyurethane insulation.

### 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test- response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by 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.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER(S)

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 MATERIALS AND/OR EQUIPMENT

A. Glass-Fiber Blanket Insulation
   1. Manufacturers:
      a. CertainTeed Corporation.
      b. Guardian Fiberglass, Inc.
      c. Johns Manville.
      d. Knauf Fiber Glass.
      e. Owens Corning.
   2. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
   3. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with polypropylene-scrim-kraft vapor-retarder membrane on 1 face.
   4. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
      a. 3-5/8 inches thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F.
      b. 6-1/2 inches thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F.
      c. 9-1/2 inches thick with a thermal resistance of 30 deg F x h x sq. ft./Btu at 75 deg F.

B. Spray Applied Polyurethane Insulation
   1. Manufacturers:
      a. Gaco Western.
      b. NCFI Polyurethans
   2. The sprayed in Place insulation shall be a two component system made by combining an isocyanate (A) component with a polyol (B) component and shall possess the following typical physical properties ASTM Test Values:
      a. Nominal Density: Sprayed-in-Place (D-1622-03): 1.8 – 2.0 lbs/ft³
      b. Compressive Strength: Parallel to Rise (D-1621-04a): 37.0 psi
      c. Closed Cell Content (D-2856C-94): 90.8%
      d. Initial R Value (C-518), tested at 40° F (4.4° C):
         1) R at 1 Inch: 7.5
      e. Aged R Value (C-518), tested at 75° F (23.9° C):
         1) R at 1 Inch: 6.22
         2) R at 4 Inches: 27.17
      f. NOTE: Federal Trade Commission regulations published in the Federal Register 16 CFR Part 460 require that R value testing of polyurethane foam insulation must be conducted on aged samples at a 75° F mean test temperature. Failure to comply can result in substantial fines by the FTC.
      g. Flame Spread / Smoke Developed: 25 Flame / 400 Smoke (ASTM E84-05, Also known as ANSI 2.5, NFPA 255, UBC 8-1 (42-1) and UL 723)
      h. Typical data as obtained from laboratory samples and actual value may vary under field conditions.
      i. Note: These flame-spread ratings are not intended to reflect hazards presented by this or any other material under actual fire conditions.

C. Primer: Primer used shall be as recommended by manufacturer.
   1. Fire Safety Requirements: See API Bulletin AX-119, "MDI - Based Polyurethane Foam Systems: Guidelines for Safe Handling and Disposal."

D. Auxiliary Insulating Materials
   1. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacture for sealing joints and penetrations in vapor-retarder facing.
   2. Single Component Polyurethane Foam Sealants for use around windows, doors etc.
   3. Examples of 15-Minute Rated Thermal Barriers
      a. Sprayed in place cementitious fire barrier
      b. Sprayed in place fiber fire barrier
      c. Minimum 1/2 inch gypsum board
   4. Vapor Retarder (if required)
   5. Asphaltic
   6. Butyl
   7. Chlorosulfonated Polyethylene
   8. Polyethylene Film
   9. Other

## PART 3 EXECUTION

## 3.1 PREPARATION

A. Examination
   1. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
      a. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

### 3.2 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

A. General Installation
   1. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
   2. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
   3. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
   4. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
   5. For preformed insulating units, 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.

B. Installation of General Building Insulation
   1. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
   2. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
      a. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
      b. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
      c. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
      d. 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. Installation of Spray Applied Polyurethane Insulation
   1. The products intended for use in the building envelope insulation system must be applied within the manufacturer's guidelines for temperature, humidity and other atmospheric conditions. In addition, they must be sequenced so as to take into consideration substrate preparation, proper cure times and inter-pass adhesion.
   2. All surfaces not to receive foam shall be carefully masked to avoid overspray. This includes (but is not limited to) beams, floors, windows, doors, fireplaces, appliances and any other surface which could be damaged by overspray.
   3. Equipment shall be capable of maintaining 1000 psi of pressure or higher and maintaining a minimum of 130 degrees. Equipment shall be capable of maintaining 1:1 ratio of A and B components on a continuous basis. Equipment shall be product manufacturer approved type.
   4. Primer shall be applied to the properly prepared substrate in accordance with manufacturer recommendations to achieve the design coverage rate.

### 3.3 PROTECTION

A. Protect installed insulation 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.

B. Chemical storage must meet Manufacturer's specified requirements.

**END OF SECTION 07 21 00**

**MODIFIED BITUMINOUS MEMBRANE ROOFING**

**SECTION 07 52 00**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes fully adhered asphalt elastomer membrane roofing system.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry: Wood nailers.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Weather protection for base flashings.
3. Section 07 71 23 – Gutters and Downspouts.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flowmeter Apparatus.
2. ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

B. FM Global:
1. FM DS 1-28 - Wind Loads to Roof Systems and Roof Deck Securement.

C. National Roofing Contractors Association:
1. NRCA - The NRCA Roofing and Waterproofing Manual.

D. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
2. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
3. UL 1256 - Fire Test of Roof Deck Construction.

### 1.3 SYSTEM DESCRIPTION

A. Modified Bitumen Conventional Roofing System: Two ply membrane system with venting base sheet, and aggregate surface finish.

### 1.4 DESIGN REQUIREMENTS

A. Low Slope Membrane Roof Edge Securement: Conform to TSSI for wind speeds determined from FEMA 361 and indicated on structural drawings.

### 1.5 PERFORMANCE REQUIREMENTS

A. Roof Assembly Classification: FM Class 1A Construction, windstorm classification of 1-200, in accordance with FEMA 361.

### 1.6 SUBMITTALS

A. Shop Drawings: Indicate setting plan for layout of seams, direction of laps, base flashing details.

B. Product Data: Submit membrane materials, base flashing materials, venting base sheet, and fasteners.

C. Samples: Submit two 8" square samples of each membrane and flashing material.

D. Manufacturer's Installation Instructions: Ensure special precautions required for seaming membrane is included.

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

F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures and wind velocity during application.

G. Warranty: Submit sample warranty for review.

### 1.7 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's published installation instructions.

B. Roof Assembly Fire Classification: Minimum Class A when tested in accordance with ASTM E108 or UL 790.

C. Apply label from agency approved by authority having jurisdiction to identify each roof assembly component.

### 1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience and satisfactory performance record.

B. Applicator: Company specializing in performing Work of this section with minimum three years experience and applicator of products similar to specified products of a minimum of 5 projects of similar scope as Project with satisfactory performance record. Must be approved by manufacturer.

### 1.9 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meetings.

B. Convene minimum one week prior to commencing Work of this section.

C. Review installation procedures and coordination required with related Work.

### 1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

C. Each container or bulk shipping ticket for asphalt shall indicate the equiviscous

temperature, finished blowing temperature, and the flash point.

D. Store products in weather protected environment, clear of ground and moisture.

E. Stand roll materials on end on a clean flat surface.

**1.11 ENVIRONMENTAL REQUIREMENTS**

A. Section 01 60 00 - Product Requirements.

B. Do not apply roofing membrane during inclement weather or when ambient temperatures may fall below 40 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

**1.12 COORDINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with installing associated metal flashings as work of this section proceeds.

**1.13 WARRANTY**

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish ten year manufacturer material and labor warranty to cover failure to prevent penetration of water. Shall warrant to correct defective roofing materials, including installation.

**PART 2 PRODUCTS**

**2.1 MODIFIED BITUMINOUS ROOFING**

A. Manufacturers:
1. Siplast, Irving, TX; Basis of Design.
2. Johns Manville Corp., Denver CO.

**2.2 SYSTEM DESCRIPTION**

A. Roofing Membrane Assembly:
1. A roof membrane assembly consisting of two plies of a prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane, applied over a prepared substrate.
2. Both reinforcement mats shall be impregnated/saturated and coated each side with an SBS modified bitumen blend.
3. The modified bitumen finish ply shall be coated one side with a torch grade SBS bitumen blend adhesive layer.
4. The cross sectional area of the sheet material shall contain no oxidized or non-SBS modified bitumen.
5. The adhesive layer shall be manufactured using a process that embosses the surface with a grooved pattern to provide optimum burn-off of the plastic film and to maximize application rates.
6. The roof system shall pass 500 cycles of ASTM D 5849 Resistance to Cyclic Joint Displacement (fatigue) at 14F (-10C). Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles.
7. The roof system shall pass 200 cycles of ASTM D 5849 after heat conditioning performed in accordance with ASTM D 5147.
8. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof

**2.3 COMPONENTS**

A. Venting Base Sheet:
1. Siplast Parabase FS as Basis of Design.

B. Modified Bitumen Base and Stripping Ply:
1. Thickness (avg): 114 mils (2.3 mm) (ASTM D 5147)
2. Thickness (min): 110 mils (2.2 mm) (ASTM D 5147)
3. Weight (min per 100 ft² of coverage): 76 lb (3.0 kg/m²)
4. Maximum filler content in elastomeric blend - 35% by weight
5. Low temperature flexibility @ -13F (-25C): PASS (ASTM D 5147)
6. Peak Load (avg) @ 73F (23C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
7. Peak Load (avg) @ 0F (-18C): 70 lbf/inch (12.3 kN/m) (ASTM D 5147)
8. Ultimate Elongation (avg.) @ 73F (23C): 50% (ASTM D 5147)
9. Dimensional Stability (max): 0.1% (ASTM D 5147)
10. Compound Stability (min): 250F (121C) (ASTM D 5147)
11. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
12. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
13. Siplast Paradiene 20 TG as Basis of Design.

C. Modified Bitumen Finish Ply:
1. Thickness (avg): 138 mils (3.5 mm) (ASTM D 5147)
2. Thickness at selvage (coating thickness) (avg): 118 mils (3.0 mm) (ASTM D 5147)
3. Thickness at selvage (coating thickness) (min): 114 mils (2.9 mm) (ASTM D 5147)
4. Weight (min per 100 ft² of coverage): 112 lb (5.4 kg/m²)
5. Maximum filler content in elastomeric blend: 35% by weight

6. Low temperature flexibility @ -13F (-25C): PASS (ASTM D 5147)
7. Peak Load (avg) @ 73F (23C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
8. Peak Load (avg) @ 0F (-18C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
9. Ultimate Elongation (avg.) @ 73F (23C): 55% (ASTM D 5147)
10. Dimensional Stability (max): 0.1% (ASTM D 5147)
11. Compound Stability (min): 250F (121 C) (ASTM D 5147)
12. Granule Embedment (max loss): 2.0 grams per sample (ASTM D 5147)
13. SRI of 78 minimum
14. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
15. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
16. Surfacing: ceramic granules
17. Siplast Paradiene 30 CR FR TG as Basis of Design.

D. Flashing Membrane: A flashing membrane assembly consisting of a prefabricated, reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane with a continuous, channel-embossed metal-foil surfacing. The finish ply shall conform to ASTM D 6298 and the following physical and mechanical property requirements.
1. Cant Backing Sheet and Flashing Reinforcing Ply:
   a. Thickness (avg): 102 mils (2.6 mm) (ASTM D 5147)
   b. Thickness (min): 98 mils (2.5 mm) (ASTM D 5147)
   c. Weight (min per 100 ft² of coverage): 72 lb (3.5 kg/m²)
   d. Maximum filler content in elastomeric blend: 35% by weight
   e. Low temperature flexibility @ -13 F (-25 C) - PASS (ASTM D 5147)
   f. Peak Load (avg) @ 73F (23C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
   g. Peak Load (avg) @ 0F (-18C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
   h. Ultimate Elongation (avg.) @ 73F (23C): 50% (ASTM D 5147)
   i. Dimensional Stability (max): 0.1% (ASTM D 5147)
   j. Compound Stability (min - sheet): 250F (121C) (ASTM D 5147)
   k. Compound Stability (min – adhesive coating): 212F (100C) (ASTM D 5147)
   l. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
   m. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
   n. Back Surfacing: polyolefin film
2. Metal-Clad Modified Bitumen Flashing Sheet
   a. Thickness (avg): 142 mils (3.6 mm) (ASTM D 5147)
   b. Thickness (min): 138 mils (3.5 mm) (ASTM D 5147)
   c. Weight (min per 100 ft² of coverage): 92 lb (4.5 kg/m²)
   d. Coating Thickness – back surface (min): 40 mils (1 mm) (ASTM D 5147)
   e. Maximum filler content in elastomeric blend: 35% by weight
   f. Low temperature flexibility @ 0 F (-18 C): PASS (ASTM D 5147)
   g. Peak Load (avg) @ 73F (23C): 85 lbf/inch (15 kN/m) (ASTM D 5147)
   h. Peak Load (avg) @ 0F (-18C): 180 lbf/inch (31.7 kN/m) (ASTM D 5147)
   i. Ultimate Elongation (avg) @ 73F (23C): 45% (ASTM D 5147)
   j. Tear-Strength (avg): 120 lbf (0.54 kN) (ASTM D 5147)
   k. Dimensional Stability (max): 0.2% (ASTM D 5147)
   l. Compound Stability (min): 225F (107C) (ASTM D 5147)
   m. Cyclic Thermal Shock Stability (maximum): 0.2% (ASTM D 6298)
   n. Approvals: UL Approved, FM Approved (products shall bear seals of approval)
   o. Reinforcement: fiberglass scrim mat or other meeting the performance and dimensional stability criteria
   p. Surfacing: aluminum metal foil
3. Siplast Paradiene 20 TG and Veral top ply as Basis of Design.

E. Fleece Reinforced Resin Flashing System: A PMMA resin with fleece reinforced flashing system for roof penetrations where sheet flashing is not practical or where indicated.
1. Resin:
   a. Polymethyl methyl acrilate.
   b. Color: Light Grey.
   c. Siplast Parapro Flashing Resin as design basis.
2. Catalyst:
   a. Siplast Pro Catalyst as design basis.
3. Polyester Fleece.
   a. Non-woven polyester fleece.
   b. Color: White.
   c. Nominal Thickness: 40 mils.
   d. Weight: 110 g/m$^2$.
   e. Water absorption: <1%.
   f. Siplast Pro Fleece as design basis.

F. Walkway Pads: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated granule wearing surface.
1. Thickness: 0.217 in (5.5 mm)
2. Weight: 1.8 lb/ft² (8.8 kg/m²)
3. Width: 30 in (76.2 cm)

4. Walkway Adhesive: As recommended by membrane manufacturer.
5. Siplast Paratread Roof Protection as Basis of Design.

**2.4 ACCESSORIES**

A. Counterflashings: Pre-finished metal, as specified in Section 07 62 00.

B. Strip Reglet Devices: As specified in Section 07 62 00.

C. Copings:
1. Galvalume as indicated and specified in Section 04 21 29
2. Pre-finished metal, as indicated and specified in Section 07 62 00.

D. Gutters/Conductor heads: Prefinished sheet metal as specified in Section 07 71 23.

E. Fiber Cant and Tapered Edge Strips: Asphalt impregnated wood fiberboard, preformed to 45 degree angle.

F. Roofing insulation: Lightweight insulating concrete as specified in Section 03 52 16.

G. Joint Sealers: As specified in Section 07 90 00.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces and site conditions are ready to receive work.

C. Verify concrete substrate is cured to accept work and not damaged. Confirm dry deck moisture content acceptable to roofing manufacturer.

D. Verify concrete deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.

E. Verify are dry and free of snow or ice.

F. Verify roof openings, curbs, pipes, set rails, conduit, sleeves, ducts, and vents through roof are solidly set, and wood cant strips, wood nailing strips, and reglets are in place.

**3.2 PREPARATION**

A. Prepare substrate to receive roofing system in accordance with roofing manufacturer's instructions.

B. Install flashings and similar accessory items in accordance with manufacturer's instructions.

C. Sweep surface to be covered clean of debris, dirt, or other sharp objects.

D. Prime metal flanges, concrete and masonry surface, and thin shell concrete roof deck to receive membrane roofing with a uniform coating of asphalt primer.

E. Vapor Retarder Application - Concrete Deck:

**3.3 APPLICATION**

A. Start installation only in presence of manufacturer's technical representative.

B. Install roofing in accordance with manufacturer's instructions.

C. Apply one layer of base sheet. Mechanically fasten to substrate.

D. Each layer of roofing shall be laid free of wrinkles, creases, or fishmouths and shall be laid at right angles to the slope of the deck:
1. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.

E. Ply Sheet:
1. Fully bond to the insulation and provide minimum of 3 inch side and end laps.
2. Stagger courses of ply sheet to insure that laps in the ply sheet do not coincide with the joints of the insulation.

F. Surface Sheet:
1. Fully bond to the ply sheet and provide minimum 3 inch side and end laps.
2. Stagger courses of surface sheet to insure that laps in the surface sheet do not coincide with the laps of the ply sheet.

**3.4 SHEET MEMBRANE FLASHINGS**

A. Accomplish flashing using the ply sheet as a reinforcing membrane under the flashing sheet:
1. Lap reinforcing membrane, a minimum of 3 inches to itself and shall extend a minimum of 4 inches onto the ply sheet surface and 3 inches up the parapet wall.
2. Adhere reinforcing membrane by a mopping of asphalt.

B. Lap flashing sheet, a minimum of 3 inches to itself and extend a minimum of 6 inches onto the surface sheet and 8 inches up the parapet wall.

C. Torched in place flashing sheet.

D. Stagger reinforcing membrane laps with flashing sheet laps.

**3.5 PMMA FLASHINGS**

A. For roof penetrations without curbs or where sheet membrane flashings are impractical:

B. Install per manufacturer's instructions.

C. Remove all rust, scale, loose material, or other material that will be detrimental to the application and performance of the system. Metals should be ground or stripped to bright metal and cleaned in accordance with manufacturer's requirements.

D. Seal joint between roofing membrane and penetrating member with flashing manufacturer approved sealant.

E. Cut fleece to proper outline to ensure proper coverage. Fleece to be in two layers, one

over the penetrating member and extending 2 inches over the roofing membrane, and the second to cover the roofing membrane to the penetrating member.

F. Mask off member and roofing membrane ¼ inch beyond the extend of the fleece.

G. Apply base coat of catalyzed resin to penetrating member, extending onto the roof membrane a minimum of 2 inches.

H. Apply fleece to penetrating member, pressing fleece into PMMA catalyzed resin with a roller. Apply additional PMMA catalyzed resin before applying overlaying layers of fleece.

I. Apply base coat of PMMA catalyzed resin to the roofing membrane, extending a minimum of 8 inches in all directions from the penetrating member.

J. Embed the second layer of fleece into the PMMA catalyzed resin and top coat with PMMA catalyzed resin. Remove masking before resin cures.

K. Lap flashing sheet, a minimum of 3 inches to itself and extend a minimum of 6 inches onto the surface sheet and 8 inches up the parapet wall.

L. Torched in place flashing sheet.

M. Stagger reinforcing membrane laps with flashing sheet laps.

**3.6 FIELD QUALITY CONTROL**

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Correct identified defects or irregularities.

C. Require site attendance of roofing materials manufacturers during installation of the Work.

D. Arrange for manufacturer's inspection of completed installation in the presence of the Architect and Owner.

**3.7 CLEANING**

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or disfigured finishes caused by work of this section.

**3.8 PROTECTION OF INSTALLED CONSTRUCTION**

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect building surfaces against damage from roofing work.

C. Where traffic must continue over finished roof membrane, protect surfaces.

D. Before the end of each working day, or before application is interrupted by precipitation, seal all exposed sheet edges along laps and around drains, projections and upstands.

E. Build cutoffs using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service. Completely remove cutoffs prior to the resumption of roofing.

**3.9 SCHEDULE**

A. Roof over Generator Enclosure Room/Electrical Room. Reference Drawings for more information.

**END OF SECTION**

**SECTION 07 62 00**

**SHEET METAL FLASHING AND TRIM**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes flashings and counterflashings and fabricated sheet metal items.
   1. Provide reglets and accessories.

B. Related Sections:
   1. Section 04 20 00 - Unit Masonry: Through-wall flashings in masonry.
   2. Section 06 10 00 - Rough Carpentry: Wood blocking and battens for metal roofing substrate profiles.
   3. Section 07 52 00 - Modified Bituminous Membrane Roofing

### 1.2 REFERENCES

A. American Architectural Manufacturers Association:
   1. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc-Iron Alloy-Coated Galvannealed by the Hot-Dip Process.
   2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   3. ASTM A792 – Standard Specification for Steel Sheet, 55% Aluminum Zinc Alloy Coated by the Hot Dip Process.
   4. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   5. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
   6. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

C. Federal Specification Unit:
   1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

D. National Roofing Contractors Association:
   1. NRCA – Roofing and Waterproofing Manual.

E. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual.

### 1.3 DESIGN REQUIREMENTS

A. Sheet Metal Flashings: Reference drawings for specific detailing. Where specific details are not indicated, conform to typical detailing for condition indicated in SMACNA "Architectural Sheet Metal Manual."

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.

D. Samples:
   1. After initial color selection by Architect, submit two samples, for final approval, 4x6 inch in size, minimum, illustrating metal finish color.

### 1.5 QUALIFICATIONS

A. Fabricator and Installer: Company specializing in sheet metal work with minimum six years documented experience.

### 1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum on] week prior to commencing work of this section.

### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

### 1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate with Work of Section 03 10 00 and Section 04 20 00 for installing recessed flashing reglets.

## PART 2 PRODUCTS

### 2.1 SHEET METAL FLASHING AND TRIM

A. Pre-Finished Galvanized Steel Sheet: ASTM A755/A755M; structural steel sheet, G90 zinc coating; 0.024, 24 gauge inch thick core steel, shop pre-coated with two coat fluoropolymer top coat; color as selected.

B. Pre-Finished Galvalume Steel Sheet: ASTM A792/A792M; structural steel sheet, AZ 55 aluminum-zinc coating; 0.024, 24 gauge inch thick core steel shop pre-coated with protective clear acrylic top coating.

C. Pre-Finished Galvalume Steel Sheet: ASTM A792/A792M; structural steel sheet, AZ 50 or AZ

55 aluminum-zinc coating; 0.024, 24 gauge inch thick core steel, shop pre-coated with two coat fluoropolymer top coat; color as selected.

**2.2 COPINGS**

A. Manufactured Coping System equal to Petersen Aluminum PAC-Continuous Cleat Coping.

B. Pre-Finished Galvalume Steel Sheet: ASTM A792/A792M; structural steel sheet, AZ 55 aluminum-zinc coating; 0.024, 24 gauge inch thick core steel shop pre-coated with protective clear acrylic top coating.

**2.3 ACCESSORIES**

A. Fasteners: Stainless steel, with soft neoprene washers.

B. Underlayment: ASTM D226; [Type II, No. 30 unperforated asphalt felt.

C. Slip Sheet: Rosin sized building paper.

D. Primer: Zinc molybdate or Galvanized iron type.

E. Protective Backing Paint: FS TT-C-494, Bituminous.

F. Sealant: Silyl terminated Polyether sealant specified in Section 07 90 00.

G. Plastic Cement: ASTM D4586, Type I.

H. Reglets: Surface mounted type, galvanized steel, exposed ends covered with preformed caps, prefabricated corners at transitions; [SM] manufactured by Fry Reglet as design basis.

**2.4 FABRICATION**

A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet metal, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

H. Seal metal joints.

**2.5 FACTORY FINISHING**

A. Fluoropolymer Coating: Multiple coat as specified for sheet metal system, thermally cured, conforming to AAMA 2605.

B. Washcoat: Finish concealed side of metal sheets with washcoat compatible with finish system, as recommended by finish system manufacturer.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

**3.2 PREPARATION**

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets to lines and levels indicated on Drawings. Seal top of reglets with sealant.

C. Paint concealed metal surfaces with protective backing paint to minimum dry film thickness of 15 mil.

**3.3 INSTALLATION**

A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

**3.4 FIELD QUALITY CONTROL**

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspection will involve surveillance of Work during installation to ascertain compliance with specified requirements.

**3.5 SCHEDULE**

A. Reference drawings for typical details utilizing products identified in this section.

**END OF SECTION**

## SECTION 07 71 23
## GUTTERS AND DOWNSPOUTS

### PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes galvalume steel gutters, conductor heads, and downspouts.
   1. Provide precast concrete splash pads.

B. Related Sections:
   1. Section 04 20 00 – Unit Masonry.
   2. Section 07 52 00 - Modified Bituminous Membrane Roofing
   3. Section 07 62 00 - Sheet Metal Flashing and Trim.
   4. Section 07 90 00 - Joint Protection.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   2. ASTM A792 - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

B. Federal Specification Unit:
   1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual

### 1.3 DESIGN REQUIREMENTS

A. Conform to applicable code for size and method of rain water discharge. If sizes shown on drawings or called out, Contractor must verify conformance as noted above.

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

C. Product Data: Submit data on manufactured components, materials, and finishes.

D. Samples: Upon selection of color by Architect, submit two samples, 12 inch long illustrating component design, finish, color, and configuration.

### 1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA Manual.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to drain.

C. Prevent contact with materials during storage capable of causing discoloration, staining, or damage.

### 1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

### 1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for gutter and downspout finishes.

### PART 2 PRODUCTS

### 2.1 GUTTERS AND DOWNSPOUTS

A. Product Description:
   1. Gutters: Sheet metal; Profile as indicated on Drawings.
   2. Downspouts: Galvanized Steel Pipe: ASTM A53/A53M, Schedule 40, Grade B.
   3. Splash Pads: One Precast concrete type for each downspout location, 12x24 inches; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

### 2.2 COMPONENTS

A. Galvalume Steel Sheet: ASTM A792 aluminum-zinc coating; 24 gage] core steel.

B. Galvanized Pipe: ASTM A53/A53M.

### 2.3 ACCESSORIES

A. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: In accordance with SMACNA.
   2. Gutter Supports: Brackets and straps.
   3. Downspout Supports: Brackets and straps.

B. Fasteners: Same material and finish as gutters and downspouts, with soft neoprene washers

C. Protective Backing Paint: FS TT-C-494, bituminous.

### 2.4 FABRICATION

A. Form gutters of profiles and sizes indicated.

B. Fabricate with required connection pieces.

C. Form sections to shape indicated on Drawings, square, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

### 2.5 FACTORY FINISHING

A. Factory coat gutters with protective clear acrylic top coating.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive gutters and downspouts.

### 3.2 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

### 3.3 INSTALLATION

A. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

B. Slope gutters internally 1/16 inch per foot minimum.

C. Set splash pads under downspouts. Secure in place.

### 3.4 SCHEDULE

A. Reference drawings for locations and sizes.

**END OF SECTION**

**SECTION 07 90 00**

**JOINT PROTECTION**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Preparing substrate surfaces.
2. Sealant and joint backing.

B. Related Sections:
1. Section 03 30 00 – Cast-in-Place Concrete: Sealants in expansion joints.
2. Section 04 20 00 – Unit Masonry.
3. Section 06 10 00 – Rough Carpentry: Sheathing assemblies where sealant is required.
4. Section 06 41 00 – Architectural Wood Casework.
5. Section 06 61 19 – Quartz Surfacing.
6. Section 07 52 00 – Modified Bituminous Membrane Roofing.
7. Section 07 62 00 – Sheet Metal Flashing and Trim.
8. Section 08 12 14 – Standard Steel Frames.
9. Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM C510 – Standard Test Method for Staining and Color Change of Single or Multicomponent Joint Sealants.
2. ASTM C711 – Standard Test Method for Low Temperature Flexibility and Tenacity of One Part, Elastomeric, Solvent Release Type Sealants.
3. ASTM C834 - Standard Specification for Latex Sealants.
4. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
5. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
6. ASTM C1193 - Standard Guide for Use of Joint Sealants.
7. ASTM C1247 – Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.
8. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
9. ASTM D2240 – Standard Test Method for Rubber Property – Durometer Hardness.
10. ASTM D3574 – Standard Test Methods for Flexible Cellular Materials – Slab, Bonded, and Molded Urethane Foams.
11. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
12. ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtains walls, and Doors Under Specified Pressure Differences Across the Specimen.
13. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
14. ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

B. California Department of Health Services:
1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

C. FDA Regulation CFR Title 21, Chapter 1, Subchapter B, Section177.2600 – Indirect Food Additives: Polymers – Rubber articles intended for repeated use.

D. NSF/ANSI Standard 61 – Drinking Water System Components.

E. South Coast Air Quality Management District:
1. SCAQMD Rule 1168[-January 7, 2005] - Adhesive and Sealant Applications.

F. Underwriters Laboratory:
1. UL 2079 – Standard for tests for Fire Resistance of Building Joint Systems.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, size illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Warranty: Include coverage for installed sealants and accessories failing to achieve airtight seal, watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

### 1.4 QUALITY ASSURANCE

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform acoustical sealant application work in accordance with ASTM C919 and ASTM C1193, as appropriate to condition.

**1.5 QUALIFICATIONS**

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

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

**1.6 ENVIRONMENTAL REQUIREMENTS**

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

**1.7 COORDINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

**PART 2 PRODUCTS**

**2.1 JOINT SEALERS**

A. Sealant Type ES-A
1. Single-component Non-sag Polyether High Performance General Purpose Exterior (Nontraffic) Sealant.
   a. ASTM C920 Grades S & NS
   b. ASTM C920 Class 25
   c. ASTM C920 Exposure NT (non-traffic)
   d. ASTM C920 Uses M, G, and A with O Joint substrates.
   e. Color: black at thresholds, Colors as selected at other locations.
2. Manufacturers:
   a. Sonneborn, a division of BASF – Sonolastic 150 w/ VLM technology.
   b. STS Coatings – GreatSeal PE-150.
3. Applications: Use for:
   a. Control, expansion, and soft joints in masonry at interior walls only. For exterior joints, type CS-A must be used.
   b. Joints between concrete and other materials.
   c. Joints between metal frames, including doors, louvers, etc. and other materials at exterior/perimeter walls. Apply sealant on both exterior and interior sides of wall.
   d. Under thresholds and window/storefront/curtainwall systems at floor slab to prevent air/water infiltration.
   e. At intersections of dissimilar materials where infiltration of water or air is possible.
   f. Perimeter joints of door and window frames or other framed openings in walls where there is no finished edge flange.
   g. Open Joints at penetrations through walls, and open joints at penetrations through concrete or gypsum board ceilings, where intended to be tight sealed joints
   h. Open joints between dissimilar materials where intended to be tight, sealed joints.
   i. Joints where edge trim of gypsum board abuts irregular surfaces or other surfaces and leaves an open joint.
   j. Within masonry system and at perimeter.
   k. Intersection of dissimilar materials which installations not uniform or where workmanship does not meet acceptable construction tolerances, when such workmanship is acceptable by the Architect.
   l. Metal Siding, louvers, fixtures and other penetrations in building enclosures not otherwise sealed weathertight. Unless noted otherwise provide continuous sealing perimeter joints and all other joints at exterior soffits.
   m. As sealant in roofing systems where a urethane sealant is not required by roofing manufacturer.
   n. Other exterior non-traffic joints for which no other sealant is indicated.
   o. Paintable.

B. Sealant Type ES-B
1. Single-component Neutral Curing Silicone Sealant.
   a. ASTM C920 Grades S & NS
   b. ASTM C920 Class 50
   c. ASTM C920 NT (non traffic)
   d. ASTM C920 Uses M, G, and A with substrates type O
   e. Color: Colors as selected.
2. Manufacturers:
   a. Dow Corning Corporation – 795.
   b. GE/Momentiv – SilPruf NB SCS9000.
   c. Sonneborn – OmniSeal 50.
3. Applications: Use for:
   a. Exterior Aluminum Window Frames, storefront, and curtainwall to adjacent substrate, exterior and interior joints.
   b. Within Glazing systems.
   c. Do not paint.

C. Sealant Type ES-C
1. Single-component Acid Curing Silicone Sealant.
   a. Mildew resistant.
   b. ASTM C920 Grades S & NS
   c. ASTM C920 Class 25
   d. ASTM C920 NT (non traffic)
   e. ASTM C920 Uses G, and A with substrates type O
   f. Color: Colors as selected.
2. Manufacturers:
   a. Dow Corning Corporation – 999A
   b. GE/Momentiv – Sanitary SCS1700.
   c. Pecora Corporation – 860.

d. Sonneborn – OmniPlus.
e. Tremco – Tremsil 200
3. Applications: Use for:
a. Joints between plumbing fixtures and floor and wall surfaces.
b. Joints between all counter tops and wall surfaces.

D. Sealant Type ES-D
1. Multi-component Pourable Urethane High Performance Exterior Traffic Sealant.
a. ASTM C920 Grades M & P
b. ASTM C920 Class 25
c. ASTM C920 Exposure T (traffic) and NT (non-traffic).
d. ASTM C920 Uses M, G, and A with type O substrate joints.
e. Color: Grey.
2. Manufacturers:
a. Sika Corpoaratin, Inc., – Sikaflex-2c-SL.
b. Sonneborn – SL 2.
3. Applications: Use for:
a. Expansion joint in concrete construction that is principally horizontal in nature, including paving, sidewalks, curbs, etc. and where water immersion capability is required.

E. Sealant Type ES-E
1. Multi-component Pourable Urethane High Performance Exterior Water Immersible Traffic Sealant.
a. ASTM C920 Grades M & P
b. ASTM C920 Class 25
c. ASTM C920 Exposure T (traffic) and NT (non-traffic).
d. ASTM C920 Uses M, G, and A with type O substrate joints.
e. Color: Grey.
2. Manufacturers:
a. Pecora Corporation – Dynatrol II-SG.
b. Sika Corpoaratin, Inc., – Sikaflex-2c-SL.
c. Sonneborn – SL 2.
3. Applications: Use for:
a. Expansion joint in exterior concrete construction that is principally horizontal in nature, including paving, sidewalks, curbs, etc. where water immersion is likely.
b. Expansion joints in concrete slabs adjacent to column piers or penetrations in slab.

F. Sealant Type ES-F
1. Multi-component Non-sag Urethane Sealant.
a. ASTM C920 Grades NS
b. ASTM C920 Class 25
c. ASTM C920 T (traffic) and NT (non-traffic)
d. ASTM C920 Uses M, G, and A with substrates type O
e. Color: Black.
2. Manufacturers:
a. Sonneborn – NP2.
3. Applications: Use for:
a. Within roofing systems where roofing manufacturer requires a urethane sealant.

G. Sealant Type AS-A
1. Manufacturers:
a. Pecora Corporation – AC-20 FTR.
b. USG – Sheetrock Acoustical Sealant.
2. Single-component Acrylic Acoustical Sealant.
a. ASTM E90: Sealant will effectively reduce airborne sound transmission through perimeter joints and opening in building construction as demonstrating by testing of representative assemblies in accordance with ASTM E90.
b. ASTM C834
c. Color: White-paintable.
3. Applications: Use for:
a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
b. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated. Not for use at exterior walls.
c. Paintable.

H. Sealant Type CS-A
1. Pre-compressed foam sealer system.
a. Open-cell polyurethane expanding foam impregnated with anon-drying, water-based, stabilized, polymer-modified acrylic.
b. Silicone external weather facing, factory applied.
c. Silicone Sealant for application as bands.
d. ASTM D2240: Shore hardness – 15 pts.
e. ASTM D3574: Tensile Strength – 21 psi min.
f. ASTM C711: Temperature service range - -40°F to 185°F.
g. ASTM E283: Rate of Air leakage – passed.
h. ASTM E331: Water penetration – upt to 20.88 psf.
i. ASTM E330: Pressure resistance - +62.66 psf, -56.39 psf.
j. Joint movement capability: +/- 25%
k. Color: Colors as selected.
2. Manufacturers:
a. Emseal – Colorseal.
3. Applications: Use for:
a. Control, expansion, and soft joints in masonry and concrete between ½" and 8" in width. This product type must be used for all exterior masonry expansion and control joints.

b. Joints between dissimilar materials such as soffit to wall, siding to masonry, etc. where the joint is between ½" and 8" in width.
c. May also be used as an alternative to sealant type ES-A or ES-B.

I. Sealant Type CS-B
1. Pre-compressed fire-rated foam sealer system.
a. Expanding polyurethane foam impregnated with fire-retardent acrylic blend and bonded to intumescent sealant.
b. Silicone external weather facing on both faces.
c. Epoxy adhesive primer.
d. Silicone Sealant for application as bands.
e. UL 2079: 2 or 3 hour fire protection.
f. Joint movement capability: +/- 25%
g. STC 64/OITC 52 when tested in a STC 68/OITC 51 wall assembly.
h. Color: Colors as selected.
2. Manufacturers:
a. Emseal – Emshield WFR2 or WFR3.
3. Applications: Use for:
a. Control, expansion, and soft joints in masonry and concrete between ½" and 6" in width where a fire rating is required and as an alternative to products specified in section 07 84 00.
b. Joints between dissimilar materials such as soffit to wall, siding to masonry, etc. where the joint is between ½" and 6" in width where a fire rating is required and as an alternative to products specified in section 07 84 00.
c. Other joints in accordance with the manufacturer's recommendations, between ½" and 6" in width, where a fire-rating is required and as an alternative to products specified in section 07 84 00, or where sound attenuation is required by the assembly.
d. Utilize WFR2 for assemblies requiring a 2 hour or less fire rating. Utilize WFR3 for assemblies requiring a 3 hour or less fire rating.
e. As an alternative to sealant type ES-A or ES-B.

J. Sealant Type CS-C
1. Pre-compressed fire-rated and pick resistant foam sealer system.
a. Fire-retardant expanding foam.
b. Intumescent fire-proofing material on each face of foam, factory applied.
c. Tamper resistant hardened polyurethane waterproof coating factory applied to faces.
d. Polyurethane Sealant for application as band seals.
e. UL 2079: 2 hour fire protection.
f. Joint movement capability: +/- 25%
g. STC 64/OITC 52 when tested in a STC 68/OITC 52 wall assembly.
h. Color: Colors as selected.
2. Manufacturers:
a. Emseal – SecuritySeal SSW2.
3. Applications: Use for:
a. Control, expansion, and soft joints in masonry and concrete between ½" and 6" in width where a fire rating of up to 2 hours is required and as an alternative to products specified in section 07 84 00.
b. Joints between dissimilar materials such as soffit to wall, siding to masonry, etc. where the joint is between ½" and 6" in width where a fire rating of up to 2 hours is required and as an alternative to products specified in section 07 84 00.
c. Other joints in accordance with the manufacturer's recommendations, between ½" and 6" in width, where a fire-rating up to 2 hours is required and as an alternative to products specified in section 07 84 00.
d. Joints indicated in sealant types ES-A, ES-B, and CS-A where adjacent to sidewalks, or where accessible to students in schools.
e. As an alternative to sealant type ES-A or ES-B.

K. Sealant Type CS-D
1. Pre-compressed traffic rated foam sealer system.
a. Expanding polyurethane foam impregnated with fire-retardent acrylic blend and bonded to intumescent sealant on one side.
b. Silicone external weather facing on the other side.
c. Field applied Epoxy adhesive.
d. ASTM D3574: Tensile Strength – 22.3 psi min.
e. ASTM C711: Temperature service range - -40°F to 185°F.
f. Joint movement capability: +30% - 25%
g. Color: Grey.
2. Manufacturers:
a. Emseal – DSM System.
3. Applications: Use for:
a. Control and expansion joints in concrete traffic areas with widths between ½" and 6" in width.
b. Other joints in accordance with the manufacturer's recommendations, between ½" and 6" in width.
c. As an alternative to sealant type ES-E.

L. Sealant Type CS-E
1. Pre-compressed fire-rated, pick resistant, and traffic rated foam sealer system.

a. Expanding polyurethane foam impregnated with fire-retardent acrylic blend and bonded to intumescent sealant.
b. Tamper resistant hardened polyurethane waterproof coating factory applied to faces.
c. Polyurethane Sealant for application as band seals.
d. UL 2079: 2 hour fire protection.
e. Joint movement capability: +/- 25%
f. STC 64/OITC 52 when tested in a STC 68/OITC 52 wall assembly.
g. Color: [Standard colors matching finished surfaces] [Colors as selected] [White].

2. Manufacturers:
   a. Emseal – SecuritySeal SSW2.
3. Applications: Use for:
   a. Control and expansion joints in concrete traffic areas with widths between ½" and 4" in width where a fire-rating is required.
   b. Other joints in accordance with the manufacturer's recommendations, between ½" and 4" in width.
   c. Utilize SSF2 for assemblies requiring a 2 hour or less fire rating. Utilize SSF3 for assemblies requiring a 3 hour or less fire rating.
   d. As an alternative to sealant type ES-E.
   e. Joints indicated in sealant types ES-E, where accessible to students in schools.

M. Sealant Type CS-F
1. Pre-compressed NSF-Compliant foam sealer system.
   a. Open-cell polyurethane expanding foam impregnated with anon-drying, water-based, stabilized, polymer-modified acrylic.
   b. Factory applied Silicone external facing.
   c. Field applied Epoxy Adhesive.
   d. Field applied NSF-compliant silicone sealant as edge beads.
   e. NSF/ANSI Standard 61: compliant.
   f. FDA regulation CFR 177.2600: Compliant for indirect food contact.
   g. ASTM C711: Temperature service range - -40°F to 185°F.
   h. Joint movement capability: +/- 25%
   i. Color: White.
2. Manufacturers:
   a. Emseal – DSF System.
3. Applications: Use for:
   a. Joints between similar and dissimilar materials in food preparation and storage areas where the joint is between ½" and 8" in width.

N. Sealant Type CS-G
1. Pre-compressed foam sealer system for horizontal applications.
   a. Open-cell polyurethane expanding foam impregnated with water-based, polymer-modified asphalt.
   b. Field applied epoxy adhesive.
   c. Field applied polymer modified rubberized asphalt emulsion top coat.
   d. ASTM D3574: Tensile Strength – 21 psi min.
   e. ASTM C711: Temperature service range - -40°F to 185°F.
   f. Joint movement capability: +/- 25%
   g. Color: [Black].
2. Manufacturers:
   a. Emseal – 20H System.
3. Applications: Use for:
   a. Control, expansion, and soft joints in masonry and concrete below grade and between ½" and 3" in width.

O. Sealant Type CS-H
1. Pre-compressed foam sealer system.
   a. Open-cell polyurethane expanding foam impregnated with anon-drying, water-based, stabilized, polymer-modified acrylic.
   b. Silicone external weather facing, factory applied.
   c. Silicone Sealant for application as bands.
   d. ASTM D3574: Tensile Strength – 21 psi min.
   e. ASTM C711: Temperature service range - -40°F to 185°F.
   f. Joint movement capability: +/- 25%
   g. Color: Colors as selected.
2. Manufacturers:
   a. Emseal – Horizontal Colorseal.
3. Applications: Use for:
   a. Horizontal joints between similar and dissimilar materials in non-traffic areas where the joint is between ½" and 8" in width.
   b. As an alternative to sealant type ES-E in non-traffic areas.

P. Sealant Type CS-I
1. Pre-compressed submersible foam sealer system.
   a. Open-cell polyurethane expanding foam impregnated with anon-drying, water-based, stabilized, polymer-modified acrylic.
   b. Silicone external weather facing, factory applied.
   c. Silicone Sealant for application as bands.
   d. NSF/ANSI Standard 61: compliant.
   e. FDA regulation CFR 177.2600: Compliant for indirect food contact.
   f. Joint movement capability: +/- 25%
   g. Color: White.
2. Manufacturers:
   a. Emseal – Submerseal.
3. Applications: Use for:

a. Joints between similar and dissimilar materials in continuous immersion/submersion of potable, chlorinated, or saline water and where the joint is between 1" and 4" in width.

Q. Sealant Type CS-J
1. Pre-compressed chemically resistant and submersible foam sealer system.
   a. Open-cell polyurethane expanding foam impregnated with anon-drying, water-based, stabilized, polymer-modified acrylic.
   b. Polysulfide external facing, factory applied.
   c. Polysulfide sealant field applied as bead.
   d. NSF/ANSI Standard 61: compliant.
   e. ASTM C1247 compliant.
   f. ASTM C920: (Polysulfide facing and sealant) Type M, Grade NS, Class 25, Use NT, M, G, and A, except ASTM C510 "Stain and color change".
   g. Joint movement capability: +/- 25%
   h. Color: [Grey].
2. Manufacturers:
   a. Emseal – Chemseal+5
3. Applications: Use for:
   a. Joints between similar and dissimilar materials in contact where the joint is between ½" and 2" in width and exposed to chemicals or solvents. May be used in submersion in conditions up to 5 feet of static head pressure.
   b. Joints between similar and dissimilar materials in continuous immersion/submersion of potable, chlorinated, or saline water and where the joint is between ½" and 2" in width. May be used in submersion in conditions up to 5 feet of static head pressure.

## 2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing:
1. Pre-compressed foam sealer system, compatible with sealant;
   a. Backerseal (Greyflex) manufactured by Emseal.
   b. Open-cell polyurethane foam impregnated with anon-drying, water-based, stabilized, polymer-modified acrylic adhesive.
   c. Sized per manufacturer for proper sealing of joint width.
   d. Non-staining.
2. Round foam rod compatible with sealant;
   a. ASTM [D1056, sponge or expanded rubber].
   b. Oversized 30 to 50 percent larger than joint width.
   c. Non-staining.
3. Round elastomeric tubing compatible with sealant.
   a. [D1056 Neoprene, Butyl, or Silicone tubing];
   b. Oversized 30 to 50 percent larger than joint width.
   c. Non-staining.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
1. Non-staining.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces and or joint openings are ready to receive work.

C. Verify joint backing and release tapes are compatible with sealant.

## 3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints.

C. Perform preparation in accordance with ASTM C1193.

D. Protect elements surrounding Work of this section from damage or disfiguration.

## 3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Perform acoustical sealant application work in accordance with ASTM C919.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer , except where specific dimensions are indicated.

D. Tool joints concave.

E. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

F. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

## 3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent soiled surfaces.

**3.5 PROTECTION OF INSTALLED CONSTRUCTION**

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect sealants until cured.

**3.6 SCHEDULE**

A. Reference uses in sealant descriptions this specification and match sealant applied in field to uses listed.

B. Note that there are some conditions where both elastomeric and compressible sealers are indicated. Where both indicate the same use, it is Contractor's option which sealant to use.

**END OF SECTION**

# DIVISION 8
## OPENINGS

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

**SECTION 08 12 14**

**STANDARD STEEL FRAMES**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes non-fire rated, FEMA 361 approved, and, acoustically insulated steel frames.
   1. Provide frames for interior doors and exterior FEMA 361 rated doors.
   2. Provide frames for interior glazed lites.

B. Related Sections:
   1. Section 04 20 00 - Unit Masonry: Masonry grout fill of metal frames and placement of anchors into masonry wall construction.
   2. Section 08 13 14 - Standard Steel Doors.
   3. 08 14 16 – Flush Wood Doors
   4. Section 08 71 00 - Door Hardware: Hardware, silencers, and weatherstripping.
   5. Section 08 80 00 - Glazing.

### 1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. Federal Emergency Management:
   1. FEMA 361 – Design and Construction Guidance for Community Safe Rooms.

D. Underwriters Laboratories Inc.:
   1. UL 1784 - Air Leakage Tests of Door Assemblies.
   2. UL ZHLA Windstorm-rated Assemblies

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.

C. Product Data: Submit frame configuration and finishes.

D. Manufacturer's Installation Instructions: Submit special installation instructions.

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

### 1.4 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

B. For Tornado Resistant Frames, ensure frame is a component in a complete FEMA 361 rated Windstorm Assembly provided.

### 1.5 QUALIFICATIONS

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

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept frames on site in manufacturer's packaging. Inspect for damage.

C. Break seal on-site to permit ventilation.

### 1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with frame opening construction, door, and hardware installation.

C. Sequence installation to accommodate required door hardware electric wire connections as indicated in Section 08 71 00.

## PART 2 PRODUCTS

### 2.1 STANDARD STEEL FRAMES

A. Manufacturers:
   1. Ceco Door Products.
   2. Curries.
   3. Republic Doors and Frames
   4. Steelcraft.
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Standard shop fabricated steel frames, non-rated types.
   1. Frame Profiles:
      a. Frames in masonry walls, existing opening, or other conditions where frame does not wrap drywall;
         1) Ceco – Series SQ
         2) Curries – Masonry profile M equal rabbets
         3) Republic – ME Series equal rabbeted
         4) Steelcraft – F Series double equal rabbet.
   2. Interior Frames:
      a. Level 1, nominal 18 gage/0.042 inch thick material, base metal thickness.
      b. Level 2, nominal 16 gage/0.053 inch thick material, base metal thickness.
      c. Level 3, nominal 16 gage/0.053 inch thick material, base metal thickness.
      d. Level 4, nominal 14 gage/0.067 inch thick material, base metal thickness.

### 2.2 TORNADO RESISTANT OPENING SYSTEMS - STEEL FRAMES

A. Manufacturers:

1. Steelcraft FW14 as design basis, UL ZHLA.3 and ZHLA.4 Windstorm-rated Assemblies.
2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Standard shop fabricated steel frames. These frames are one component of a tested and approved assembly meeting FEMA 361 requirements. Reference sections 08 13 14 and 08 71 00 for other components.
1. Frame Profiles:
a. Frames in masonry walls, existing opening, or other conditions where frame does not wrap drywall; Unequal double rabbet.
2. Exterior Frames:
a. Level 3, nominal 14 gage/0.067 inch thick material, base metal thickness.

**2.3 ACCESSORIES**

A. Primer: ANSI A250.10 rust inhibitive type.

B. Silencers: Resilient rubber set in fitted into drilled hole.
1. Trimco 1229A or approved equal.
2. Coordinate with Section 08 71 00.

C. Weatherstripping: As specified in Section 08 71 00.

D. Anchors:
1. At Masonry: Wire Masonry Anchors (WMA)

**2.4 FABRICATION**

A. Fabricate frames as welded unit (SUA).

B. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes. Provide hardware reinforcement as follows:
1. Hinges: 10 gage.
2. Closers: 14 gage.
3. Exit Devices: 14 gage.
4. Locks: 14 gage.

C. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

D. Prepare frames for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors without mullions.

E. Fabricate frames to suit masonry wall coursing with 4 inch and 2 inch head members as indicated on Drawings.

**2.5 SHOP FINISHING**

A. Steel Sheet: Galvanealed to ASTM A653/A653M A60.

B. Primer: Baked.

C. Factory Finish: Baked prime paint over phosphatized steel.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes and tolerances are acceptable.

**3.2 INSTALLATION**

A. Install frames in accordance with ANSI A250.8.

B. Coordinate with masonry, gypsum board, and concrete wall construction for anchor placement.

C. Coordinate installation of glass and glazing specified in Section 08 80 00.

D. Coordinate installation of frames with installation of hardware specified in Section 08 71 00 and doors in Section 08 13 14, and 08 14 16.

E. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

F. Install mineral wool sound batt insulation in door frame to fill all crevices at all framed sound rated partitions and where sound rated doors are scheduled.

**3.3 ERECTION TOLERANCES**

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

**3.4 SCHEDULE**

A. Exterior FEMA 361 Rated Frames:
1. Doors 143. 145.1, 145.2, 145.3, 146, 147, 148.1, 148.2, 171, 172, 173, 174.
2. Insulate frames with mineral wool.
3. All frames at these doors are a component in a tested and approved FEMA 361 rated assembly. Other components specified in sections 08 13 14 and 08 71 00 must be included as part of the tested assembly.

B. Interior Welded Frames:
1. Level 2: Doors 156.1, 156.2, 157, 167, 168, 175.1, 175.2
2. Level 3: Doors 161, 164

C. Sound Insulation at Frames
1. Doors 143. 145.1, 145.2, 145.3, 146, 147, 148.1, 148.2, 161, 164, 171, 172, 173, 174.

D. Refer to Door and Frame Schedule in Drawings for additional information.

**END OF SECTION**

**SECTION 08 13 14**

**STANDARD STEEL DOORS**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes non-fire rated, FEMA 361 rated, and thermally insulated steel doors.

B. Related Sections:
1. Section 08 12 14 - Standard Steel Frames.
2. Section 08 71 00 - Door Hardware.
3. Section 09 90 00 - Painting and Coating: Field painting of doors.

### 1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM C1363 - Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E413 - Classification for Rating Sound Insulation.

C. Federal Emergency Management:
1. FEMA 361 – Design and Construction Guidance for Community Safe Rooms.

D. Hollow Metal Manufacturers Association:
1. HMMA 810 - Hollow Metal Doors.

E. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and other Opening Protectives.
3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

F. Steel Door Institute:
1. SDI 108 - Recommended Selection and Usage Guide for Standard Steel Doors.

G. Underwriters Laboratories Inc.:
1. UL 10B - Fire Tests of Door Assemblies.
2. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
3. UL 1784 - Air Leakage Tests of Door Assemblies.
4. UL ZHLA Windstorm-rated Assemblies.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing..

C. Product Data: Submit door configurations, location of cut-outs for hardware reinforcement.

D. Manufacturer's Installation Instructions: Submit special installation instructions.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

### 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI A250.8.

B. Surface Burning Characteristics:
1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

D. For Tornado Resistant Doors, ensure door is a component in a complete FEMA 361 rated Windstorm Assembly provided.

### 1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Break seal on site to permit ventilation.

### 1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with door opening construction, door frame, and door hardware installation.

C. Coordinate installation to accommodate door hardware electric wire connections.

## PART 2 PRODUCTS

### 2.1 STANDARD STEEL DOORS

A. Manufacturers: Rated and non-rated doors
1. Ceco Door Products: Imperial
2. Curries – 707 Series
3. Republic Doors and Frames: DE Series
4. Steelcraft – SL Series

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description:
1. Interior Doors (Non-Rated): ANSI A250.8, SDI 108, 1-3/4 inch thick.
a. Level 2 - Heavy Duty, Model 2, seamless design.

C. Face: Steel sheet in accordance with ANSI A250 and SDI 108, minimum 14 gage for Tornado Resistant Systems.

D. End Closure: Channel, 0.053 inches thick, inverted.

E. Core: polyurethane.

F. Thermal Insulated Door: Total insulation R-Value of 6.5 measured in accordance with ASTM C1363.

**2.2 TORNADO RESISTANT OPENING SYSTEMS - STEEL DOORS**

A. Manufacturers: Rated and non-rated doors
1. Steelcraft – PW Series as design basis, UL ZHLA.3 and ZHLA.4 Windstorm-rated Assemblies.
2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Standard shop fabricated steel doors, These doors are one component of a tested and approved assembly meeting FEMA 361 requirements. Reference sections 08 12 14 and 08 71 00 for other components.
1. Exterior Doors (Insulated): ANSI A250.8, SDI 108, 1-3/4 inch thick.
a. Level 3 - Extra heavy Duty, Model 2, seamless design.

**2.3 TORNATDO RESISTANT OPENING SYSTEM COMPONENTS**

A. Face: Steel sheet in accordance with ANSI A250 and SDI 108, minimum 14 gage for Tornado Resistant Systems.

B. Stiffening Core: 18 gage steel minimum.

C. Edges: Mechanical Interlock Edges at lock and hinge edges, with seams welded, filled, and ground smooth for full height of door.

D. End Closure: Channel, 0.067 inches thick, inverted. Additional 12 gage flush top panel welded to inverted channel.

E. Core: polystyrene.

F. Thermal Insulated Door: Total insulation R-Value of 6.5 measured in accordance with ASTM C1363.

**2.4 ACCESSORIES**

A. Primer: ANSI A250.10 rust inhibitive type.

**2.5 FABRICATION**

A. Fabricate doors with hardware reinforcement welded in place. Provide mortar/plaster guard boxes. Provide reinforcement as follows:
1. Hinges: 10 gage minimum
2. Closers: 12 gage minimum
3. Exit Devices: 14 gage minimum
4. Kick plates: 14 gage minimum.
5. Lock Reinforcement: 12 gage, full height at Tornado Resistant Systems.

**2.6 SHOP FINISHING**

A. Steel Sheet: Galvanized to ASTM A653/A653M A60.

B. Primer: Baked.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify opening sizes and tolerances are acceptable.

**3.2 INSTALLATION**

A. Install doors in accordance with ANSI A250.8.

B. Install door louvers, plumb and level.

C. Coordinate installation of doors with installation of frames specified in Section 08 12 14 and hardware specified in Section 08 71 00.

D. Touch-up damaged shop finishes.

**3.3 ERECTION TOLERANCES**

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

**3.4 ADJUSTING**

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for adjusting.

B. Adjust door for smooth and balanced door movement.

**3.5 SCHEDULE**

A. Exterior Doors
1. Level 3 FEMA 361 Rated Doors– Doors 143, 146, 147, 148.1, 148.2, 171, 172, 173, 174.
2. All doors at these locations are a component in a tested and approved FEMA 361 rated assembly. Other components specified in section s 08 12 14 and 08 71 00 must be included as part of the tested assembly.

B. Interior Doors
1. Level 2 – Doors 175.1, 175.2

C. Refer to Door and Frame Schedule in Drawings for additional information.

**END OF SECTION**

**SECTION 08 14 16**

**FLUSH WOOD DOORS**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Flush wood doors.
   2. Door glazing.
   3. Door louvers.

B. Related Requirements:
   1. Section 08 12 14 - Standard Steel Frames.
   2. Section 08 71 00 - Door Hardware.
   3. Section 08 80 00 - Glazing.

### 1.2 REFERENCE STANDARDS

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.

B. ASTM International:
   1. ASTM E413 - Classification for Rating Sound Insulation.

C. Architectural Woodwork Institute:
   1. AWI AWS - Architectural Woodwork Standards.

D. California Department of Health Services:
   1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

E. Consumer Products Safety Commission:
   1. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing.

F. Forest Stewardship Council:
   1. FSC Guidelines - Forest Stewardship Council Guidelines.

G. Hardwood Plywood and Veneer Association:
   1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

H. National Electrical Manufacturers Association:
   1. NEMA LD 3 - High Pressure Decorative Laminates.

I. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.
   2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and other Opening Protectives.
   3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

J. Underwriters Laboratories Inc.:
   1. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
   2. UL 1784 - Air Leakage Tests of Door Assemblies.

K. Wood Window and Door Manufacturers Association:
   1. WDMA I.S 1A - Architectural Wood Flush Doors.

### 1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with door opening construction, door frame and door hardware installation.

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
   1. Submit data for door core materials and construction.
   2. Submit data for veneer species, type and characteristics.
   3. Submit data for factory finishes.

C. Shop Drawings:
   1. Indicate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, and factory machining criteria.
   2. Indicate cutouts for glazing and louvers.

D. Samples:
   1. Submit two sample chains of door veneer, 3x3 inch minimum in size illustrating wood grain, stain color, and sheen.

E. Manufacturers' Instructions: Submit special installation instructions.

F. Qualification Statements:
   1. Submit manufacturer experience qualifications.

### 1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AWI AWS Section 9, Custom Grade.

B. Finish doors in accordance with AWI AWS Section 5 Custom Grade.

### 1.6 QUALIFICATIONS

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

### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer when stored more than one week.

C. Accept doors on site in manufacturer's packaging. Inspect for damage.
   1. Break seal on site to permit ventilation.

### 1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

C. Interior Doors:
   1. Factory Finished Doors: Furnish manufacturer's life of installation warranty.

## PART 2 PRODUCTS

### 2.1 FLUSH WOOD DOORS

A. Manufacturer List:
   1. Algoma Hardwoods Inc.
   2. Eggers Industries.
   3. Graham Manufacturing Corp.
   4. Marshfield Door Systems.
   5. Mohawk Flush Doors, Inc.
   6. VT Industries.
   7. Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

B. Flush Interior Doors: Solid core non-rated and 20 minute fire rated doors.
   1. Thickness: 1-3/4 inches
   2. Core: Urea free PC.
   3. Face Construction: Five ply.
      a. Wood-based composite crossbanding.
      b. Natural Birch veneer rotary cut book matched.
   4. Performance Duty Level: Heavy duty and Extra heavy duty as scheduled.
   5. Quality Grade: AWI AWS Custom.

C. Flush Interior Doors: Solid core on fire rated 45 minutes or greater.
   1. Thickness: 1-3/4 inches
   2. Core: FD.
   3. Face Construction: Five ply.
      a. Wood-based composite crossbanding.
      b. Natural Birch veneer rotary cut book matched.
   4. Performance Duty Level: Heavy duty and Extra heavy duty as scheduled.
   5. Quality Grade: AWI AWS Custom.

D. Transom Panels: Match doors.

E. Performance / Design Criteria:
   1. Performance Duty Level: WDMA I.S. 1A.
   2. Fire Resistance: As indicated on Drawings.

### 2.2 MATERIALS

A. Door Cores: AWI AWS Section 9.
   1. Solid Core, Non-Fire Rated and 20 Minute Fire Rated:
      a. Type: PC; urea-free particleboard or agrifiber, ANSI A208.1 grade LD-2.

B. Interior Door Faces:
   1. Transparent Finished Faces: Wood veneer.
      a. Species: White Natural birch
      b. Veneer Cut: Rotary cut.
      c. Veneer Matching: Book matched.
      d. Face Matching: Balanced. Pair match multiple door leaves in single opening.

C. Cross Banding Behind Wood Veneer and HPDL Finish: One ply; wood fiber based composite.

D. Top and Bottom Rail:
   1. 2 5/8" minimum wide hardwood rail.

E. Stiles:
   1. 1 3/4" wide hardwood stile.

F. Facing Adhesive: Type II – water resistant.

### 2.3 FABRICATION

A. Fabricate doors in accordance with AWI AWS Section 9 requirements.

B. Furnish lock blocks at lock edge, across face of door for panic devices and kick plates, and top of door for closer, for reinforcement of hardware specified.

C. Vertical Exposed Edge of Stiles: Wood veneer matching door facing.

D. Fit door edge trim to edge of stiles after applying veneer facing.

E. Bond edge banding to cores.

F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Furnish solid blocking for through bolted hardware.

G. Factory fit doors for frame opening dimensions identified on shop drawings.

H. Cut and configure exterior door edge to receive recessed weather stripping devices.

I. Provide edge clearances in accordance with AWI AWS Section 9.

### 2.4 FINISHES

A. Finish work in accordance with AWI AWS Section 5; Custom Grade.

B. Transparent Finish System: Stained, color as selected; sheen as selected.
   1. System 9; UV curable epoxy, polyester, urethane.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### 3.2 INSTALLATION

A. Install doors in accordance with AWI AWS Section 9 and manufacturer's instructions.

B. Coordinate installation of doors with installation of frames specified in Section 08 12 14 and hardware specified in Section 08 71 00.

**3.3 TOLERANCES**

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Conform to AWI AWS Section 9 requirements for the following:
   1. Fit and clearance tolerances.
   2. Gaps.
   3. Flushness.
   4. Flatness.
   5. Squareness.

**3.4 ADJUSTING**

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust door for smooth and balanced door movement.

C. Adjust door closer for full closure.

**3.5 ATTACHMENTS**

A. Unless noted otherwise below, all doors are solid core;

B. Heavy Duty: Doors 156.1, 164, 167, 168.

C. Extra-Heavy Duty: Doors 161, 164

D. Color Sealer on top rail: at all doors.

E. Refer to Door and Frame Schedule in drawings for required fire ratings.

F. Refer to Door and Frame Schedule in drawings for more information.

**END OF SECTION**

**SECTION 08 41 13**

**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes aluminum-framed FEMA 361 rated doors, frames, and built up window systems including aluminum and glass doors and frames.

B. Related Sections:
   1. Section 03 30 00 – Cast-in-Place Concrete: Substrate.
   2. Section 04 20 00 - Unit Masonry: Abutting substrates, flashing membranes.
   3. Section 07 90 00 - Joint Protection: System perimeter sealant and back-up materials.
   4. Section 08 71 00 - Door Hardware: hardware items other than specified in this section.

### 1.2 REFERENCES

A. Aluminum Association:
   1. AA ADM 1 - Aluminum Design Manual.

B. American Architectural Manufacturers Association/Window & Door Manufacturers Association:
   1. AAMA/WDMA 101/I.S.2 - Specification for Windows, Doors and Unit Skylights.
   2. AAMA 501.7-11 0 Standard test method and performance specification of a side-hinged exterior door system.
   3. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Glass Doors.
   4. AAMA 503 - Voluntary Specification for Field Testing of Metal Storefronts. Curtain Wall and Sloped Glazing Systems.
   5. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
   6. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
   7. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
   8. AAMA MCWM-1 - Metal Curtain Wall Manual.
   9. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.

C. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   7. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   8. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   9. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   10. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Differential.
   11. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.
   12. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
   13. ASTM E1996 – Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Windborne Debris in Hurricanes.

E. Federal Emergency Management:
   1. FEMA 361 – Design and Construction Guidance for Community Safe Rooms.

F. International Code Congress:
   1. ICC-500 – Standard for the Design and Construction of Storm Shelters.

G. National Fenestration Rating Council Incorporated:
   1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.

H. SSPC: The Society for Protective Coatings:
   1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
   2. SSPC Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.

I. Underwriters Laboratories:

1. UL 752 – Standard of Safety for Bullet-Resisting Equipment.

**1.3 SYSTEM DESCRIPTION**

A. Aluminum-framed storefront system includes tubular aluminum sections aluminum and glass entrances, shop fabricated, factory finished, related flashings, anchorage and attachment devices, for a FEMA 361 rated assembly. Door hardware as specified in Section 08 71 00 and as required to meet the FEMA 361 rated assembly requirements.

B. System Assembly:
1. Doors: Factory assembled.
2. Framing: Site assembled.
3. Glazing in Framing: Site installed.

**1.4 PERFORMANCE REQUIREMENTS**

A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners.
1. As calculated in accordance with applicable code, as tested in accordance with ASTM E330, FEMA 361, and ICC 500.

B. Wind-Borne Debris Loads: Design and size glass to withstand missile loads as defined by FEMA 361 and ICC 500.

C. Deflection: Limit mullion deflection to 1/175 for spans under 13'-6" and 1/240 plus 1/4 inch for spans over 13'-6" of span; with full recovery of glazing materials.

D. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.

E. Air Infiltration: Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area, measured at reference differential pressure across assembly of 6.24 psf as measured in accordance with ASTM E283.

F. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and inner sheet of infill panel and heel bead of glazing compound.

G. Water Leakage: None, when measured in accordance with ASTM E331with test pressure difference of 20 percent of design pressure, with minimum differential of 2.86 lbf/sq ft and maximum of 12.00 lbf/sq ft.

H. Thermal and Solar Heat Transmittance of Assembly (U Value and SHGC): Comply with ICC IEEC for climate zone in which project is located.

I. Expansion / Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components and anchorage.

J. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

K. Structural Design Data: Reference Structural drawings.

**1.5 SUBMITTALS**

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

C. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, metal infill panels, finished brake metal, and internal drainage details.

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

E. Testing Approval: Provide tested assembly approval number compliant with FEMA 361 requirements.

**1.6 QUALITY ASSURANCE**

A. Perform Work in accordance with AAMA SFM-1 and AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

**1.7 QUALIFICATIONS**

A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum three years documented experience. Framing, door, hardware, and glazing installers must be approved by Manufacturer.

**1.8 MOCKUP**

A. Section 01 40 00 - Quality Requirements: Mockup requirements.

B. Construct exterior storefront/window mockup, matching size of high windows, including masonry, all framing, flashings, glazing, and accessories.
1. Mock-up shall include all typical joints and transitions, including sill, head or top of wall, and where adjoining dissimilar materials. If the mock-up is to be erected at a portion of the storefront indicated in the drawings.

C. Locate where directed by Architect/Engineer.

D. Accepted mockup in the building construction may be incorporated as completed Work.

**1.9 PRE-INSTALLATION MEETINGS**

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

**1.10 DELIVERY, STORAGE, AND PROTECTION**

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Handle Products of this section in accordance with AAMA MCWM-1 - Curtain Wall Manual #10.

C. Protect finished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

**1.11 ENVIRONMENTAL REQUIREMENTS**

A. Section 01 60 00 - Product Requirements.

B. Do not install sealants nor glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

**1.12 COORDINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify that field measurements are as indicated on the shop drawings.

C. Coordinate work of this section with installation door hardware specified in Section 08 71 00.

**1.13 WARRANTY**

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for complete system for failure to meet specified requirements.

**PART 2 PRODUCTS**

**2.1 ALUMINUM-FRAMED STOREFRONTS**

A. Manufacturers:
   1. Insulgard Security Products
      a. Series TH350 as design basis for doors.
      b. Series TH600 as design basis for framing and glazing assemblies.
   2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description – Exterior Applications:
   1. Aluminum Frame: Thermally broken; flush glazing stops; drainage holes; internal weep drainage system.
      a. Depth of Frame: 6 inches.
      b. Face Dimension: 2-1/2 inches.
   2. Doors: Aluminum framed glass doors; 1-3/4 inches thick, 2-3/8" narrow stile; beveled glazing stops.

**2.2 COMPONENTS**

A. Extruded Aluminum: ASTM B221; 6061 alloy, T6 temper.

B. Glass: Laminated glazing designed for impact resistance.
   1. Insulgard Security Products Tor-Gard NBR2 as design basis.

C. Hardware:
Ensure hardware installed is approved in FEMA 361 tested assembly. Include required multi-point locks, continuous hinges, continuous astragals, door coordinators, carry open devices, thresholds, and any other hardware required to complete the tested assembly requirements. Reference Section 08 71 00 for hardware.

D. Base Sill with end dams on all storefront and window assemblies at all exterior horizontal sill applications.

E. Sealant and Backing Materials:
   1. Sealant Used Within System: Manufacturer's standard materials to achieve weather, moisture, and air infiltration requirements.
   2. Perimeter Sealant: Specified in Section 07 90 00.

F. Fasteners: Stainless steel.

**2.3 FABRICATION**

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to conceal from view.

E. Prepare components with internal reinforcement for door hardware.

F. Reinforce framing members for imposed loads.

**2.4 SHOP FINISHING**

A. Clear Anodized Aluminum Surfaces: AAMA 611, AA-M10C22A31 as fabricated mechanical finish, medium matte brightened finish, and Architectural Class I 0.4 mils clear anodized coating.
   1. All framing, mullions, stops, and brake metal closures and extensions.

B. Concealed Steel Items: Stainless steel type 302 or 304.

C. Apply bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar metals.

D. Extent of Finish:
   1. Apply factory coating to surfaces exposed at completed assemblies.
   2. Apply finish to surfaces cut during fabrication so no natural aluminum is visible in completed assemblies, including joint edges.
   3. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify dimensions, tolerances, and method of attachment with other Work.

C. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

### 3.2 INSTALLATION

A. Install wall system in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent Work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent Work to form water tight dam.

G. Coordinate attachment and seal of perimeter air and vapor retarder materials.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install integral flashings and integral joint sealers.

J. Set thresholds in bed of mastic and secure.

K. Install hardware using templates provided.

L. Coordinate installation of glass with work of other trades.

M. Coordinate installation of perimeter sealants with Section 07 90 00.

### 3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

### 3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspection to monitor quality of installation and glazing.

C. Test to ASTM E1105.

### 3.5 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust operating hardware [and sash] for smooth operation.

### 3.6 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove protective material from pre-finished aluminum surfaces.

C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

D. Remove excess sealant by method acceptable to sealant manufacturer.

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect finished Work from damage.

### 3.8 SCHEDULES

A. Door and framing systems: Doors 145.1, 145.2, 145.3. Reference section 08 71 00 for door hardware.

B. Fixed glazed assemblies in exterior walls: Clerestorey assemblies.

C. Reference Drawings for configurations, details, and schedule.

D. All components must be part of a tested assembly and approved for FEMA 361 applications. Reference structural drawings for impact resistance criteria.

**END OF SECTION**

# SECTION 08 71 00
# DOOR HARDWARE

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes hardware for wood, steel and aluminum doors.
   1. Provide door gaskets, including weatherstripping and seals, and thresholds.

B. Related Sections:
   1. Section 08 12 14 - Standard Steel Frames: Silencers integral with steel frames.
   2. Section 08 13 14 - Standard Steel Doors.
   3. Section 08 14 16 - Flush Wood Doors.
   4. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
   5. Section 10 14 00 - Signage.

### 1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A156.1 - Butts and Hinges.
   2. ANSI A156.2 - Bored and Preassembled Locks and Latches.
   3. ANSI A156.3 - Exit Devices.
   4. ANSI A156.4 - Door Controls - Closures.
   5. ANSI A156.5 - Auxiliary Locks and Associated Products.
   6. ANSI A156.7 - Template Hinge Dimensions.
   7. ANSI A156.8 - Door Controls - Overhead Holders.
   8. ANSI A156.12 - Interconnected Locks and Latches.
   9. ANSI A156.13 - Mortise Locks and Latches.
   10. ANSI A156.14 - Sliding and Folding Door Hardware.
   11. ANSI A156.15 - Closer Holder Release Devices.
   12. ANSI A156.16 - Auxiliary Hardware.
   13. ANSI A156.18 - Materials and Finishes

B. Builders Hardware Manufacturers Association:
   1. BHMA Directory of Certified Products.

C. Federal Emergency Management Agency
   1. FEMA 361 - Design and Construction Guidance for Community Safe Rooms.

D. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.
   2. NFPA 101 – Life Safety Code
   3. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

E. Underwriters Laboratories Inc.:
   1. UL 10B - Fire Tests of Door Assemblies.
   2. UL 305 - Panic Hardware.
   3. UL - Building Materials Directory.
   4. UL ZHLA Windstorm-rated Assemblies.

F. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

### 1.3 PERFORMANCE REQUIREMENTS

A. Fire Rated Openings: Provide door hardware listed by UL or Intertek Testing Services (Warnock Hersey Listed), or other testing laboratory approved by applicable authorities.
   1. Hardware: Tested in accordance with NFPA 252.

B. For Tornado Resistant Doors, ensure hardware is a component in a complete FEMA 361 rated Windstorm Assembly provided.

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, [electrical characteristics and connection requirements].
   2. Submit manufacturer's parts lists, and templates.

C. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

### 1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of installed cylinders and their master key code.

C. Operation and Maintenance Data: Submit data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

D. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

### 1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the following requirements:
   1. ANSI A156 series.
   2. NFPA 80.
   3. UL 305.

B. Furnish hardware marked and listed in BHMA Directory of Certified Products.

### 1.7 QUALIFICATIONS

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

B. Hardware Supplier: Company specializing in supplying commercial and institutional door hardware with minimum three years documented experience and approved by primary hardware manufacturers.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for purpose specified and indicated.

**1.8 PRE-INSTALLATION MEETINGS**

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

C. Include persons involved with installation of doors, frames, and hardware.

**1.9 DELIVERY, STORAGE, AND HANDLING**

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Package hardware items individually with necessary fasteners, instructions, and installation templates, when necessary; label and identify each package with door opening code to match hardware schedule.

**1.10 COORDINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
   1. Provide templates or actual hardware as required to ensure proper preparation of doors and frames.

C. Sequence installation to accommodate required utility connections.

D. Coordinate Owner's keying requirements during course of Work.

**1.11 WARRANTY**

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish minimum one year manufacturer warranty from the date of substantial completion for all hardware components specified in this section, unless noted otherwise this section. If manufacturer's standard term of warranty exceeds this, provide manufacturer's standard term. Coverage will include repair and replacement of all hardware at no charge to the Owner due to manufacturer defect or improper installation.

C. Furnish minimum ten year manufacturer warranty from the date of substantial completion for door closers specified in this section. If manufacturer's standard term of warranty exceeds this, provide manufacturer's standard term.

D. Furnish minimum three year manufacturer warranty from the date of substantial completion for panic hardware specified in this section. If manufacturer's standard term of warranty exceeds this, provide manufacturer's standard term.

**1.12 MAINTENANCE MATERIALS**

A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance materials.

B. Furnish special wrenches and tools applicable for each different and for each special hardware component.

C. Furnish maintenance tools and accessories supplied by hardware component manufacturer.

**1.13 EXTRA MATERIALS**

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish ten extra key lock cylinders for each master keyed group.

**PART 2 PRODUCTS**

**2.1 DOOR HARDWARE**

A. Manufacturers:
   1. Bommer Industries, Inc. – www.bommer.com
   2. Falcon – www.falconlock.com
   3. Glynn-Johnson – www.glynn-johnson.com
   4. Hager Companies – www.hagerco.com
   5. Ives – professional.iveshardware.com
   6. LCN Closers – www.lcnclosers.com
   7. National Guard Products – www.ngpinc.com
   8. Pemko – www.pemko.com
   9. Schlage Lock Co. – www.schlage.com
   10. Securitech – www.securitech.com
   11. Trimco – www.trimcobbw.com
   12. Von Duprin, Inc. – www.vonduprin.com
   13. Substitutions: Section 01 60 00 - Product Requirements.

B. Hinge Manufacturers:
   1. Hager.
   2. Ives.
   3. Bommer.
   4. Substitutions: Section 01 60 00 - Product Requirements.

C. Lockset , Latch Set, and Cylinder Manufacturers:
   1. Falcon, MA Quantum, as design basis.
   2. Schlage
   3. Securitech, as design basis for FEM 361

D. Exit Device Manufacturers:
   1. Von Duprin, Series 99 as design basis.
   2. Falcon
   3. Securitech, as design basis for FEMA 361.
   4. Substitutions: Section 01 60 00 - Product Requirements.

E. Closers Manufacturers:
   1. LCN, 4000 series as design basis.
   2. Falcon.

3. Norton.
4. Substitutions: Section 01 60 00 - Product Requirements.

F. Push/Pulls, Manual and Automatic] Bolts, Protection Plates, Gaskets, Thresholds, and Trim Manufacturers:
1. Ives.
2. Hager.
3. Trimco/BBW.
4. Substitutions: Section 01 60 00 - Product Requirements.

## 2.2 COMPONENTS

A. General Hardware Requirements: Where not specifically indicated, comply with applicable ANSI A156 standard for type of hardware required. Furnish each type of hardware with accessories as required for applications indicated and for complete, finished, operational doors.
1. Templates: Furnish templates or physical hardware items to door and frame manufacturers sufficiently in advance to avoid delay in Work.
2. Reinforcing Units: Furnished by door and frame manufacturers; coordinated by hardware supplier or hardware manufacturer.
3. Fasteners: Furnish as recommended by hardware manufacturer and as required to secure hardware.
   a. Finish: Match hardware item being fastened.
4. Fire Ratings: Provide hardware with UL or Intertek Testing Services (Warnock Hersey Listed) listings for type of application involved.
5. Electrical Devices: Make provisions and coordinate requirements for electrical devices and connections for hardware.

B. Hinges: ANSI A156.1, full mortise type, template type, ANSI A156.7, complying with following general requirements unless otherwise scheduled.
1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
2. Number: Furnish minimum three hinges to 90 inches high, four hinges to 120 inches high for each door leaf.
   a. Fire Rated Doors To 86 inches High: Minimum three hinges.
3. Size and Weight: 4-1/2 inch heavy weight typical for 1-3/4 inch doors.
   a. Doors Over 40 inches Wide: Extra heavy weight ball or oilite bearing hinges.
   b. Doors 1-3/8 inch Thick: 3-1/2 inch size.
   c. Doors 2 inch Thick: 5 inch extra heavy weight ball or oilite bearing.
   d. Doors Over 48 inches Wide: 5 inch extra heavy weight ball or oilite bearing.
4. Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior and locked outswinging doors, non-rising pins at interior doors.
5. Tips: Flat button with Flush tips.

C. Locksets: Furnish locksets compatible with specified cylinders. Typical 2-3/4 inch backset. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt verify type of cutouts provided in metal frames.
1. Mortise Locksets: ANSI A156.13, Series 1000, Grade 1 unless otherwise indicated.

D. Exit Devices: ANSI A156.3, Grade 1 concealed vertical rod type and rim type] as scheduled, with touch pad, unless otherwise indicated. All exit devices shall be UL listed for Accident Hazard or Fire Exit Hardware.
1. Types: Suitable for doors requiring exit devices.
2. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt verify type of cutouts provided in metal frames, with dust-proof floor strikes.
3. Provide latch gaurds.
4. Push Pad to have no plastic insert on Touch Pad.

E. Cylinders: ANSI A156.5, Grade 1, 6 pin type
1. Keying: Keyed as directed by Owner.
2. Include construction keying.
3. Keys: Nickel silver. [Stamp keys with "DO NOT DUPLICATE".]
4. Supply keys in the following minimum quantities:
   a. 5 master keys.
   b. 5 grand master keys.
   c. 5 great grand master keys.
   d. 10 construction keys.
   e. 5 control keys and 10 extra cylinder cores.
   f. 5 change keys for each [bitting.

F. Closers: ANSI A156.4 modern type with cover, surface mounted closers; full rack and pinion type with steel spring and non-freezing hydraulic fluid; closers required for fire rated doors unless otherwise indicated.
1. Adjustability: Furnish controls for regulating closing, latching, speeds, and back checking.
2. Arms: Type to suit individual condition; parallel-arm closers at reverse bevel doors and where doors swing full 180 degrees.
3. Location: Mount closers on inside of exterior doors, room side of interior doors typical; mount on pull side of other doors.
4. Operating Pressure: Maximum operating pressure as follows.
   a. Interior Doors: Maximum 5 pounds.
   b. Exterior Doors: Maximum 10 pounds.
   c. Fire Rated Doors: As required for fire rating, maximum 15 pounds.
5. Door closers shall be furnished with full cover. Sized in accordance with the

manufacturers recommendations for door size and condition.

6. Door closers shall be furnished with backcheck, delayed action, hold-open and advanced backcheck as listed in the Hardware Schedule.
7. Door closers shall be mounted out of the line of sight wherever possible (i.e., room side of corridor doors, etc.) with parallel arm mounting on out swinging doors. Mount closer top jamb or on brackets and/or drop plates, where special conditions call for it. All closer installation on wood doors shall include sex nut bolts.

G. Push/Pulls, Manual and Automatic Bolts, Protection Plates, Gaskets, Thresholds, and Trim: Furnish as indicated in Schedule, with accessories as required for complete operational door installations.
   1. Push/Pulls: ANSI A156.6; push plates minimum 0.050 inch thick. Furnish straight push-pull type pulls with bolts to secure from opposite door face; furnish with minimum 0.050 inch pull plates unless otherwise indicated.

H. Kickplates Door Edging: ANSI A156.6, metal; height indicated in Schedule by 2 inches less than door width; minimum 0.050 inch thick stainless steel.

I. Weatherstripping: Furnish continuous weatherstripping at top and sides of exterior doors.
   1. Fire Rated Gaskets: Furnish continuous fire rated gaskets at top and sides of fire rated doors.

J. Thresholds: Maximum 1/2 inch height.

K. Wall Stops: ANSI A156.1, Grade 1.

L. Floor Stops: ANSI A156.1 Grade 1.

**2.3 ACCESSORIES**

A. Lock Trim: Furnish levers with rose plate as selected from manufacturer's full range of levers and roses.
   1. Do not permit through bolts on solid wood core doors.

B. Through Bolts: Do not permit through bolts and grommet nuts on door faces in occupied areas unless no alternative is possible.
   1. Do not use through bolts on solid wood core doors.

C. Key Cabinet:
   1. Cabinet Construction: Sheet steel construction, piano hinged door with cylinder type lock master keyed to building system.
   2. Cabinet Size: Size for Project keys plus sufficient room to allow for [10] [50] percent growth.
   3. Horizontal strips for key hook labeling with clear plastic strip cover over labels.
   4. Finish: Baked enamel finish, color as selected.

**2.4 FINISHES**

| CATEGORY | FINISH |
|---|---|
| Butts | |
| Interior Non Labeled | 626/652 |
| Interior Labeled | 652 |
| Interior Corrosive Area | 630 |
| Exterior | 630 |
| Locks/Latches | 626 |
| Cylinders | 626 |
| Exit Devices | 626/630 |
| Door Closers | ALUM |
| Door Stops and Holders | 626 |
| Weatherstrip | 689 |
| Threshold | Aluminum |

*Where indicated 630 finish, core metal shall be stainless steel.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify doors and frames are ready to receive door hardware and dimensions are as instructed by manufacturer.

C. Verify electric power is available to power operated devices and is of correct characteristics.

**3.2 INSTALLATION**

A. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.

B. Mounting Heights From Finished Floor to Center Line of Hardware Item: Comply with manufacturer recommendations and applicable codes where not otherwise indicated.
   1. Locksets: 38 inch.
   2. Push/Pulls: 42 inch.
   3. Push Pad Type Exit Devices: 42 inch.
   4. Cross Bar Type Exit Devices: 38 inch.
   5. Top Hinge: Jamb manufacturer's standard, but not greater than 10 inches from head of frame to center line of hinge.
   6. Bottom Hinge: Jamb manufacturer's standard, but not greater than 12-1/2 inches from floor to center line of hinge.
   7. Intermediate Hinges: Equally spaced between top and bottom hinges and from each other.
   8. Hinge Mortise on Door Leaf: 1/4 inch. to 5/16 inch from stop side of door.

**3.3 FIELD QUALITY CONTROL**

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Architect's Architectural Hardware Consultant shall inspect installation and certify hardware

and installation has been furnished and installed in accordance with manufacturer's instructions and as specified. Contractor shall correct all items noted by inspector.

**3.4 ADJUSTING**

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust hardware for smooth operation.

C. Make adjustments and corrections as required by [Architectural Hardware Consultant] [Supplier] [Primary Hardware Manufacturer's] recommendation following inspection.

**3.5 PROTECTION OF INSTALLED CONSTRUCTION**

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit adjacent work to damage hardware or hardware finish.

C. The contractor shall use all means at his disposal to protect all finish hardware items from abuse, corrosion and other damage until the owner accepts the project as complete.

**3.6 HARDWARE SCHEDULE**

**HARDWARE GROUP NO. 01.01**

FOR USE ON MARK/DOOR #(S):
143 146

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HW HINGE | 5BB1HW 4.5 X 4.5 NRP | 630 | IVE |
| 2 | EA | EXIT DEVICE | 8V T 45 G4 IHD TI VC | 630 | SEC |
| 2 | EA | MORTISE CYLINDER | C987 | 626 | FAL |
| 2 | EA | SFIC CONST. CORE | C607CCA | | FAL |
| 2 | EA | SFIC CORE | C607 | 626 | FAL |
| 2 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 2 | EA | FLOOR STOP | FS18L | BLK | IVE |
| 1 | EA | DRIP CAP | 16A | CL | NGP |
| 1 | SET | SEALS | 162S | AL | NGP |
| 1 | SET | ASTRAGAL | 9600A | CL | NGP |
| 2 | EA | DOOR SWEEP | 9600 | AL | NGP |
| 1 | EA | THRESHOLD | 322 | AL | NGP |

PROVIDE HARDWARE REQUIRED TO MEET FEMA 361 REQUIREMENT ON DOORS/FRAMES BEING PROVIDED. MUST MATCH FUNCTION SHOWN ABOVE.

**HARDWARE GROUP NO. 01.02**

FOR USE ON MARK/DOOR #(S):
147 148.1 148.2

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HW HINGE | 5BB1HW 4.5 X 4.5 NRP | 630 | IVE |
| 2 | EA | EXIT DEVICE | 8V T 11 IHD TI VC | 630 | SEC |
| 2 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 2 | EA | FLOOR STOP | FS18L | BLK | IVE |
| 1 | EA | DRIP CAP | 16A | CL | NGP |
| 1 | SET | SEALS | 162S | AL | NGP |
| 1 | SET | ASTRAGAL | 9600A | CL | NGP |
| 2 | EA | DOOR SWEEP | 9600 | AL | NGP |
| 1 | EA | THRESHOLD | 322 | AL | NGP |

PROVIDE HARDWARE REQUIRED TO MEET FEMA 361 REQUIREMENT ON DOORS/FRAMES BEING PROVIDED. MUST MATCH FUNCTION SHOWN ABOVE.

**HARDWARE GROUP NO. 01.03**

FOR USE ON MARK/DOOR #(S):
174

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HW HINGE | 5BB1HW 5 X 4.5 NRP | 630 | IVE |
| 1 | EA | EXIT DEVICE | 8V T 45 G4 IHD TI VC | 630 | SEC |
| 1 | EA | MORTISE CYLINDER | C987 | 626 | FAL |
| 1 | EA | SFIC CONST. CORE | C607CCA | | FAL |
| 1 | EA | SFIC CORE | C607 | 626 | FAL |
| 1 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 1 | EA | FLOOR STOP | FS18L | BLK | IVE |
| 1 | EA | DRIP CAP | 16A | CL | NGP |
| 1 | SET | SEALS | 162S | AL | NGP |
| 1 | EA | DOOR SWEEP | 9600 | AL | NGP |
| 1 | EA | THRESHOLD | 322 | AL | NGP |

PROVIDE HARDWARE REQUIRED TO MEET FEMA REQUIREMENT ON DOORS/FRAMES BEING PROVIDED. MUST MATCH FUNCTION SHOWN ABOVE.

**HARDWARE GROUP NO. 01.04**

FOR USE ON MARK/DOOR #(S):
175.1 175.2

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HW HINGE | 5BB1HW 4.5 X 4 NRP | 652 | IVE |
| 1 | EA | PANIC HARDWARE | 99-NL-990 | 626 | VON |
| 1 | EA | RIM HOUSING | C953 | 626 | FAL |
| 1 | EA | SFIC CONST. CORE | C607CCA | | FAL |
| 1 | EA | SFIC CORE | C607 | 626 | FAL |
| 1 | EA | SURFACE CLOSER | 4040XP REG OR PA AS REQ | 689 | LCN |
| 1 | EA | WALL STOP | WS407CCV | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 01.05**

FOR USE ON MARK/DOOR #(S):
145.1 145.2 145.3

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONTINUOUS HINGE | SL 11HD | AL | SEL |
| 2 | EA | EXIT DEVICE | IG7VT S14 F13E CVR 630 | 630 | SEC |
| 2 | EA | CYLINDER | C987 | 626 | FAL |
| 2 | EA | SFIC CONST. CORE | C607CCA | | FAL |
| 2 | EA | SFIC CORE | C607 | 626 | FAL |
| 2 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 2 | EA | FLOOR STOP | FS18L | BLK | IVE |
| 1 | SET | SEALS | 162S | AL | NGP |
| 2 | EA | DOOR SWEEP | 9600A | CL | NGP |
| 1 | EA | THRESHOLD | 425 | AL | NGP |

PROVIDE HARDWARE REQUIRED TO MEET FEMA 361 REQUIREMENT ON DOORS/FRAMES BEING PROVIDED. MUST MATCH FUNCTION SHOWN ABOVE.

**HARDWARE GROUP NO. 02.01**

FOR USE ON MARK/DOOR #(S):
156.1 156.2 157 167 168

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5PB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | STOREROOM LOCK | MA581H7 QG | 626 | FAL |
| 1 | EA | SFIC CORE | C607 | 626 | FAL |
| 1 | EA | WALL STOP | WS407CCV | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 02.02**

FOR USE ON MARK/DOOR #(S):

172

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 630 | IVE |
| 1 | EA | MORTISE LOCK | 5314 F07M IHD HVL | 630 | SEC |
| 1 | EA | MORTISE CYLINDER | C987 | 626 | FAL |
| 1 | EA | SFIC CONST. CORE | C607CCA | | FAL |
| 1 | EA | SFIC CORE | C607 | 626 | FAL |
| 1 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 1 | EA | FLOOR STOP | FS18L | BLK | IVE |
| 1 | EA | DRIP CAP | 16A | CL | NGP |
| 1 | SET | SEALS | 162S | AL | NGP |
| 1 | EA | DOOR SWEEP | 9600 | AL | NGP |
| 1 | EA | THRESHOLD | 896S | 719 | NGP |

PROVIDE HARDWARE REQUIRED TO MEET FEMA 361 REQUIREMENT ON DOORS/FRAMES BEING PROVIDED. MUST MATCH FUNCTION SHOWN ABOVE.

**HARDWARE GROUP NO. 02.03**

FOR USE ON MARK/DOOR #(S):
171 173

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 630 | IVE |
| 2 | EA | MORTISE LOCK | 8V L 44 G4 IHD TI | 630 | SEC |
| 2 | EA | MORTISE CYLINDER | C987 | 626 | FAL |
| 2 | EA | SFIC CONST. CORE | C607CCA | | FAL |
| 2 | EA | SFIC CORE | C607 | 626 | FAL |
| 2 | EA | SURFACE CLOSER | 4040XP SCUSH | 689 | LCN |
| 2 | EA | FLOOR STOP | FS18L | BLK | IVE |
| 1 | EA | DRIP CAP | 16A | CL | NGP |
| 1 | SET | SEALS | 162S | AL | NGP |
| 1 | SET | ASTRAGAL | 9600A | CL | NGP |
| 2 | EA | DOOR SWEEP | 9600 | AL | NGP |
| 1 | EA | THRESHOLD | 896S | 719 | NGP |

PROVIDE HARDWARE REQUIRED TO MEET FEMA 361 REQUIREMENT ON DOORS/FRAMES BEING PROVIDED. MUST MATCH FUNCTION SHOWN ABOVE.

**HARDWARE GROUP NO. 07.01**

FOR USE ON MARK/DOOR #(S):
161 164

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PUSH PLATE | 8200 4" X 16" | 630 | IVE |
| 1 | EA | PULL PLATE | 8303 10" 4" X 16" | 630 | IVE |
| 1 | EA | CLASSROOM DEAD LOCK | MA911H7 | 626 | FAL |
| 1 | EA | SFIC CORE | C607 | 626 | FAL |
| 1 | EA | SURFACE CLOSER | 4040XP REG OR PA AS REQ | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW | 630 | IVE |
| 1 | EA | WALL STOP | WS407CCV | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**END OF SECTION**

# DIVISION 9
## FINISHES

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

## SECTION 09 51 13
## ACOUSTICAL PANEL CEILINGS

### PART 1 GENERAL

#### 1.1 SUMMARY

A. Section Includes:
   1. Suspended metal grid ceiling system and perimeter trim.

B. Related Requirements:
   1. Section 04 20 00 – Unit Masonry Assemblies.
   2. Section 07 90 00 - Joint Protection.
   3. Section 21 13 13 – Wet-Pipe Sprinkler Systems: Sprinkler heads in ceiling system.
   4. 26 51 00 - Interior Lighting: Light fixtures in ceiling system.
   5. Section 27 51 16 - Public Address and Mass Notification Systems: Speakers in ceiling system.
   6. Section 28 31 00 - Fire Detection and Alarm: Fire alarm components in ceiling system.

#### 1.2 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   2. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   4. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   5. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

B. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. Ceilings and Interior Systems Construction Association:
   1. CISCA - Acoustical Ceilings: Use and Practice.

D. National Fire Protection Association:
   1. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

#### 1.3 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

#### 1.4 SEQUENCING

A. Section 01 10 00 - Summary: Requirements for sequencing.

B. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

#### 1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on metal grid system components.

#### 1.6 QUALITY ASSURANCE

A. Conform to CISCA requirements.

B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

#### 1.7 QUALIFICATIONS

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

B. Installer: Company specializing in performing work of this section with minimum three years experience.

### PART 2 PRODUCTS

#### 2.1 SUSPENDED ACOUSTICAL CEILINGS

A. Manufacturer and Product List:
   1. Armstrong.
   2. CertainTeed.
   3. United States Gypsum Company.
   4. Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

B. Performance / Design Criteria:
   1. Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1/360 of span. Assume ceiling panels will be installed in the calculations.

#### 2.2 COMPONENTS

A. Grid:
   1. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T; components die cut and interlocking.
   2. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
   3. Exposed Grid Surface Width: 15/16 inch.
   4. Perimeter Molding Width: Match grid width.
   5. Grid Finish: White.
   6. Accessories: Stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required for suspended grid system.
   7. Support Channels and Hangers: Galvanized steel; size and type to suit application, and ceiling system flatness requirement specified.

**2.3 ACCESSORIES**

A. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.

B. Touch-up Paint: Type and color to match acoustic and grid units.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify layout of hangers will not interfere with other work.

**3.2 INSTALLATION**

A. Lay-In Grid Suspension System:
1. Install suspension system in accordance with ASTM C635, ASTM C636 and as supplemented in this section.
2. Install system capable of supporting imposed loads with maximum deflection of 1/360 maximum.
3. Locate system on room axis according to reflected plan.
4. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
5. Install hanger clips during steel deck erection. Install additional hangers and inserts as required.
6. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
7. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers [and related carrying channels] to span extra distance.
8. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
9. Do not eccentrically load system, or produce rotation of runners.
10. Perimeter Molding:
    a. Install edge molding at intersection of ceiling and vertical surfaces with continuous gasket.
    b. Use longest practical lengths.
    c. Overlap and rivet corners.
    d. Install at junctions with other interruptions.

**3.3 TOLERANCES**

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**3.4 ATTACHMENTS**

A. Room 155 Nurse's Station: interlocking suspension grid to accept 24 x 48 inch acoustical panels by others.

**END OF SECTION**

# DIVISION 10
## SPECIALTIES

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

# SIGNAGE

## SECTION 10 14 00

### PART 1 GENERAL

**1.1 SUMMARY**

A. Section includes interior, building mounted, and pole mounted directional signs.

B. Related Sections:
   1. Section 04 20 00 – Unit Masonry.
   2. Section 08 13 14 – Standard Steel Doors.
   3. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
   4. Section 23 05 53 - Identification for HVAC Piping and Equipment.

**1.2 REFERENCES**

A. 2012 Texas Accessibility Standards.

**1.3 SUBMITTALS**

A. Product Data:
   1. Submit Manufacturer's product data sheets. Include color selector for interior signs.
   2. Submit information regarding manufacturer's software and system of color coated, pre-perforated paper sign inserts allowing client to update and maintain signage graphics in-house, to be included as part of the interior signage product.

B. Shop Drawings: Indicate sign styles, lettering font, artwork, foreground and background colors, locations, overall dimensions of each sign. Shop drawings shall include a signage schedule.

C. Manufacturer's Installation Instructions: Submit installation template and attachment devices.

**1.4 QUALIFICATIONS**

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

**1.5 DELIVERY, STORAGE, AND HANDLING**

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Package signs, labeled in name groups.

C. Store adhesive attachment tape at ambient room temperatures.

**1.6 ENVIRONMENTAL REQUIREMENTS**

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install signs when ambient temperature is lower than recommended by manufacturer.

C. Maintain this minimum temperature during and after installation of signs.

### PART 2 PRODUCTS

**2.1 INTERIOR SIGNAGE MANUFACTURER AND PRODUCT**

A. APCO Signs, model Accord15 Modular Sign System as design basis.

B. Substitutions: Section 01 60 00 - Product Requirements.

**2.2 INTERIOR ROOM/DOOR IDENTIFICATION SIGN COMPONENTS**

A. Materials & Construction:
   1. Frames/Holders.
      a. Low-profile injection molded plastic bevel edge profile.
      b. Plastic edge profiles shall be integrally colored injection molded UV and impact resistant ASA (Acrylonitrile Stryrene Acrylate).
      c. Sign frames shall feature an overall depth of 5/8 inch or less and must accommodate front-loading, updateable message panels and inserts.
      d. Color: As selected from manufacturelrs standard colors.
   2. Message Panels/Inserts
      a. Material: Solid Color Rigid Photopolymer.
      b. Thickness: 1/16 inch.
      c. Color: As selected from manufacturerls standard colors.
   3. Background:
      a. Material: Solid Color Rigid Photopolymer.
      b. Thickness: 1/16 inch.
      c. Color: As selected from manufacturer's standard colors.

B. Individual Graphics
   1. Character Font: Helvetica.
      a. Height: 5/8 inch, uppercase.
   2. Graphic Style: Must meet ADA requirements for letter proportions and sizes.
   3. Character & Graphics Color: As selected from manufacturer's standard colors..

C. Braille and Tactile Components
   1. PETG-backed photopolymer.
   2. Raised characters and Braille minimum 1/32 inch (0.8 mm) depth/thickness.

**2.3 ACCESSORIES**

A. Tape Adhesive: Double sided vinyl tape for indoor signs.

**2.4 PAINTED METAL SIGNS**

A. Manufacturers:
   1. ComplianceSigns.com, Model ONE-8453 as design basis.

2. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Painted aluminum.
   1. Face Color: White
   2. Marker Bar Color: Light blue.
   3. Text Color: Black
   4. Total Thickness: 0.040.
   5. Size: 10"hX14"w.
   6. Corners: Rounded.
   7. Character Font: Helvetica.
   8. Graphic Style: OSHA compliant.
   9. Finish: Factory Painted both sides.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

**3.2 INSTALLATION**

A. Install signs after doors and mounting surfaces are finished, in locations indicated on Drawings.

B. Position sign as indicated in the drawings and level.

**3.3 SCHEDULES**

A. Reference drawings for schedule and details

B. Coordinate with Fire Marshall with jurisdiction to ensure placement of Fire Riser Room sign, as scheduled, is acceptable.

**END OF SECTION**

## CAST BUILDING PLAQUES AND LETTERS

## SECTION 10 14 16

### PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes cast metal building plaques and letters.

B. Related Sections:
   1. Section 04 20 00 – Unit Masonry: Anchorage into unit masonry.

### 1.2 REFERENCES

A. 2012 Texas Accessibility Standards.

### 1.3 SUBMITTALS

A. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.

B. Submit four copies of a full size rubbing, indicate installation method, type of fastening divides and accessories, to the Architect for approval prior to casting. Architect will return two copies of the approved rubbing to the Contractor.

C. Manufacturer's Installation Instructions: Submit installation template and attachment devices.

### 1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Package plaques and letters to avoid damage in transit and storage..

C. Inspect plaques upon delivery for damage and correctness.

D. Store plaques and letters inside building. Building shall be enclosed and dry.

### 1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate installation with work of section 04 20 00.

### PART 2 PRODUCTS

### 2.1 CAST METAL PLAQUES AND LETTERS

A. Manufacturers:
   1. ARK Ramos, Oklahoma City, OK
   2. Gemini, Marlborough, MA
   3. The Southwell Company, San Antonio, TX
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Casting of all plaques and letters shall be free of pits and gas holes. All letters on plaques and mounted letters shall be sharp and hand tooled.

### 2.2 COMPONENTS

A. Bronze Dedicatory/Informational Plaque:
   1. Bronze: (85-5-5 Standard U.S. Bronze Alloy).
   2. Border and faces of raised letters shall be satin finish.
   3. Plaque shall be chemically cleaned and etched and treated with Alodine and sprayed with two coats of Clear Acrylic Lacquer.
   4. Size: 10"Wx16"H.
   5. Border Design: Raised, double edge band, satin finish.
   6. Letter style: "Helvetica Medium", satin finish.
   7. Background: Black leatherette finish.
   8. Mounting: Masonry screw through plaque into unit masonry. Cover screw with manufacturer's decorative rosette firmly secured.
   9. Text/Layout: Layout and text as indicated in the drawings.

### PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify substrate is acceptable and ready for acceptance of the mounting where plaques/letter to be installed.

C. Ensure blocking installed in framed partitions to accept mounting screws.

D. Verify that proposed installation method is compatible with substrate, and that surface is plumb, even, and within required tolerances.

E. Notify Architect of unsatisfactory mounting conditions. Do not proceed with installation until unsatisfactory mounting conditions are corrected.

### 3.2 INSTALLATION

A. Install plaques in accordance with Manufacturer's instructions.

B. Ensure plaques are installed plumb, level, and square, in proper planes with related surfaces.

### 3.3 SCHEDULES

A. One Bronze FEMA Plaque installed adjacent to exterior doors. Reference Drawings for schedule and mounting locations.

**END OF SECTION**

**SECTION 10 21 13.17**

**SOLID PHENOLIC TOILET COMPARTMENTS**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes solid phenolic toilet compartments and urinal screens.

B. Related Sections:
   1. Section 04 20 00 – Unit Masonry.
   2. Section 05 50 00 - Metal Fabrications: Concealed steel support members.
   3. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor door swings.

C. Product Data: Submit data on panel construction, hardware, and accessories.

D. Samples: Submit two 4x4 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

### 1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with placement of support framing and anchors in wall.

## PART 2 PRODUCTS

### 2.1 SOLID PHENOLIC TOILET COMPARTMENTS

A. Manufacturers:
   1. Accurate Partitions Corp.
   2. Ampco Inc.
   3. Bobrick.
   4. Bradley Mills
   5. General Partitions Mfg. Corp.
   6. Global Partitions
   7. Marlite
   8. PSISC
   9. Spec-Rite Designs
   10. Tex-Lam
   11. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Overhead braced partitions.

### 2.2 COMPONENTS

A. Toilet Compartments: Solid molded phenolic panels, doors, and pilasters, floor-mounted headrail-braced.
   1. Color: Pattern and color as selected.

B. Door and Panel Dimensions:
   1. Thickness: 3/4 inch minimum at doors, ½" minimum at partitions.
   2. Door Width: 24 inch
   3. Accessible Door Width: 36 inch [, out-swinging].
   4. Height: 58 inch
   5. Thickness of Pilasters: 3/4 inch minimum.

### 2.3 ACCESSORIES

A. Pilaster Shoe: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Hollow anodized aluminum tube, 1 x 1-5/8 inch size, with anti-grip profiles and cast socket wall brackets.

C. Brackets: Satin stainless steel or anodized aluminum continuous brackets.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

E. Hardware: Satin Stainless steel:
   1. Continuous pin hinge.
   2. Thumb slide door latch with receptor mounted to pilaster.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one for each compartment, mounted on door.
   5. Furnish door pull for outswinging doors.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field measurements are as indicated on shop drawings.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

### 3.2 INSTALLATION

A. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.

B. Attach panel brackets securely to walls using anchor devices.

C. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

D. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

**3.3 ERECTION TOLERANCES**

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Indicated Position: 1/4 inch.

C. Maximum Variation From Plumb: 1/8 inch.

**3.4 ADJUSTING**

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

C. Adjust hinges to position doors in [partial opening] [full closed] position when unlatched. Return out-swinging doors to closed position.

D. Adjust adjacent components for consistency of line or plane.

**3.5 SCHEDULES**

A. Toilet partitions at Rooms 151, 153, 161, and 164.

B. Reference the contract drawings for more information.

**END OF SECTION**

**SECTION 10 28 00**

**TOILET, BATH, AND LAUNDRY ACCESSORIES**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes toilet accessories and utility room accessories.

B. Related Sections:
   1. Section 04 20 00 – Unit Masonry.
   2. Section 09 30 00 - Tiling.

### 1.2 REFERENCES

A. ASTM International:
   1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   3. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   5. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   6. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
   7. ASTM C1036 - Standard Specification for Flat Glass.

B. Federal Specification Unit:
   1. FS A-A-3002 - Mirrors, Glass.

### 1.3 DESIGN REQUIREMENTS

A. Design grab bars, shower seats, dressing room bench seats, and attachments to resist minimum 250 lb concentrated load applied at any point in any direction and as required by applicable code.

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer's Installation Instructions: Submit special procedures and conditions requiring special attention.

### 1.5 QUALITY ASSURANCE

A. Flame Resistant Fabric: Passes when tested in accordance with NFPA 701, Test 1 or Test 2.

### 1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with placement of internal wall reinforcement to receive anchor attachments.

## PART 2 PRODUCTS

### 2.1 TOILET AND BATH ACCESSORIES

A. Manufacturers:
   1. A & J Washroom Accessories
   2. American Specialties, Inc.
   3. Bobrick.
   4. Bradley Corp.
   5. Excel Dryer
   6. Franklin Brass.
   7. Royce Rolls Ringer.
   8. Substitutions: Section 01 60 00 - Product Requirements.

### 2.2 COMPONENTS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

### 2.3 TOILET ROOM ACCESSORIES

A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, satin finished cast aluminum brackets eccentric-shaped plastic spindle without concealed locking device for unrestricted delivery.
   1. Product: B-2740 manufactured by Bobrick.

B. Combination Towel Dispenser/Waste Receptacle: Recessed with projecting waste receptacle and towel head. For unit except towel head, satin finish stainless steel; seamless wall flanges, continuous piano hinges, tumbler lock on lower doors. Towel head high impact resin housing, touch free automatic feed and transfer to full roll. AC power adapter.
   1. Towel dispenser capacity: Up to 8" wide by 8" diameter paper rolls 800 feet long.
   2. Waste receptacle capacity: 18 gallons.
   3. Product: B-39747 manufactured by Bobrick with Bobrick 3974-57 AC External adapter.

C. Soap Dispenser: Liquid soap dispenser, wall-mounted, with satin stainless steel cover and vertical stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock.
   1. Minimum Capacity: 40 ounces.
   2. Product: B-2111 manufactured by Bobrick.

D. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base.
   1. Minimum capacity: 250 seat covers.
   2. Product: B-221 manufactured by Bobrick.

E. Grab Bars: Stainless steel satin finished, 1-1/2 inches outside diameter, minimum 18 gauge wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
   1. Length and configuration: As indicated on schedule.
   2. Lengths and configurations:
      a. 42 inches long.
      b. 36 inches long.
      c. 16x31 inches nominal shower stall model.
      d. 24x35 inches nominal horizontal tub bath model.
      e. 36x54 inches nominal two wall toilet compartment model.
   3. Products: B-6806x42, B-6806x36,B-6861 manufactured by Bobrick.

F. Sanitary Napkin Disposal Unit: Stainless steel satin finish, surface-mounted with full-length stainless steel piano-type hinge on top cover.
   1. Product: B-270 manufactured by Bobrick.

G. Baby Changing Station: Surface mounted, Stainless steel, 18 gauge type 304 with FDA approved blow molded high-dnsity grey polyethylene with Microban antimicrobial interior. Reinforced full-length steel on steel hinge with 11 gauge steel mounting plates. Concealed pneumatic cylinder to provide slow and controlled opening and closing of the bed.
   1. Product: KB110-SSWM manufactured by Koala Kare Child Care Products.

**2.4 FACTORY FINISHING**

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, Type SC 2, satin finish, unless otherwise noted.

C. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication.

D. Galvanizing for Nuts, Bolts and Washers: ASTM A153/A153M.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify exact location of accessories for installation.

C. Verify field measurements are as indicated [on product data.

D. See Section 06 10 00 Rough Carpentry for installation of blocking in walls.

**3.2 PREPARATION**

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

**3.3 EXISTING WORK**

A. Clean and repair existing toilet accessories which remain or are to be reinstalled.

**3.4 INSTALLATION**

A. Install plumb and level, securely and rigidly anchored to substrate.

B. Mounting Heights and Locations: As required by accessibility regulations and as indicated on Drawings.

**3.5 SCHEDULES**

A. Room #151 – Women's Restroom
   1. Toilet Paper Dispenser – Bobrick Model 2740.
      a. Qty: 12
   2. Combination Paper Towel Dispenser and Disposal – Bobrick Model B-39474 w/ 3974-57 adapter.
      a. Qty: 3
   3. Soap Dispenser – Bobrick Model B-2111
      a. Qty: 5
   4. Sanitary Napkin Disposal Unit: Bobrick Model B-270.
      a. Qty: 12
   5. Seat Cover Dispenser – Bobrick Model B221
      a. Qty: 12.
   6. Grab Bar – Bobrick Model B-6806x42
      a. Size: 42"
      b. Qty: 3
   7. Grab Bar – Bobrick Model B-6806x36
      a. Size: 36"
      b. Qty: 1
   8. Baby Changing Station – Koala Kare Model KB110-SSWM.
      a. Qty: 1

B. Room #153 – Men's Restroom
   1. Toilet Paper Dispenser – Bobrick Model 2740.
      a. Qty: 3
   2. Combination Paper Towel Dispenser and Disposal – Bobrick Model B-39474 w/ 3974-57 adapter.
      a. Qty: 2
   3. Soap Dispenser – Bobrick Model B-2111
      a. Qty: 2
   4. Grab Bar – Bobrick Model B-6806x42
      a. Size: 42"
      b. Qty: 1
   5. Grab Bar – Bobrick Model B-6806x36
      a. Size: 36"
      b. Qty: 1
   6. Baby Changing Station – Koala Kare Model KB110-SSWM.
      a. Qty: 1

C. Room #161 – Men's Restroom

1. Toilet Paper Dispenser – Bobrick Model 2740.
   a. Qty: 2
2. Combination Paper Towel Dispenser and Disposal – Bobrick Model B-39474 w/ 3974-57 adapter.
   a. Qty: 2
3. Soap Dispenser – Bobrick Model B-2111
   a. Qty: 2
4. Grab Bar – Bobrick Model B-6806x42
   a. Size: 42"
   b. Qty: 1
5. Grab Bar – Bobrick Model B-6806x36
   a. Size: 36"
   b. Qty: 1
6. Baby Changing Station – Koala Kare Model KB110-SSWM.
   a. Qty: 1

D. Room #164 – Women's Restroom

1. Toilet Paper Dispenser – Bobrick Model 2740.
   a. Qty: 5
2. Combination Paper Towel Dispenser and Disposal – Bobrick Model B-39474 w/ 3974-57 adapter.
   a. Qty: 2
3. Soap Dispenser – Bobrick Model B-2111
   a. Qty: 2
4. Sanitary Napkin Disposal Unit: Bobrick Model B-270.
   a. Qty: 5
5. Grab Bar – Bobrick Model B-6806x42
   a. Size: 42"
   b. Qty: 3
6. Grab Bar – Bobrick Model B-6806x36
   a. Size: 36"
   b. Qty: 1
7. Baby Changing Station – Koala Kare Model KB110-SSWM.
   a. Qty: 1

**END OF SECTION**

**SECTION 10 44 00**

**FIRE PROTECTION SPECIALTIES**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes fire extinguishers; fire extinguisher cabinets; and brackets for wall mounting.

B. Related Sections:
   1. Section 04 20 00 – Unit Masonry: Wall construction to accept cabinets and brackets.

### 1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 10 - Standard for Portable Fire Extinguishers.

B. Underwriters Laboratories Inc.:
   1. UL - Fire Protection Equipment Directory.

### 1.3 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10 and applicable building/fire code.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for purpose specified and indicated.

C. Provide fire extinguisher cabinets classified and labeled by Underwriters Laboratories Inc. for purpose specified and indicated.

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, location, fire ratings, and anchorage details.

C. Product Data: Submit extinguisher operational features, color and finish, and anchorage details.

D. Manufacturer's Installation Instructions: Submit special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

### 1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

### 1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install extinguishers when ambient temperature are capable of freezing extinguisher ingredients.

## PART 2 PRODUCTS

### 2.1 FIRE EXTINGUISHERS

A. Manufacturers:
   1. Amerex Models B500, B386T.
   2. JL Industries Models Cosmic 5E, Mercury 5.
   3. Larsen's Manufacturing Co. Models MP5, HT5.
   4. Nystrom Products Co. Models EX-3005, EX-3105.
   5. Potter Roemer Model 3005
   6. Substitutions: Section 01 60 00 - Product Requirements.

B. Dry Chemical Type: Steel tank, with pressure gage; Class 2A-10B:C.

C. Halotron I Type: Steel tank, with pressure gage; Class 5-B:C.

D. Extinguisher Finish: Red painted finish.

### 2.2 FIRE EXTINGUISHER CABINETS

A. Manufacturers:
   1. JL Industries Model 1826; with Saf-T-Lok.
   2. Larsen's Manufacturing Co. Model AL2409-5R; with Larsen-Loc.

B. Enclosure Metal: Formed sheet steel, 0.036 inch thick base metal, finish with baked enamel.

C. Door & Trim Metal: Formed aluminum.

D. Configuration: Semi-recessed type, inside box nominal dimensions of 9.5 inch wide x 24 inch high x 5 inch deep.

E. Trim Type: Returned to wall surface, with 1.5-2 inch projection.

F. Door: 0.016 inch thick minimum, reinforced for flatness and rigidity; breakaway lock access.

G. Door Glazing: Full Panel Plastic, clear, 1/8 inch thick acrylic.

H. Cabinet Mounting Hardware: Appropriate to cabinet.

I. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim [and door stiles].

J. Pre-drill for anchors.

K. Hinge doors for 180 degree opening with continuous piano hinge. Furnish roller type catch.

L. Weld, fill, and grind components smooth.

M. Glaze doors with resilient channel gasket glazing.

N. Finishing Cabinet Exterior: White baked enamel.

O. Finishing Trim and Door: White baked enamel.

P. Finishing Cabinet Interior: White baked enamel.

**2.3 ACCESSORIES**

A. Extinguisher Brackets: Formed steel, red enamel finish.

B. Cabinet Signage: Die-cut lettering in vertical format identifying "Fire Extinguisher".

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify rough openings for cabinet are correctly sized and located.

**3.2 INSTALLATION**

A. Install cabinets plumb and level in wall openings, maximum 48 inches from finished floor to top of extinguisher handle.

B. Install wall brackets, maximum 48 inches from finished floor to top of extinguisher handle.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets and on wall brackets as scheduled.

E. Position cabinet signage as required by authorities having jurisdiction.

**3.3 SCHEDULES**

A. Class 2A-10B:C extinguishers in cabinets: Rooms 141 near door 156.1, 141 near door 167, 142 near door 157, 142 near door 168, 145, 148.

B. Halotron I Type extinguishers on brackets: Rooms 156, 174, 175.

**END OF SECTION**

# DIVISION 22
## PLUMBING

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

**SECTION 22 01 00**
**SUMMARY OF PLUMBING WORK**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and other Division 15 Specification Sections, apply to this Section.

**1.2 WORK COVERED BY CONTRACT DOCUMENTS**

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

Plumbing Contract Documents were prepared for the Project by:

TRINITY MEP ENGINEERING, LLC.
3533 Moreland Ste A.
Weslaco, Texas 78596
Phone Number: (956) 973-0500
Contact Person: Leonardo Munoz, P.E.

B. General Scope of Work:
1. Plumbing: Safe room building - Provide all materials and labor associated with a complete operational installation of new Plumbing systems including, but not limited to:

- Plumbing Fixtures for facility
- Piping for Sanitary Sewer and Vent Systems
- Piping for Domestic water and Hot Water Systems.

**1.3 CONTINGENCIES**

Refer to architectural instruction for project contingencies.

**1.4 COORDINATION**

A. All plumbing work shall be done under sub-contract to a General Contractor. Plumbing Contractor shall coordinate all work through General Contractor, even in areas where only plumbing work is to take place.

B. Coordination between all trades shall take place on a regular basis to avoid conflicts between disciplines and equipment clearances.

C. Work shall take place with minimal disruption to Owner's operations in areas surrounding the new building.

D. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

E. Fully coordinate with electrical contractor for providing power to plumbing equipment.

**1.5 UTILITIES**

1. Coordinate with power, water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

**1.6 CONTRACTOR USE OF PREMISES**

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

1. Temporary fencing around construction areas.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
3. Temporary fencing around equipment while site work is in progress.

**1.7 SUBMITTALS**

1. To extradite the submittal process more efficiently, DO NOT piece-meal the submittals. Submit entire plumbing in a bound enclosure. This will eliminate delays in the submittal process.

**END OF SECTION**

**SECTION 22 01 10**
**BASIC MECHANICAL MATERIALS AND METHODS**

PART 1 - GENERAL

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Mechanical sleeve seals.
7. Equipment nameplate data requirements.
8. Nonshrink grout for equipment installations.
9. Field-fabricated metal and wood equipment supports.
10. Installation requirements common to equipment specification sections.
11. Cutting and patching.
12. Touchup painting and finishing.

**1.3 DEFINITIONS**

A. 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, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
1. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene propylene diene terpolymer rubber.

**1.4 SUBMITTALS**

A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

B. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of

installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
3. Sizes and location of required concrete pads and bases.
4. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
5. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

## 1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes, ductwork, equipment, and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8.

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

**1.8 OPERATION PRIOR TO ACCEPTANCE**

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments, and complete punch list items before final acceptance by the Owner.

C. The date of acceptance by the Engineer, for beneficial use by the Owner, shall be the beginning date of the warranty period.

**1.9 SPACE AND EQUIPMENT ARRANGEMENT**

A. The size of each item of mechanical equipment shown on the Drawings is based on the dimensions of a particular manufacturer as indicated. While other manufacturers may be acceptable, it shall be the responsibility of the Contractor to determine whether or not the equipment he proposes to furnish will fit into the space. Shop drawings shall be prepared when required by the engineer to indicate a suitable arrangement.

B. Install equipment in a manner to permit access to all surfaces. Install valves, motors, drives, lubricating devices, filters, and other accessory items in a position to allow removal for service without requiring the disassembly of another part.

C. Provide access panels acceptable to the Engineer for equipment that is concealed above ceiling space.

D. Large equipment assemblies or components which will be installed in the building, and which are too large to permit access through doorways, stairways or shafts, shall be brought to the site and placed in the appropriate spaces before the enclosing structure is completed. Provisions shall be implemented by the Contractor to insure that the equipment will not be damaged in any way during the associated construction procedures.

**1.10 START-UP OF EQUIPMENT AND SYSTEMS**

A. Whenever the manufacturer of a particular item of equipment or a particular system makes available a start-up service after completion of the installation, such manufacturer's start-up service (rendered by the manufacturer or his authorized representative) shall be provided.

B. Witnessing and explanations of start-up services shall be included as part of the "Instruction of Owner's Personnel" as specified below.

1.11 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers or technicians acceptable to the Engineer to instruct representatives of the Owner in complete and detailed operation and maintenance of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include piping diagrams, valve identification charts, control and interlocking wiring diagrams, manufacturers' operation and maintenance manuals, parts lists (with sources identified), and other data as appropriate for each system, and as required elsewhere in the Specifications to be furnished to the Owner prior to final acceptance of the project.

D. Provide the Owner with three (3) complete sets of all maintenance manuals, pamphlets, brochures or instructions. This material shall be catalogued, indexed and bound into books.

### 1.12 ACCEPTABLE MANUFACTURERS

A. Provide equipment and materials from listed manufacturers listed within this specification. Deviations from this specification will not be acceptable. When one manufacturer is listed, alternate materials and equipment may be provided "equal to" the listed. When more than one manufacturer is listed, equipment and material must be provided by one of the listed manufacturers.

## PART 2 - PRODUCTS

### 2.1 STANDARD PRODUCTS

A. Each item of equipment furnished under this Division of the Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same kind or class of equipment are required, these shall be the products of a single manufacturer; however, the component parts of the equipment need not be the products of one manufacturer.

B. Materials and equipment shall be of the base quality normally used in good commercial practice, and shall be the products of reputable domestic manufacturers unless otherwise specified. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

### 2.2 QUALITY AND CLASSIFICATION OF MATERIALS

A. Materials and equipment shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site, but shall be replaced with new materials or equipment identical with those damaged.

B. Wherever a UL standard has been established for a particular type of material or equipment, each such material or equipment provided on this project shall meet the requirements of the UL standard in every way and shall be UL listed and labeled.

### 2.3 LOCAL PARTS AND SERVICE

A. Each item of equipment furnished on this project shall have local representation, factory-authorized service, and an adequate stock of repair parts. "Local" shall be defined, for this purpose, as "within 50 miles of the project site."

### 2.4 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials used for insulation, acoustical linings, adhesives, jackets and coatings, and combinations of these materials, shall each have a flame spread rating of 25 or less, and a smoke developed rating of 50 or less, as determined by an independent testing

laboratory in accordance with NFPA-255.

## 2.5 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Unions:

   a. Watts Industries, Inc.; Water Products Div.
   b. Zurn Industries, Inc.; Wilkins Div.

2. Mechanical Sleeve Seals:

   a. Calpico, Inc.
   b. Metraflex Co.
   c. Thunderline/Link-Seal.

## 2.6 PIPE AND PIPE FITTINGS

A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

## 2.7 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
2. PVC to ABS Piping Transition: ASTM D 3138.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

## 2.8 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

## 2.9 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

## 2.10 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

   a. Underdeck Clamp: Clamping ring with set screws.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.

   a. Finish: Rough brass.
   b. Finish: Polished chrome-plate.

4. Cast-Iron Floor Plate: One-piece casting.

## 2.11 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

# PART 3 - EXECUTION

## 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping

Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
   b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger,

penetrating gypsum-board partitions.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 for materials.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe or pipe insulation and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. 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:

a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
c. Align threads at point of assembly.
d. Tighten joint with wrench. Apply wrench to valve

end into which pipe is being threaded.

e. 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.

6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. PVC Nonpressure Piping: ASTM D 2855.
   c. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.

   a. Plain-End Pipe and Fittings: Use butt fusion.
   b. Plain-End Pipe and Socket Fittings: Use socket fusion.

W. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

## 3.2 EQUIPMENT AND MATERIAL INSTALLATION - COMMON REQUIREMENTS

A. Install equipment and material to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and

repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment and ductwork giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

## 3.3 PAINTING AND FINISHING

A. Refer to Division 9 for paint materials, surface preparation, and application of paint.

B. Do not paint piping specialties with factory-applied finish.

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

## 3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement or as specified in Division 3.

## 3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

## 3.6 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

## 3.7 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

**END OF SECTION**

**SECTION 22 05 00**
**PLUMBING SPECIALTIES**

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following plumbing specialties:
1. Balancing valves.
2. Washer-supply outlets.
3. Key-operation hydrants.
4. Trap seal primer valves.
5. Drain valves.
6. Miscellaneous piping specialties.
7. Sleeve penetration systems.
8. Flashing materials.
9. Cleanouts.
10. Floor drains.
11. Roof drains.
12. Grease interceptors.

### 1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PVC: Polyvinyl chloride plastic.

### 1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig (860 kPa).
2. Sanitary Waste and Vent Piping: 10-foot head of water (30 kPa).
3. Storm Drainage Piping: 10-foot head of water (30 kPa).

### 1.5 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
1. Balancing valves.
2. Water hammer arresters, and trap seal primer valves and systems.
3. Hose bibbs, hydrants.
4. Washer-supply outlets.
5. Cleanouts, floor drains, and roof drains.
6. Roof flashing assemblies.
7. Grease interceptors.
8. Sleeve penetration systems.

B. Shop Drawings: Diagram power, signal, and control wiring.

### 1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

## PART 2 - PRODUCTS

### 2.1 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.
1. Manufacturers:

a. Armstrong Pumps, Inc.
b. Flow Design, Inc.
c. ITT Industries; Bell & Gossett Div.
d. Taco, Inc.
e. Watts Industries, Inc.; Water Products Div.

2. NPS 2 and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
3. NPS 2 and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
4. NPS 2-1/2 and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

B. Memory-Stop Balancing Valves, NPS 2 and smaller: MSS SP-110, ball valve, rated for 400-psig mininmum CWP. Include two-piece, copper-alloy body with full-port, chrome-plated brass ball, replaceable seats and seals, threaded or solder-joint ends, and vinyl-covered steel handle with memory-stop device.

1. Manufacturers:

a. Conbraco Industries, Inc.
b. Crane Co., Crane Valve Group; Crane Valves.
c. Grinnell Corporation.
d. NIBCO INC.
e. Red-White Valve Corp.

### 2.2 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
2. NPS 2 and Smaller: Bronze body, with female threaded ends.
3. NPS 2-1/2and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.

### 2.3 OUTLET BOXES

A. Manufacturers:

1. Acorn Engineering Company.
2. Gray, Guy Manufacturing Co., Inc.
3. Symmons Industries, Inc.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.

C. Clothes Washer Outlet Boxes: With hot- and cold-water hose connections, drain, and the following:

1. Box and Faceplate: Stainless steel.
2. Shutoff Fitting: Two hose bibbs.
3. Supply Fittings: Two NPS 1/2 gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
4. Drain: NPS 2 standpipe, P-trap, and direct waste connection to drainage piping.
5. Inlet Hoses: Two ASTM D 3571, 60-inch-long, rubber household clothes washer inlet hoses with female hose-thread couplings.
6. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.

D. Icemaker Outlet Boxes: With hose connection and the following:

1. Box and Faceplate: Stainless steel.
2. Shutoff Fitting: Hose bibb.
3. Supply Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

## 2.4 KEY-OPERATION HYDRANTS

A. Manufacturers:

1. Josam Co.
2. Smith, Jay R. Mfg. Co.
3. Woodford Manufacturing Co.

B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig (860 kPa).

1. Inlet: NPS 3/4 or NPS 1 threaded or solder joint.
2. Outlet: ASME B1.20.7, garden-hose threads.
3. Operating Keys: One with each key-operation hydrant.

C. Moderate-Climate, Concealed-Outlet Wall Hydrants: ASSE 1019, self-drainable with flush-mounting box with cover, integral nonremovable hose-connection vacuum breaker, and concealed outlet.

1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.

D. Hot and Cold, Nonfreeze Concealed-Outlet Wall Hydrants: With deep flush-mounting box with cover; hot- and cold-water casings and operating rods to match wall thickness; concealed outlet; wall clamps; and factory- or field-installed, nonremovable and manual drain-type, hose-connection vacuum breaker complying with ASSE 1011.

## 2.5 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:
1. Manufacturers:

a. Josam Co.
b. MIFAB Manufacturing, Inc.
c. Precision Plumbing Products, Inc.
d. Smith, Jay R. Mfg. Co.

2. 125-psig minimum working pressure.
3. Bronze body with atmospheric-vented drain chamber.
4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## 2.6 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.
1. Manufacturers:

a. Josam Co.
b. Smith, Jay R. Mfg. Co.

c. Tyler Pipe; Wade Div.
d. Zurn Industries, Inc.; Specification Drainage Operation.

B. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig; integral, nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

C. Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft. , 0.0625-inch thick, lead flashing collar and skirt extending at least 8 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

D. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

E. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

F. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

G. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

H. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

## 2.7 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:

1. ProSet Systems, Inc.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

## 2.8 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4-lb/sq. ft. , 0.0625-inch thickness.
2. Vent Pipe Flashing: 3-lb/sq. ft. , 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft. , 0.0938-inch thickness.

B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

C. Fasteners: Metal compatible with material and substrate being fastened.

D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

E. Solder: ASTM B 32, lead-free alloy.

F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## 2.9 CLEANOUTS

A. Cleanouts: Comply with [ASME A112.36.2M] [ASME A112.3.1] <Insert other>.

1. Application: [Floor cleanout] [Wall cleanout] [For installation in exposed piping].
2. Products:
   a. Josam Co.
   b. Mifab
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe, Wade Div.
   e. Zurn Industries, Inc., Specification Drainage Operation.

## 2.10 FLOOR DRAINS

A. Floor Drains.
1. Products:
   a. Josam Co.
   b. Mifab
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe, Wade Div.
   e. Zurn Industries, Inc.

## 2.11 ROOF DRAINS

A. Roof Drains: Comply with [ASME A112.21.2M] [ASME A112.3.1].

1. Application: Roof drain.
2. Products:
   a. Josam Co.
   b. Mifab
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe, Wade Div.
   e. Watts Industries, Inc., Drainage Products Div.
   f. Zurn Industries, Inc.

## 2.12 GREASE INTERCEPTORS

A. Grease Interceptors: Comply with PDI-G101.
1. Products:
   a. American Industrial Precast Products, Inc.
   b. Brooks Products
   c. Park Equipment Co.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

C. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

D. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

E. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

F. Install expansion joints on vertical risers, stacks, and conductors if indicated.

G. 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 (DN 100). Use NPS 4 (DN 100) 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 (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

H. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

I. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

J. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

K. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

L. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

M. 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. 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.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

N. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

O. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Flush with In-Ground Installation: Set unit and extension, if required, with cover flush with finished grade.
2. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

P. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

Q. Fasten recessed-type plumbing specialties to reinforcement built into walls.

R. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

S. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

T. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

## 3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 15 Sections.

D. Ground equipment.

E. 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 and UL 486B.

F. Connect plumbing specialties and devices that require power according to Division 16 Sections.

G. Interceptor Connections: Connect piping, flow-control fittings, and accessories.

1. Grease Interceptors: Connect inlet and outlet to unit, and flow-control fitting and vent to unit inlet piping.

## 3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft.,0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings,

according to Division 7 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

## 3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

## 3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION**

**SECTION 22 05 23**
**GENERAL DUTY VALVES FOR PLUMBING**

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following general-duty valves:
1. Copper-alloy ball valves.
2. Bronze check valves.
3. Bronze gate valves.
4. Cast-iron gate valves.

### 1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

### 1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

### 1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

1. Exceptions: , sanitary waste, and storm drainage piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

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 handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Grinnell Corporation.
      c. Hammond Valve.
      d. Milwaukee Valve Company.
      e. NIBCO INC.
      f. Red-White Valve Corp.
      g. Watts Industries, Inc.; Water Products Div.

### 2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:
   1. Handwheel: For valves other than quarter-turn types.
   2. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.
   1. Solder Joint: With sockets according to ASME B16.18.
      a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.
   2. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

### 2.3 COPPER-ALLOY BALL VALVES

A. Copper-Alloy Ball Valves, General: MSS SP-110.

B. One-Piece, Copper-Alloy Ball Valves: Brass or bronze body with chrome-plated bronze ball, PTFE or TFE seats, and 400-psig (2760-kPa) minimum] [600-psig (4140-kPa)] CWP rating.

C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.

### 2.4 BRONZE CHECK VALVES

A. Bronze Check Valves, General: MSS SP-80.

B. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.

C. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.

## 2.5 BRONZE GATE VALVES

A. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

B. Type 1, Class 125, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge and union-ring bonnet.

## 2.6 CAST-IRON GATE VALVES

A. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

B. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.

C. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.

## 2.7 CAST-IRON PLUG VALVES

A. Cast-Iron Plug Valves, General: MSS SP-78.

B. Class 125 or 150, lubricated-type, cast-iron plug valves.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

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

B. 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.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. 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.

F. Do not attempt to repair defective valves; replace with new valves.

## 3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, gate, or plug valves.
2. Throttling Service: Ball, butterfly, or globe valves.
3. Pump Discharge: Swing check, lift-disc check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, [400-psig (2760-kPa)]CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
3. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class [125] [150], bronze.
4. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.

5. Gate Valves, NPS 2 (DN 50) and Smaller: Type [1] [2], Class 150] , bronze.
6. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.

## 3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

## 3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

**END OF SECTION**

**SECTION 22 05 29**
**HANGERS AND SUPPORT**

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

### 1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

### 1.4 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

### 1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

### 1.6 QUALITY ASSURANCE

A. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

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

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:

a. Globe Pipe Hanger Products, Inc.
b. Grinnell Corp.
c. Michigan Hanger Co., Inc.

### 2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-

fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

2.3 MISCELLANEOUS MATERIALS

A. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
3. Extension Hinged Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. C-Clamps (MSS Type 23): For structural shapes.
5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
6. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
7. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching tobottom of steel I-beams for heavy loads, with link extensions.
8. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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 (32 mm).

## 3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

F. 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.

G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

I. Insulated Piping: Comply with the following:

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 according to ASME B31.9.

2. 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 inserts.

6. Insert Material: Length at least as long as protective shield.

## 3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

## 3.4 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

**END OF SECTION 15060**

**SECTION 22 05 30**
**SUPPORTS AND ANCHORS**

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Pipe, and equipment hangers, supports and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.02 REFERENCES

A. ANSI/ASME B31.1 - Power Piping.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems.

C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.03 QUALITY ASSURANCE

A. Supports for Sprinkler Piping: In conformance with NFPA 13.

B. Supports for Standpipes: In conformance with NFPA 14.

1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.

C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roll.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

J. Roof Pipe Supports and Hangers: Galvanized Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.

For pipes 2-1/2" and smaller – Type PP10 with roller
For pipes 3" through 8" – Type PS
For multiple pipes – Type PSE - Custom

K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut "Cush-A-Clamp" or equal. Hangers:

Plastic coated; Unistrut or equal.

L. For installation of protective shields refer to specification section 15140-3.03.

M. Shields for Vertical Copper Pipe Risers: Sheet lead.

N. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief "Pipe Titan", Holdrite or equal.

2.02 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.03 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Lead Flashing: 4 lb. /sq. ft. sheet lead for waterproofing; 1 lb. /sq. ft. sheet lead for soundproofing.

C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.05 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.
1. Provide with hurricane clip to anchor RTU to roof curb.

B. For metal roof construction, roof curbs shall be made of aluminum or stainless steel. Coordinate with architectural drawings and details.

2.06 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe, schedule 40.

C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Form with galvanized steel.

E. Sleeves for Rectangular Ductwork: Form with galvanized steel.

F. Fire Stopping Insulation: Glass fiber type, non-combustible, U.L. listed.

G. Caulk: Paintable 25-year acrylic sealant.

H. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as

recommended by manufacturer to allow indicated travel.

2.07 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.08 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.02 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

| PIPE SIZE HANGER R DIAMETER | MAX. SPACING HANGE |
|---|---|
| (Steel Pipe) | |
| 1/2 to 1-1/4 inch | 7’-0” |
| 1-1/2 to 3 inch | 10'-0" |
| 4 to 6 inch | 10'-0" |
| 8 to 10 inch | 10'-0" |
| 12 to 14 inch | 10'-0" |
| 15 inch and over | 10'-0" |
| (Copper Pipe) | |
| 1/2 to 1-1/4 inch | 5'-0" |
| 1-1/2 to 2-1/2 inch | 8'-0" |
| 3 to 4 inch | 10'-0" |
| 6 to 8 inch | 10'-0" |
| (Cast Iron) | |
| 2 to 3 inch | 5'-0" |
| 4 to 6 inch | 10'-0" |
| 8 to 10 inch | 10'-0" |
| 12 to 14 inch | 10'-0" |
| 15 inch and over | 10'-0" |
| (PVC Pipe) | |
| 1-1/2 to 4 inch | 4'-0" |
| 6 to 8 inch | 4'-0" |
| 10 and over | 4'-0" |

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

J. Portable pipe hanger systems shall be installed per manufacturers' instructions.

K. Distances between supports are maximum distance. Supports shall be provided to carry the pipe/equipment load.

3.03 Insulated Piping: Comply with the following installation requirements.

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

| NPS | LENGTH |
|---|---|
| 1/4 THROUGH 3-1/2 | 12 |
| 4 | 12 |
| 5 & 6 | 18 |
| 8 THROUGH 14 | 24 |
| 16 THROUGH 24 | 24 |

D. Piping 2" and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.

E. Insert material shall be at least as long as the protective shield.

F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.04 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation

components are installed.

3.05 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor shower mop sink and all other drains watertight to adjacent materials.

E. Provide curbs for mechanical roof installations 8 inches minimum high above roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.06 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.

C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with U.L. listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Fire protection sleeves may be flush with floor of stairways.

**END OF SECTION**

**SECTION 22 06 01**
**IDENTIFICATION AND PIPE MARKING**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.03 Refer to Architectural Sections for additional requirements.

PART 2 - PRODUCTS

2.01 VALVE AND PIPE IDENTIFICATION

A. Valves:

1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.

2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.

3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.

4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.

B. Pipe Marking:

1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.

2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton nameplate company. Factory location 20 Thompson Road, Branford, Connecticut, or approved equal.

3. Generally, markers shall be located on each side of each partition, on each side of each tee, on each side of each valve and/or valve group, on each side of each piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In

congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.

4. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.

5. Markers shall be colored as indicated below per ANSI/OSHA Standards:

| SYSTEM | COLOR | LEGEND |
|---|---|---|
| Chilled Water | Green | Chilled Water Supply<br>Chilled Water Return |
| Sanitary Sewer | Green | Vent<br>Sanitary Sewer |
| Storm Drain | Green | Storm Drain |
| Domestic Water | Green | Domestic Water |
| Domestic Hot Water Supply | Yellow | Domestic Hot Water Supply |
| Domestic Hot Water Recirculating | Yellow | Domestic Hot Water Return |
| Fire Protection | Red | Fire Protection |
| Automatic Sprinkler | Red | Fire Sprinkler |
| Gas | Yellow | Natural Gas |
| Condenser Water | Green | Condenser Water Supply<br>Condenser Water Return |
| Compressed Air | Blue | Compressed Air |
| Pneumatic Control | Yellow | Pneumatic Control |
| Oxygen | Yellow | Oxygen |
| Nitrogen | Green | Nitrogen |
| Deionized Water | Green | Deionized Water |
| Steam | Yellow | Steam Supply<br>Steam Return |

C. Pipe Painting:

1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior
2. to installation.

3. The entire fire protection piping system shall be painted red.

4. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

| System | Color |
|---|---|
| Storm Sewer | White |
| Sanitary Sewer Waste and Vent | Light Gray |
| Domestic Cold Water | Dark Blue |
| Domestic Hot Water Supply and Return | Orange |
| Condenser Water Supply and Return | Light Green |
| Gas | Yellow |
| Chilled Water Supply and Return | Light Blue |
| Heating Hot Water Supply and Return | Reddish Orange |

PART 3 - EXECUTION

3.01 All labeling equipment shall be installed as per manufacturers printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors price shall include all items required as per manufacturers' requirements.

3.03 All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Install primer and a quality latex paint over all surfaces of pipe.

**END OF SECTION**

## SECTION 22 07 19
## PIPE INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

#### 1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

#### 1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

#### 1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for insulation application.

C. Coordinate installation and testing of steam or electric heat tracing.

#### 1.7 SCHEDULING

A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mineral-Fiber Insulation:

   a. CertainTeed Manson.
   b. Knauf FiberGlass GmbH.

c. Owens-Corning Fiberglas Corp.
d. Schuller International, Inc.

2. Flexible Elastomeric Thermal Insulation:

a. Armstrong World Industries, Inc.
b. Rubatex Corp.

## 2.2 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
2. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:

a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.

3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
4. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.

B. Flexible Elastomeric Thermal Insulation used on Refrigerant Piping: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

C. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

## 2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- (0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

D. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

1. Finish and Thickness: Smooth finish, 0.010 inch (0.25 mm) thick.
2. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
3. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

## 2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Aluminum: 0.007 inch (0.18 mm) thick.

## 2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

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

## 3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

## 3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

G. Keep insulation materials dry during application and finishing.

H. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

I. Apply insulation with the least number of joints practical.

J. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

K. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments. Insulation around hanger or pipe clamp will not be acceptable.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from

point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

L. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

M. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

N. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply 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 (100 mm) o.c.

   a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

P. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

## 3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

## 3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the 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 the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

## 3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.
2. Apply lap or joint strips with the same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

C. Apply metal jacket where indicated, with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

## 3.7 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Fire-suppression piping.
3. Drainage piping located in crawl spaces, unless otherwise indicated.
4. Below-grade piping, unless otherwise indicated.
5. Chrome-plated pipes and fittings, unless potential for personnel injury.
6. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

## 3.8 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot and recirculated hot water.

1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
2. Insulation Material: Mineral fiber with a minimum of K of 0.24 at 75 degrees F.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Tempered hot water piping to be provided with ½" insulation.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Service: Domestic cold water.

1. Operating Temperature: 35 to 60 deg F (2 to 15 deg C).
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses: 1"
   a. Tempered cold water piping to be provided with ½" insulation.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

C. Service: Rainwater conductors.

1. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses: 1"
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

D. Service: Roof drain bodies.

1. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: 1"
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

E. Service: Condensate drain piping.

1. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: ½"
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

F. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.

1. Operating Temperature: 35 to 120 deg F (2 to 49 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: ½"
4. Field-Applied Jacket: PVC P-trap and supply covers.
5. Vapor Retarder Required: No.
6. Finish: Painted.

**3.9 EXTERIOR INSULATION APPLICATION SCHEDULE**

A. Service: Domestic water.

1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses: 1"
4. Field-Applied Jacket: Aluminum.
5. Vapor Retarder Required: Yes.
6. Finish: None.

**END OF SECTION**

**SECTION 22 08 01**
**WET PIPE FIRE PROTECTION SPRINKLER SYSTEM**

## PART 1 - GENERAL

### 1.01 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

### 1.02 SCOPE

A. Scope of the work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. City of Edinburg Safe Room-South Park Site to be fully protected as per specs. Free Standing F.D.C. to be located along side East Palm Drive next to Existing Fire Hydrant. Backflow Preventer to be located in Riser Room.

### 1.03 REGULATORY CODES

A. Work in accordance with:

1. NFPA.
2. Local municipal codes that have jurisdiction.

B. Products in accordance with:

1. United Laboratories (UL) listed.
2. Factory Mutual (FM) approved.

### 1.04 CERTIFICATE OF TESTING

A. Furnish Owner with test certificate certifying the system approved by:

1. City Fire Marshall & Insurance Services Office(ISO).

## PART 2 - PRODUCTS

### 2.01 FIRE SPRINKLER SYSTEM

A. GENERAL:

1. Work Included:
   a. Design, coordination and installation of inside and outside piping, including sprinkler heads, valves, hangers and supports sleeves.
   b. The sprinkler system is a wet type and is designed to provide coverage for entire building. The Contract Drawings indicate the extent and general arrangement, and the various occupancy classifications.
   c. The plans provide a preliminary

layout with riser assembly location, flow switch locations, valve locations, and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor's detailed working drawings.

d. Interface system with building fire and smoke alarm system.

2. Quality Assurance: Equipment and installation to meet requirements of NFPA Number 13, latest edition and local authority having jurisdiction. All components of the completed system shall be UL listed for the intended service.

**2.02 SUBMITTALS:**

A. Submit shop drawings in accordance with Section 220100.

B. Submit preliminary layout showing only head locations for review by Architect/Engineer. Furnish additional heads which may be required for coordinated ceiling pattern without added cost, even though number of heads may exceed minimum code requirements.

C. Submit shop drawings of entire sprinkler system including hydraulic calculations to Architect/Engineer.

D. Provide Architect with six complete sets of final approved shop drawings before starting the installation. Include details of the sprinkler system showing sections, light fixtures, air conditioning, ducts, and a plan giving fire department connections, location of all exposed structures within twenty feet of this structure, and other equipment to be used. Drawings shall bear the stamp of review of the local fire insurance rating organization having jurisdiction.

E. Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground Work.

F. Provide a printed sheet giving brief instructions relative to all necessary aspects of sprinkler controls and emergency procedures

next to sprinkler riser mains. Instruction sheet to be protected by glass or a transparent plastic cover.

G. Materials:

1. **Piping:**
   a. All piping above grade shall be:
      - schedule 10 black steel pipe with a rolled groove ends, joined with mechanical coupling and cut groove cast iron fittings for pipe 2-1/2" and greater.
      - schedule 40 black steel threaded pipe and fittings for pipe 2" and smaller.
   b. Acceptable manufacturer:
      - American Tube
      - Wheatland Tube
      - Gem Sprinkler
      - **All piping shall be by a domestic manufacturer.**
   c. Acceptable mechanical coupling manufacturer:
      - Victaulic
      - Grinnell

2. **Sprinkler Heads:**
   a. Suspended Ceiling Type: Concealed pendant type with white or matching escutcheon.
   b. Exposed Area Type: Standard upright type with brass finish and head guards.
   c. Sidewall Type: Chrome plated finish with matching escutcheon.
   d. Temperature rating on fusible links to suit specific hazard area with minimum margin or safety 50 degrees F.
   e. Sprinkler heads of the "O"-ring seal type are not acceptable.
   f. In natatoriums and pool equipment rooms provide chrome

plated or wax coated heads for corrosive environments.

g. Acceptable manufacturer:
- Reliable
- Grinnell
- Viking
- Tyco

3. Sprinkler Alarm Valve:
   a. Provide approved automatic sprinkler valve.
   b. Acceptable manufacturer:
      - Reliable
      - Grinnell
      - Viking
      - Tyco

4. Valves:
   a. 2" and smaller: bronze, rising stem, inside screw, solid wedge, U.L. listed valve.
   b. 2-1/2" and larger: iron body, bronze trim, rising stem, OS&Y, solid wedge, U.L. listed valve.
   c. Check valve: cast iron flanged body, bronze fitted, non-slam type.
   d. Install valves with stems upright or horizontal, not inverted.
   e. Acceptable manufacturer:
      - Nibco
      - Grinnell
      - Stockham
      - Victaulic

5. Fire Department Connection:
   a. Free standing siemese or approved by local fire department marked "Sprinkler – Fire Department Connection".
   b. Acceptable manufacturer:
      - Potter – Roemer
      - Elkhart Brass
      - Reliable

6. **Insulation:**
   **a. All piping and valves exposed to the weather or within building and exposed to the weather shall be insulated with Phenolic foam with ASJ and all joints sealed. Insulation density shall not be less than 1.5 pounds per cubic foot, and conductivity (K) not higher than 0.25 and**

**75°F mean temperature difference, with factory applied all weather vapor barrier jacket.**

b. All insulated pipe and valves subject to damage shall be protected with an aluminum jacket with sealed joints.

## PART 3 - EXECUTION

**3.01** All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

**3.02** All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items as required by NFPA and installed as per manufacturer's recommendations.

**3.03 DESIGN**

A. Design spacing of sprinkler heads and selection sizes shall conform to the requirement of NFPA 13 for the indicated occupancy.

B. Uniform discharge density design shall be based on hydraulic calculations utilizing the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform with NFPA 13.

C. Friction losses in pipe will be based on a value of "C" =120 in the Hazen - Williams formula.

D. Design and install the system so that no part will interfere with doors, windows, heating, plumbing, or electrical equipment. Do not locate sprinkler heads within 6 inches of lighting fixtures, HVAC diffusers and other obstructions. Sprinkler piping cannot penetrate ductwork or lighting fixtures.

E. The Contractor shall conform to the National Fire Protection Association's Fire Code No. 13, latest edition. Special attention shall be given to Article 1-9, working plans. It shall be the Registered Fire Protection Engineer's responsibility to determine if any deficiency or deviations, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

**3.04 INSTALLATION**

A. Install all items in accordance with applicable codes.

B. Install piping so that mains and branches are not located directly underneath HVAC equipment or other items needing access.

**C. All sprinkler heads shall be**

**located as near the center of ceiling tiles as is practical (±1/2"). Location shall present a uniform pattern with all heads aligned when completely installed.**

D. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.

**E. Wire guards on all pendant or upright sprinkler heads in mechanical rooms, gymnasiums, athletic areas, an all other exposed clgs.**

F. Protect sprinkler heads against mechanical injury with standard guards.

G. Locate outside alarms on wall of building adjacent to siamese fire department connection.

H. Provide on wall near sprinkler valve, cabinet containing four extra sprinkler heads of each type and wrench suitable for each head type.

I. Provide 1 inch diameter nipple and 1 inch x 1/2 inch reducing fitting for each upright head.

J. Painting shall be as follows:

1. Exposed sprinkler riser, alarm valve and all related piping shall be painted red.
2. Exposed sprinkler piping in finished areas shall be painted as directed by Architect.

**3.05 REPLACEMENT**

Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

**3.06 TESTING**

A. Prior to testing, the entire sprinkler system shall be thoroughly flushed clean.

B. Upon completion of the installation and flushing, test the system and obtain approval of the local fire insurance rating organization having jurisdiction. Particular attention is called to the requirements of NFPA 13 pamphlet.

**3.07 TRAINING**

A. Owner's people shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown, and maintenance of the system.

B. Routine maintenance, yearly maintenance, winterization, and spring start-up shall be fully discussed and documented.

C. Names of those instructed and dates, as well as a list of

information handed over to the owner, shall be included in the final report.

## 3.08 CLEANING

A. Clean dirt and debris from sprinklers. Replace sprinklers having paint other than factory finish with new sprinklers. Cleaning and reuse of painted sprinklers is prohibited.

## 3.09 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Comply with plumbing code and authority with jurisdiction. Install air-gap fitting on units with atmospheric vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer.

**END OF SECTION**

# SECTION 22 11 16
# DOMESTIC WATER PIPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.

### 1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Distribution Piping: 125 psig.

### 1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

### 1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic, potable domestic water piping and components.

C. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

### 2.2 COPPER TUBING

A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

3. 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.

B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.

Furnish Class 300 flanges if required to match piping.

3. 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.

4. Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.

a. Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.3 **PVC PIPING**

A. PVC Schedule 40 Pipe:

**2.4 VALVES**

A. Refer to Division 15 Section "Valves" for bronze and cast-iron, general-duty valves.

B. Refer to Division 15 Section "Plumbing Specialties" for balancing and drain valves.

**PART 3 - EXECUTION**

**3.1 EXCAVATION**

A. Refer to Division 2 for excavating, trenching, and backfilling.

**3.2 PIPING APPLICATIONS**

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.

E. Aboveground Domestic Water Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.

2. NPS 2: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.

3. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.

4. NPS 4 to NPS 6: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.

F. Underground Domestic Water Piping NPS 4 (DN 100) and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints. Water service larger than NPS 4 shall be PVC Schedule 40.

**3.3 VALVE APPLICATIONS**

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.

4. Drain Duty: Hose-end drain valves.

B. Cast-iron, grooved-end valves may be used with grooved-end piping.

**3.4 PIPING INSTALLATION**

A. Refer to Division 2 for site water distribution and service piping.

B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

C. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.

D. Install underground copper tubing according to CDA's "Copper Tube Handbook."

E. Install underground PVC piping according to ASTM D 2774 and ASTM F 645. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

G. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.

H. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each domestic water service. Refer to Division 15 Section "Meters and Gages" for pressure gages, and to Division 15 Section "Plumbing Specialties" for drain valves and strainers.

I. Install water-pressure regulators downstream from shutoff valves. Refer to Division 15 Section "Plumbing Specialties" for water-pressure regulators.

J. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

K. Perform the following steps 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. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

L. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

## 3.5 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Mechanically Formed Outlets: Form tee in copper tube according to equipment manufacturer's written instructions. 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.

## 3.6 VALVE INSTALLATION

A. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

B. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Refer to Division 15 Section "Plumbing Specialties" for calibrated balancing valves.

**3.7 HANGER AND SUPPORT INSTALLATION**

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod
2. NPS 1 and NPS-1-1/4: 72 inches with 3/8-inch Rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6 (DN 150): 10 feet with 5/8-inch rod.
7. NPS 8 (DN 200): 10 feet with 3/4-inch rod.

G. Install supports for vertical copper tubing every 10 feet.

**3.8 CONNECTIONS**

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow 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 service piping with shutoff valve, and extend and connect to the following:

1. Water Heaters: Cold-water supply 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 required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

**3.9 FIELD QUALITY CONTROL**

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction and MEP Engineer.

2. During installation, notify authorities having jurisdiction and engineer at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. 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 separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. 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 to stand for four (4) hours. Leaks and loss in test pressure constitute defects that must be repaired.

4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

## 3.10 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.

2. Adjust calibrated balancing valves to flows indicated.

## 3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as 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 (50 mg/L) 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 (200 mg/L) 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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

**END OF SECTION**

## SECTION 22 13 16
## SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

#### 1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:
   1. PVC: Polyvinyl chloride plastic.

#### 1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

   1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

#### 1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings: For sovent drainage system, include plans, elevations, sections, and details.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

#### 1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

#### 2.2 PVC PIPING

A. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

   1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

### PART 3 - EXECUTION

#### 3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

## 3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 1-1/4 and NPS 1-1/2 : PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. NPS 2 to NPS 4: PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. NPS 5 and NPS 6: Use NPS 6 PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:

1. NPS 2 to NPS 4: PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. NPS 5 and NPS 6: PVC pipe, PVC socket fittings, and solvent-cemented joints.

## 3.3 PIPING INSTALLATION

A. Refer to Division 2 Section "Sanitary Sewerage" for Project-site sanitary sewer piping.

B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

1. Encase piping with PE film according to ASTM A 674 or AWWA C105.

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixture are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Re-verify building drainage piping slope before covering pipe in trench if left uncovered over a 24 hour period of subjected to exterior water. If slope of piping has changed, provide new shoring material to maintain original slope after trench has been covered.

I. Install soil and waste drainage and vent piping at the code required minimum slopes, unless otherwise indicated:

J. Install engineered soil and waste drainage and vent piping systems in locations indicated and as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Cast-Iron, Sovent, Single Stack: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

## 3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

## 3.5 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with ½-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with ¾-inch rod.
5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.

K. Install supports for vertical PVC piping every 48 inches.

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

## 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 drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
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 drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

## 3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction and MEP Engineer 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 and MEP Engineer 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 drainage and vent piping according to 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. 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 drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. 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. 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. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without

introducing additional air throughout period of inspection. 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.

**3.8 CLEANING**

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains 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.

**END OF SECTION**

## SECTION 22 30 10
## DRINKING FOUNTAINS AND WATER COOLERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

A. This Section includes the following:

1. Drinking fountains.
2. Self-contained water coolers.
3. Fixture supports.

#### 1.3 DEFINITIONS

A. Accessible Drinking Fountain and Water Cooler: Fixture that can be approached and used by people with disabilities.

B. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.

C. Fitting: Device that controls flow of water into or out of fixture.

D. Fixture: Drinking fountain or water cooler, unless one is specifically indicated.

E. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

#### 1.4 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of fixture indicated.

B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For fixtures to include in maintenance manuals specified in Division 1.

#### 1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" about fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

E. TAS: Texas Accessibility Standards.

#### 1.6 COORDINATION

A. Coordinate roughing-in and final fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

### PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified below.

1. Elkay.
2. Halsey Taylor.
3. Haws Corporation.

## 2.2 DRINKING FOUNTAINS

A. Drinking Fountains,: Accessible, Style W, wall-hanging fixture made of stainless steel.

1. Receptor Shape: Rectangular.
2. Back Panel: Stainless-steel wall plate behind drinking fountain.
3. Bubblers: Two, with automatic stream regulator, located on deck.
4. Control: Push button.
5. Supply: NPS 3/8 with ball, gate, or globe valve.
6. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME Standards.
7. Support: Type I, water-cooler carrier. Refer to "Fixture Supports" Article.

## 2.3 SELF-CONTAINED WATER COOLERS

A. Water Coolers: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-hanging fixture.

1. Cabinet: Bilevel with two attached cabinets, enameled steel with stainless-steel top.
2. Bubbler: One, with automatic stream regulator, located on each cabinet deck.
3. Control: Push button.
4. Supply: NPS 3/8 with ball, gate, or globe valve and filter.
5. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME Standards.
6. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
   a. Capacity: 8 gph of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
   b. Electrical Characteristics: 1/5 hp; 120-V ac; single phase; 60 Hz.
7. Support: Type II, water-cooler carrier. Refer to "Fixture Supports" Article.

## 2.4 FIXTURE SUPPORTS

A. Off-Floor, Plumbing Fixture Supports: ASME A112.6.1M, water-cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

1. Available Manufacturers:
2. Manufacturers:
   a. Josam Co.
   b. Smith, Jay R. Mfg. Co.
   c. Tyler Pipe; Wade Div.
   d. Zurn Specifications Drainage Operation.
3. Type I: Hanger-type carrier with two vertical uprights.
4. Type II: Bilevel, hanger-type carrier with three vertical uprights.
5. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual

locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.

B. Examine walls and floors for suitable conditions where fixtures are to be installed.

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

## 3.2 APPLICATIONS

A. Use carrier off-floor supports for wall-hanging fixtures, unless otherwise indicated.

B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

## 3.3 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-hanging fixtures, unless otherwise indicated.

B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.

C. Install fixtures level and plumb.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Refer to Division 15 Section "Valves" for general-duty valves.

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.

G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 for sealant and installation requirements.

## 3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Ground equipment.

1. 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 and UL 486B.

**END OF SECTION**

## SECTION 22 33 00
## ELECTRIC, DOMESTIC WATER HEATERS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following for domestic water systems:

1. Tankless, electric water heaters.
2. Commercial, electric water heaters.
3. Compression tanks.
4. Accessories.

### 1.3 SUBMITTALS

A. Product Data: For each type and size of water heater. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

B. Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.

D. Maintenance Data: For water heaters to include in maintenance manuals specified in Division 1.

### 1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on specific units indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

E. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:

1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.
2. ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings," for household water heaters.

### 1.5 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Point-of-Use, Tankless, Electric Water Heaters:
   a. Chronomite Laboratories, Inc.
   b. Eemax
   c. Bosch
2. Commercial, Point-of-Use, Storage, Electric Water Heaters:
   a. Rheem
   b. State Industries.
   c. Bosch
3. Commercial, Storage, Electric Water Heaters:
   a. Lochinvar Corp.
   b. PVI Industries, Inc.
   c. State Industries.
   d. Rheem.
4. Water Heater Stand and Drain Pan Units:
   a. Safety: W. H. Safety Products, Inc.
5. Compression Tanks:
   a. Bell & Gossett
   b. Taco, Inc.
   c. Zurn Industries, Inc.; Wilkins Div.

### 2.2 POINT-OF-USE, TANKLESS, ELECTRIC WATER HEATERS

A. Description: Comply with UL 499.

B. Construction: Without hot-water storage.

1. Working-Pressure Rating: 150 psig (1035 kPa).
2. Tappings: ASME B1.20.1, pipe thread.
3. Interior Finish: Materials complying with NSF 61, barrier materials for potable-water tank linings.
4. Jacket: Aluminum or steel, with enameled finish, or plastic.

C. Heating System: Electric-resistance type.

1. Temperature Control: Adjustable thermostat.
2. Safety Control: Automatic, high-temperature-limit cutoff device or system.

D. Mounting: Bracket or device for wall mounting.

### 2.3 COMMERCIAL, POINT-OF-USE, STORAGE, ELECTRIC WATER HEATERS (6 TO 40 GALLON)

A. Description: Comply with UL 174 or UL 1453, and listed by manufacturer for commercial applications.

B. Storage Tank Construction: Non-ASME-code steel with 150-psig (1035-kPa) working-pressure rating.

1. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, drain, anode rod, and controls as required. Attach tappings to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
2. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
3. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
4. Jacket: Steel, with enameled finish.

C. Heating Elements: Two, unless otherwise indicated; electric, screw-in, immersion type.

1. Temperature Control: Adjustable thermostat.

D. Anode Rod: Factory installed, magnesium.

E. Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.

F. Special Requirement: NSF 5 construction.

## 2.4 COMMERCIAL, STORAGE, ELECTRIC WATER HEATERS (OVER 40 GALLONS)

A. Description: Comply with UL 1453.

B. Storage Tank Construction: ASME-code steel with 150-psig (1035-kPa) working-pressure rating.

1. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometer, drain, anode rods, and controls as required. Attach tappings to tank shell before testing and labeling.

   a. NPS 2 (DN50) and Smaller: Threaded ends according to ASME B1.20.1, pipe threads.

2. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
3. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
4. Jacket: Steel, with enameled finish.

C. Heating Elements: Electric, screw-in or bolt-on, immersion type arranged in multiples of three.

1. Exception: Water heaters up to 9-kW input may have 2 or 3 elements.
2. Staging: Input not exceeding 18 kW per step.
3. Temperature Control: Adjustable surface-mounted thermostat.
4. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

D. Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.

E. Anode Rods: Factory installed, magnesium.

F. Dip Tube: Factory installed. Not required if cold-water inlet is near bottom of storage tank.

G. Special Requirement: NSF 5 construction.

## 2.5 COMPRESSION TANKS

A. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

B. Construction: 150-psig (1035-kPa) working-pressure rating.

C. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.

D. Tank Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

E. Tank Exterior Finish: Manufacturer's standard, unless finish is indicated.

F. Air-Charging Valve: Factory installed.

## 2.6 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

B. Vacuum Relief Valves: Comply with ASME PTC 25.3. Furnish for installation in piping.

1. Exception: Omit if water heater has integral vacuum-relieving device.

C. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

D. Water Heater Stands: Water heater manufacturer's factory-fabricated, steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches (457 mm) above the floor.

E. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated, steel bracket for wall mounting and capable of supporting water heater and water.

F. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4 (DN20).

## PART 3 - EXECUTION

### 3.1 CONCRETE BASES

A. Install concrete bases of dimensions indicated. Refer to Division 3 and Division 15 Section "Basic Mechanical Materials and Methods."

### 3.2 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.

1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.

B. Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

D. Install vacuum relief valves in cold-water-inlet piping.

E. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 15 Section "Plumbing Specialties" for drain valves.

F. Install thermometers on water heater inlet and outlet piping

1. Exception: Omit thermometers for the following:

a. Commercial, point-of-use, water heater inlet piping.
b. Water heater with thermometer outlet piping.

G. Fill water heaters with water.

### 3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect hot- and cold-water piping with shutoff valves and unions. Connect hot-water-circulating piping with shutoff valve, check valve, and union.

D. Make connections with dielectric fittings where piping is made of dissimilar metal.

E. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Arrange wiring to allow unit service.

F. Ground equipment.

1. 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 Standards.

## 3.4 FIELD QUALITY CONTROL

A. In addition to manufacturer's written installation and startup checks, perform the following:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify that piping system tests are complete.
3. Check for piping connection leaks.
4. Check for clear relief valve inlets, outlets, and drain piping.
5. Check operation of circulators.
6. Test operation of safety controls, relief valves, and devices.
7. Energize electric circuits.
8. Adjust operating controls.
9. Adjust hot-water-outlet temperature settings. Do not set above 140 deg F (60 deg C) unless piping system application requires higher temperature.
10. Balance water flow through manifolds of multiple-unit installations.

## 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.

1. Train Owner's maintenance personnel on procedures for starting and stopping, troubleshooting, servicing, and maintaining equipment.
2. Review data in maintenance manuals. Refer to Division 1.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

**END OF SECTION**

# SECTION 22 40 00
# PLUMBING FIXTURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes plumbing fixtures and related components.

### 1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

### 1.4 SUBMITTALS

A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

### 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. TAS: Texas Accessibility Standards.

### 1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Products," and "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.

## 2.2 LAVATORY FAUCETS

A. Lavatory Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.
1. Products:
   a. American Standard.
   b. Eljer.
   c. Kohler.

## 2.3 SHOWER FAUCETS

A. Shower Faucet: Include hot- and cold-water indicators; tub spout; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.
1. Manufacturers:
   a. American Standard.
   b. Eljber.
   c. Kohler.

## 2.4 SINK FAUCETS

A. Sink Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.
1. Manufacturers:
   a. American Standard.
   b. Eljer
   c. Kohler.

## 2.5 TOILET SEATS

A. Toilet Seat: Solid plastic.
1. Manufacturers:
   a. Bemis.
   b. Beneke.
   c. Centoco.
   d. Church.

## 2.6 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard, Manufactured, plastic enclosure for covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.
1. Manufacturers:
   a. Engineered Brass Co.
   b. Plumerex
   c. Truebro.

## 2.7 FIXTURE SUPPORTS

A. Water-Closet Support: Water-closet combination carrier designed for accessible and standard mounting heights. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
1. Manufacturers:
   a. Mifab
   b. Josam.
   c. Wade.
   d. Zurn

B. Urinal Support: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include steel uprights with feet.
1. Manufacturers:
   a. Josam.
   b. J.R. Smith
   c. Zurn.
2. Accessible Fixture Support: Include rectangular steel uprights.

C. Lavatory Support: Type II, lavatory carrier with concealed arms and tie rod. Include steel uprights with feet.
1. Manufacturers:
   a. Josam.

b. J.R. Smith
c. Zurn.

2. Accessible Fixture Support: Include rectangular steel uprights.

D. Sink Support: Type II, sink carrier with hanger plate, bearing studs, and tie rod. Include steel uprights with feet.
1. Manufacturers:

a. Josam.
b. J.R. Smith
c. Zurn.

## 2.8 WATER CLOSETS

A. Water Closets: Accessible, wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.
1. Products:

a. American Standard, Inc.
b. Kohler Co.
c. TOTO USA, Inc.
d. Crane

B. Water Closets: Accessible, floor mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
1. Products:

a. American Standard, Inc.
b. Kohler Co.
c. TOTO USA, Inc.
d. Crane

## 2.9 URINALS

A. Urinals,: Accessible, wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.
1. Products:

a. American Standard, Inc.
b. Kohler Co.
c. TOTO USA, Inc.
d. Crane.

## 2.10 LAVATORIES, SINKS

A. Lavatories,: Accessible, wall hanging, vitreous-china fixture.
1. Products:

a. American Standard, Inc.
b. Kohler Co.
c. Toto
d. Crane

## 2.11 KITCHEN SINKS

A. Kitchen Sinks: Commercial, counter-mounting, stainless-steel fixture.
1. Products:

a. Elkay Manufacturing Co.
b. Just Manufacturing Co.
c. Kindred

## 2.12 SERVICE SINKS

A. Service Sinks: Floor-mounting, enameled, sink with front apron, raised back, and coated, wire rim guard.
1. Products:

a. Commercial Enameling Co.
b. Kohler Co.
c. Fiat

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

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

## 3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 15 Section "Valves" for general-duty valves.

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install toilet seats on water closets.

N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install traps on fixture outlets.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.

S. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

## 3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

F. Ground equipment.

1. 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 and UL 486B.

## 3.4 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

## 3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

## 3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

## 3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

# DIVISION 23
## HVAC

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS

**SECTION 23 05 00**

**COMMON WORK RESULTS FOR HVAC**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Equipment installation requirements common to equipment sections.
8. Concrete bases.
9. Supports and anchorages.

### 1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

### 1.3 SUBMITTALS

A. Welding certificates.

### 1.4 QUALITY ASSURANCE AND COORDINATION

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

C. Division 23 contractor shall be responsible for the sufficiency of the size of shafts and chases and the adequate clearance in double partitions and hung ceilings for proper installation of his work. He shall cooperate with contractors of other divisions of the work whose work is in the same space and shall advise the general contractor of his requirements. Such spaces and clearances shall, however, be kept to the minimum size required.

D. Division 23 contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. If required for better accessibility, furnish access doors for this purpose. Minor deviations from drawings may be allowed to provide for better accessibility. Any changes shall be approved by the general contractor prior to making the change.

E. Division 23 contractor shall provide the Construction Manager/General Contractor with the exact locations of access doors for each concealed valve, damper, or other device requiring service. Locations of these doors shall be submitted in sufficient time to be installed in the normal course of work.

F. Prior to purchasing, installing, and/or fabricating any equipment, piping, or ductwork; the division 23 contractor shall assure himself that they can be installed as contemplated in cooperation with

contractors of other divisions of the work and the physical constraints of the structural and architectural work.

## PART 2 - PRODUCTS

### 2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12.

### 2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

### 2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Carbon steel. Include two for each sealing element.

D. 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.

### 2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

### 2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to

closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Rough brass.

## 2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

# PART 3 - EXECUTION

## 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space

between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

## 3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

## 3.3 PIPING CONNECTIONS

A. Make connections according to 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. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

## 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

## 3.5 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and

directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

**3.6 GROUTING**

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

**END OF SECTION 230500**

## SECTION 23 05 48

## VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Spring isolators.
5. Housed spring mounts.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Restraining braces and cables.

### 1.2 PERFORMANCE REQUIREMENTS

A. Refer to General Notes on Sheet M0.1.

### 1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

E. Field quality-control test reports.

### 1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

### PART 2 - PRODUCTS

### 2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene

isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

H. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

I. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

## 2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

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: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. 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.

G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. 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. Minimum length of eight times diameter.

## PART 3 - EXECUTION

### 3.1 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.

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.

### 3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment 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 agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. 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.

G. 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### 3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.

### 3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

**3.5 ADJUSTING**

A. Adjust isolators after piping 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.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

**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. Pipe labels.
3. Duct labels.

### 1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances 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.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures 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 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.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

### 2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

## 2.3 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

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 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, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

## 3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

## 3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. 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. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigerant Piping:

a. Background Color: White.
b. Letter Color: Black.

## 3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated or self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

**END OF SECTION 23 05 53**

# SECTION 23 05 93
# TESTING, ADJUSTING, AND BALANCING FOR HVAC

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

### 1.2 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 entity engaged to perform TAB Work.

### 1.3 SUBMITTALS

A. Certified TAB reports.

### 1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Construction Manager.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 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 systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices 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 ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Nonmetal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. 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.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units and verify that they are accessible and their controls are connected and functioning.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. 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.

## 3.2 PREPARATION

A. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

## 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance," ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets 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. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC 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.

## 3.4 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

C. 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.

D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

E. Verify that motor starters are equipped with properly sized thermal protection.

F. Check dampers for proper position to achieve desired airflow path.

G. Check for airflow blockages.

H. Check condensate drains for proper connections and functioning.

I. Check for proper sealing of air-handling-unit components.

J. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

## 3.5 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. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. 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 will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal

outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

## 3.6 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. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

## 3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

## 3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

## 3.9 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

## 3.10 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.
2. Include a list of instruments used for procedures, along with proof of calibration.

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 contractor.
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. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

**END OF SECTION 230593**

**SECTION 23 07 00**

**HVAC INSULATION**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:

   a. Cellular glass.
   b. Flexible elastomeric.
   c. Mineral fiber.
   d. Polyolefin.
   e. Polystyrene.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied jackets.
10. Tapes.
11. Securements.
12. Corner angles.

B. Related Sections:

1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section "Metal Ducts" for duct liners.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

### 1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade 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.

## 3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and 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, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom 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 application and finishing.

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 at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install 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.
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 2 inches o.c.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

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 similar to butt joints.

## 3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

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 Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. 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.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

## 3.4 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.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be 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.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as 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 used for adjacent pipe. Overlap adjoining pipe insulation by not less than two 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 two 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 and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
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.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. 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 shall conform 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 adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two 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.

## 3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

## 3.6 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

## 3.7 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.

## 3.8 INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric or Polyolefin, 1 inch thick.

## 3.9 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Flexible Elastomeric: 2 inches thick.
3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
4. Polyolefin: 2 inches thick.
5. Polystyrene: 2 inches thick.

## 3.10 OUTDOOR, 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.

C. Piping:

1. Aluminum, Smooth: 0.016 inch thick.

**END OF SECTION 23 07 00**

**SECTION 23 09 00**

**INSTRUMENTATION AND CONTROLS FOR HVAC**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each control device indicated.

B. Shop Drawings:

1. Schematic flow diagrams.
2. Power, signal, and control wiring diagrams.
3. Details of control panel faces.
4. Damper schedule.
5. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
6. Control System Software: Schematic diagrams, written descriptions, and points list.

### 1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Software and firmware operational documentation.

### 1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 CONTROL SYSTEM

A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

### 2.3 DDC EQUIPMENT

A. Operator Workstation: PC-based microcomputer with minimum configuration as follows:

1. Motherboard: With 8 integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Pentium 4
3. Random-Access Memory: 512MB.
4. Graphics: Video adapter, minimum 1280 x 1024pixels, 64 MB video memory, with TV out.
5. Monitor: 17 inches LCD color.

6. Keyboard: QWERTY, 105 keys in ergonomic shape.
7. Floppy-Disk Drive: 1.44 MB.
8. Hard-Disk Drive: 80 GB.
9. CD-ROM Read/Write Drive: 48x24x48
10. Mouse: Three button, optical.
11. Uninterruptible Power Supply: 2 kVa.
12. Operating System: Microsoft Windows 7with high-speed Internet access.

B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.
b. Discrete/digital, analog, and pulse I/O.
c. Monitoring, controlling, or addressing data points.
d. Software applications, scheduling, and alarm processing.
e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.
b. Discrete/digital, analog, and pulse I/O.
c. Monitoring, controlling, or addressing data points.

3. Local operator interface provides for download from or upload to operator workstation.

D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA)
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

G. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

## 2.4 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Section 27 15 00 "Communications Horizontal Cabling."

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

B. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.

C. Install automatic dampers according to Section 23 33 00 "Air Duct Accessories."

D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

E. Install labels and nameplates to identify control components according to Section 23 05 53 "Identification for HVAC Piping and Equipment."

F. Install duct volume-control dampers according to Section 23 31 13 "Metal Ducts" and Section 23 31 16 "Nonmetal Ducts."

G. Install electronic and fiber-optic cables according to Section 27 15 00 "Communications Horizontal Cabling."

## 3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."

B. Install building wire and cable according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Section 27 15 00 "Communications Horizontal Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

## 3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
8. Check DDC system as follows:

   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare I/O capacity has been provided.
   d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

## 3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls.

**END OF SECTION 23 09 00**

**SECTION 23 23 00**

**REFRIGERANT PIPING**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

### 1.2 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Field quality-control test reports.

D. Operation and maintenance data.

### 1.3 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

### 1.4 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

### 2.2 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

A. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with soldered joints.

### 3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at strainers if they are not an integral part of strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

L. Install flexible connectors at compressors.

### 3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

T. Install sleeve seals for piping penetrations of concrete walls and slabs.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

## 3.4 PIPE JOINT CONSTRUCTION

A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

## 3.5 HANGERS AND SUPPORTS

A. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

B. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

C. Support multifloor vertical runs at least at each floor.

## 3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

   a. Fill system with nitrogen to the required test pressure.
   b. System shall maintain test pressure at the manifold gage throughout duration of test.
   c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
   d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

## 3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

## 3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

**END OF SECTION 23 23 00**

**SECTION 23 31 13**

**METAL DUCTS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

### 1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Welding certificates.

### 1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

### 2.1 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.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) 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."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "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."

## 2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 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.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

## 2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CertainTeed Corporation; Insulation Group.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.

2. Maximum Thermal Conductivity:

   a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

   a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   a. Fan discharges.
   b. Intervals of lined duct preceding unlined duct.
   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

   a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

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. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## 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 according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. 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.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

### 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 the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

## 3.6 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that

extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

## 3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

## 3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: A.

2. Ducts Connected to Constant-Volume Air-Handling Units:

a. Pressure Class: Positive 3-inch wg.
b. Minimum SMACNA Seal Class: A.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: B.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg.
b. Minimum SMACNA Seal Class: B.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.

F. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, R-5 (installed).
2. Return Air Ducts: Fibrous glass, Type I, R-5 (installed).
3. Exhaust Air Ducts: Fibrous glass, Type I, R-5 (installed).
4. Transfer Ducts: Fibrous glass, Type I, R-5 (installed).

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral.

**END OF SECTION 23 31 13**

**SECTION 23 33 00**

**AIR DUCT ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Flange connectors.
7. Turning vanes.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

**1.2 SUBMITTALS**

A. Product Data: For each type of product indicated.

B. Operation and maintenance data.

**1.3 QUALITY ASSURANCE**

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

**2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ruskin Company.
11. SEMCO Incorporated.
12. Vent Products Company, Inc.

B. Description: Gravity balanced.

**2.3 MANUAL VOLUME DAMPERS**

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. Flexmaster U.S.A., Inc.
d. McGill AirFlow LLC.
e. METALAIRE, Inc.
f. Nailor Industries Inc.

g. Pottorff; a division of PCI Industries, Inc.
h. Ruskin Company.
i. Trox USA Inc.
j. Vent Products Company, Inc.

2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. Flexmaster U.S.A., Inc.
d. McGill AirFlow LLC.
e. METALAIRE, Inc.
f. Nailor Industries Inc.
g. Pottorff; a division of PCI Industries, Inc.
h. Ruskin Company.
i. Trox USA Inc.
j. Vent Products Company, Inc.

2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.

## 2.4 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. Lloyd Industries, Inc.
8. M&I Air Systems Engineering; Division of M&I Heat Transfer Products Ltd.
9. McGill AirFlow LLC.
10. METALAIRE, Inc.
11. Metal Form Manufacturing, Inc.
12. Nailor Industries Inc.
13. NCA Manufacturing, Inc.
14. Ruskin Company.
15. Vent Products Company, Inc.
16. Young Regulator Company.

## 2.5 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. PHL, Inc.
10. Pottorff; a division of PCI Industries, Inc.
11. Prefco; Perfect Air Control, Inc.
12. Ruskin Company.
13. Vent Products Company, Inc.
14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

## 2.6 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. PHL, Inc.
6. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection.

## 2.7 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.
9. Ventfabrics, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
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.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 10-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

## 2.8 DUCT ACCESSORY HARDWARE

A. 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.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," 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 or control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. 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.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Control devices requiring inspection.
10. 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 Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Install duct test holes where required for testing and balancing purposes.

O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

## 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 purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

**END OF SECTION 23 33 00**

**SECTION 23 34 16**

**CENTRIFUGAL HVAC FANS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Backward-inclined centrifugal fans.
2. Forward-curved centrifugal fans.

### 1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

### 1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA 1.

## PART 2 - PRODUCTS

### 2.1 BACKWARD-INCLINED CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier Corporation.
2. Chicago Blower Corporation.
3. Loren Cook Company.
4. Madison Manufacturing.
5. GreenHeck
6. New York Blower Company (The).
7. Trane.

B. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.

C. Housings: Formed panels to make curved-scroll housings with shaped cutoff; with doors or panels to allow access to internal parts and components.

1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Spun inlet cone with flange.
3. Outlet flange.

D. Backward-Inclined Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

E. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.

1. Ball-Bearing Rating Life: ABMA 9, LI0 at 50,000 hours.
2. Roller-Bearing Rating Life: ABMA 11, LI0 at 50,000 hours.

G. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor Size: 1.5.
2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
3. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
5. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
6. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

1. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Discharge Dampers: Assembly with parallel blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
5. Inlet Screens: Grid screen of same material as housing.

I. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.

## 2.2 FORWARD-CURVED CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation.
2. Chicago Blower Corporation.
3. GreenHeck
4. Industrial Air; a division of Lau Industries, Inc.
5. Loren Cook Company.
6. Madison Manufacturing.
7. New Philadelphia Fan Co.
8. New York Blower Company (The).
9. Trane.

B. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.

C. Housings: Formed panels to make curved-scroll housings with shaped cutoff; with doors or panels to allow access to internal parts and components.

1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Spun inlet cone with flange.
3. Outlet flange.

D. Forward-Curved Wheels: Black-enameled or galvanized steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

E. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.

G. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor Size: 1.5.

2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
3. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
5. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
6. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

1. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
5. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
6. Inlet Screens: Grid screen of same material as housing.
7. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
8. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

I. Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.

## 2.3 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Support floor-mounting units using restrained spring isolators having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by authorities having jurisdiction. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label fans according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

## 3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install line-sized piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

## 3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. 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.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
10. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

**END OF SECTION 23 34 16**

**SECTION 23 37 13**

**DIFFUSERS, REGISTERS, AND GRILLES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Perforated diffusers.
4. Louver face diffusers.
5. Adjustable bar registers and grilles.
6. Fixed face registers and grilles.

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

**1.2 SUBMITTALS**

A. Product Data: For each type of product indicated, include the following:

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. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

**PART 2 - PRODUCTS**

**2.1 REGISTERS, DIFFUSERS AND GRILLES**

A. Air Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anemostat Products; a Mestek company.
b. Air Diffusion Products (ADP).
c. Nailor Industries Inc.
d. Price Industries.
e. Titus.
f. Tuttle & Bailey.

**2.2 SOURCE QUALITY CONTROL**

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: 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 diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

**3.2 ADJUSTING**

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

## SECTION 23 63 13

## AIR-COOLED REFRIGERANT CONDENSERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes packaged, air-cooled refrigerant condensers for outdoor installation.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For air-cooled refrigerant condensers. 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.

#### 1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

#### 1.4 QUALITY ASSURANCE

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. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. AAON
2. Carrier Corporation; Commercial HVAC Systems.
3. Trane; a business of American Standard Companies.
4. USA Coil & Air.
5. YORK; a Johnson Controls company.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

B. Equipment Mounting: Install air-cooled condenser refrigerant condensers using elastomeric mounts and secure to concrete pad. Comply with requirements for vibration isolation devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Maintain manufacturer's recommended clearances for service and maintenance. Coordinate enclosure requirements with general contractor.

D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

#### 3.2 CONNECTIONS

A. Install piping adjacent to machine to allow service and maintenance.

B. Refrigerant Piping: Connect piping to unit with pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line. Refrigerant piping and specialties are specified in Section 23 23 00 "Refrigerant Piping."

## 3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform electrical test and visual and mechanical inspection.
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 proper motor rotation and unit operation. Complete manufacturer's starting checklist.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

D. Air-cooled refrigerant condensers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

**END OF SECTION 23 63 13**

**SECTION 23 72 00**

**AIR-TO-AIR ENERGY RECOVERY EQUIPMENT**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Heat wheels.
2. Fixed-plate sensible heat exchangers.

### 1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For air-to-air energy recovery equipment. 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.

### 1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For air-to-air energy recovery equipment, accessories, and components, from manufacturer.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 1.6 QUALITY ASSURANCE

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. ARI Compliance:

1. Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."
2. Capacity ratings for air coils shall comply with ARI 410, "Forced-Circulation Air- Cooling and Air-Heating Coils."

C. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."

D. UL Compliance:

1. Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."
2. Electric coils shall comply with requirements in UL 1995, "Heating and Cooling Equipment."

### 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fails in materials or workmanship within specified warranty period.

1. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

## PART 2 - PRODUCTS

### 2.1 HEAT WHEELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Advanced Thermal Technologies.
2. Airxchange Inc.
3. American Energy Exchange, Inc.
4. SEMCO Incorporated.

B. Casing:

1. Steel with standard factory-painted finish.
2. Integral purge section limiting carryover of exhaust air to between 0.05 percent at 1.6-inch wg and 0.20 percent at 4-inch wg differential pressure.
3. Casing seals on periphery of rotor and on duct divider and purge section.
4. Support vertical rotors on grease-lubricated ball bearings having extended grease fittings or permanently lubricated bearings. Support horizontal rotors on tapered roller bearing.

C. Rotor: Aluminum segmented wheel strengthened with radial spokes, with nontoxic, noncorrosive, silica-gel desiccant coating.

1. Maximum Solid Size for Media to Pass: 800 micrometer.

D. Rotor: Polymer segmented wheel strengthened with radial spokes impregnated with nonmigrating, water-selective, molecular-sieve desiccant coating.

1. Maximum Solid Size for Media to Pass: 800 micrometer.

E. Drive: Fractional horsepower motor and gear reducer and self-adjusting multilink belt around outside of rotor.

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
2. 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.

F. Disposable Panel Filters:

1. Comply with NFPA 90A.
2. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
3. Factory-fabricated, viscous-coated, flat-panel type.
4. Thickness: 2 inches.
5. Minimum Arrestance: 80, according to ASHRAE 52.1.
6. Minimum Merv: 5, according to ASHRAE 52.2.
7. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
8. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

### 2.2 FIXED-PLATE SENSIBLE HEAT EXCHANGERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. American Energy Exchange, Inc.
2. Des Champs Technologies.
3. Eclipse, Inc.; Exothermics Business Group.
4. Nutech Brands Inc.
5. RenewAire LLC.
6. UAS, Inc.; a CLARCOR company.

B. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Casing: Galvanized steel with duct collars.

D. Casing Insulation: 1-inch- thick, foil-faced glass fiber.

E. Drain Pan: Same material as casing, with drain connections on exhaust and supply side.

1. Comply with requirements in ASHRAE 62.1.

F. Plates: Evenly spaced and sealed and arranged for counter airflow.

1. Plate Material: Embossed aluminum.
2. Plate Coating: Epoxy.

G. Bypass Plenum: Within casing, with gasketed face-and-bypass dampers having operating rods extended outside casing.

H. Disposable Panel Filters:

1. Comply with NFPA 90A.
2. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
3. Factory-fabricated, viscous-coated, flat-panel type.
4. Thickness: 2 inches.
5. Minimum Arrestance: 80, according to ASHRAE 52.1.
6. Minimum Merv: 5, according to ASHRAE 52.2.
7. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
8. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

## 2.3 FIXED-PLATE TOTAL HEAT EXCHANGERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Mitsubishi Electric Sales Canada Inc.
2. RenewAire LLC.

B. Casing: Galvanized steel.

C. Plates: Evenly spaced and sealed and arranged for counter airflow.

1. Plate Material: Chemically treated paper with selective hydroscopicity and moisture permeability, and gas barrier properties.

D. Bypass Plenum: Within casing, with gasketed face-and-bypass dampers having operating rods extended outside casing.

E. Disposable Panel Filters:

1. Comply with NFPA 90A.
2. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
3. Factory-fabricated, viscous-coated, flat-panel type.
4. Thickness: 2 inches.
5. Minimum Arrestance: 80, according to ASHRAE 52.1.
6. Minimum Merv: 5, according to ASHRAE 52.2.
7. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
8. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install heat wheels so supply and exhaust airstreams flow in opposite directions and rotation is away from exhaust side to purge section to supply side.

1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
3. Access doors and panels are specified in Division 23 Section "Air Duct Accessories."

B. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in opposite directions.

1. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to heat exchanger. Access doors and panels are specified in Division 23 Section "Air Duct Accessories."

C. Install floor-mounted units on 4-inch- high concrete base.

D. Suspended Units: Suspend and brace units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

E. Install units with clearances for service and maintenance.

F. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

G. Pipe drains from drain pans to nearest floor drain; use ASTM B 88, Type L, drawn-temper copper water tubing with soldered joints, same size as condensate drain connection.

**3.2 CONNECTIONS**

A. Install piping adjacent to unit to allow service and maintenance.

B. Connect piping to units mounted on vibration isolators with flexible connectors.

**END OF SECTION 23 72 00**

**SECTION 23 82 19**

**FAN COIL UNITS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes fan-coil units and accessories.

### 1.2 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

### 1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install fan-coil units to comply with NFPA 90A.

B. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Verify locations of thermostats and other exposed control sensors with Drawings, architect, and room details before installation.

D. Install new filters in each fan-coil unit within two weeks after Substantial Completion.

E. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connect condensate drain to indirect waste.

   a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

F. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Section 23 33 00 "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.

### 3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION 23 82 19**

# DIVISION 26
## ELECTRICAL

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

### 1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS AND CABLES

A. Aluminum and Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW and SO.

C. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

### 2.2 CONNECTORS AND SPLICES

A. 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:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHN-THWN, in raceway.

**3.3 INSTALLATION OF CONDUCTORS AND CABLES**

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. 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.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."

G. 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 and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

**3.4 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 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

**3.5 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 13 "Penetration Firestopping."

**3.6 FIELD QUALITY CONTROL**

A. 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 visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION 26 05 19**

**SECTION 26 05 26**

**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Grounding systems and equipment.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

### 1.3 QUALITY ASSURANCE

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.

## PART 2 - PRODUCTS

### 2.1 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:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

### 2.2 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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

### 2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

## 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. 3/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

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 EQUIPMENT GROUNDING

A. 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.
8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. 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.

C. 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.

D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

## 3.3 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 (50 mm) 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. 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.

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 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 [**tinned** ]bonding jumper to bond across flexible duct connections to achieve continuity.

**3.4 LABELING**

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

**3.5 FIELD QUALITY CONTROL**

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

**END OF SECTION 26 05 26**

**SECTION 26 05 29**

**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

### 1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

### 1.3 ACTION SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

### 1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

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 non-armored 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 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. 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:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

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 in which used.

a. 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:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type 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.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

# PART 3 - EXECUTION

## 3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. 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 single-bolt conduit clamps.

## 3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. 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 (90 kg).

D. 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 (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS 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 meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

## 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

## 3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) 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 4000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 "Cast-in-Place Concrete." Anchor equipment to concrete base.

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.

**3.5 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 minimum dry film thickness of 2.0 mils (0.05 mm).

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 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

B. Related Requirements:
1. Section 27 05 28 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

### 1.2 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

### 1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. IMC: Comply with ANSI C80.6 and UL 1242.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; zinc-coated steel or aluminum.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:

   a. Material: Steel.
   b. Type: Setscrew or compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

H. 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, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a

qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

D. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

H. Gangable boxes are prohibited.

I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

J. 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.

# PART 3 - EXECUTION

## 3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: GRC, IMC or EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

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: IMC. Raceway locations include the following:
   a. Gymnasiums.
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 or IMC.
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: 1/2-inch trade size.

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. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

## 3.2 INSTALLATION

A. 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.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches (300 mm) of enclosures to which attached.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) 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 (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
4. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. 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.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. 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 (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

N. 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.

O. 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. Where otherwise required by NFPA 70.

P. Expansion-Joint Fittings:

1. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
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 time of installation. Install conduit supports to allow for expansion movement.

Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) 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.

R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

S. 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 the box and cover plate or the supported equipment and box.

T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

U. Locate boxes so that cover or plate will not span different building finishes.

V. 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.

W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

X. Set metal floor boxes level and 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. Prepare trench bottom as specified in Section 31 20 00 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 31 20 00 "Earth Moving."
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 (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00 "Earth Moving."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. 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 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 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

### 3.6 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 43

## UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried duct banks, and in single duct runs.

#### 1.2 ACTION SUBMITTALS

A. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Cover design.
3. Grounding details.
4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

#### 1.3 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

#### 2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. 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:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses" and "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

## 3.2 DUCT INSTALLATION

A. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1220 mm), both horizontally and vertically, at other locations, unless otherwise indicated.

B. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

C. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

D. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

E. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.

## 3.3 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

**END OF SECTION 26 05 43**

**SECTION 26 05 44**

**SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

## PART 2 - PRODUCTS

### 2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

### 2.2 SLEEVE-SEAL SYSTEMS

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, provide products by one of the following:

   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

### 2.3 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

## 2.4 SILICONE SEALANTS

A. 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 that are not fire rated.
2. Sealant shall have VOC content of 40 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

# PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [**steel**] [**cast-iron**] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

**3.2 SLEEVE-SEAL-SYSTEM INSTALLATION**

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install 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.

**END OF SECTION 26 05 44**

**SECTION 26 05 48**

**VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

### 1.2 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class Defined in the IBC: A.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.

   a. Component Importance Factor: 1.5.
   b. Component Response Modification Factor: 1.5.
   c. Component Amplification Factor: 1.0.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.095.
4. Design Spectral Response Acceleration at 1.0-Second Period: 0.046.

### 1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details 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. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
2. Field-fabricated supports.
3. Seismic-Restraint Details.

### 1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-(6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

C. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

### 2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti Inc.
5. Loos & Co.; Seismic Earthquake Division.
6. Mason Industries.
7. TOLCO Incorporated; a brand of NIBCO INC.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements 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: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining

cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. 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.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl 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 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application.

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.

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.

### 3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

B. 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.

C. 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.

D. 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.

**3.3 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 they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

**3.4 FIELD QUALITY CONTROL**

A. Tests and Inspections:

1. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
2. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
3. Test to 90 percent of rated proof load of device.
4. Measure isolator restraint clearance.
5. Measure isolator deflection.
6. Verify snubber minimum clearances.
7. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

**3.5 ADJUSTING**

A. Adjust isolators after isolated equipment 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.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

**END OF SECTION 26 05 48**

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

### 1.3 QUALITY ASSURANCE

A. Comply with ANSI 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. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

## PART 2 - PRODUCTS

### 2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

### 2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

### 2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

### 2.4 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

### 2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate

underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

**2.6 WARNING LABELS AND SIGNS**

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign 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 (915 MM)."

**2.7 INSTRUCTION SIGNS**

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with [**black letters on white face**] <**Insert colors**>.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

**2.8 EQUIPMENT IDENTIFICATION LABELS**

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

**2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS**

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select 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 INSTALLATION**

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly

above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

## 3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 10-foot (3-m) maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. 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.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

**END OF SECTION 26 05 53**

**SECTION 26 09 26**

**LIGHTING CONTROL PANELBOARDS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Lighting controls using electrically operated circuit breakers.

### 1.2 DEFINITIONS

A. BAS: Building automation system.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

C. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

D. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each lighting control panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail bus configuration, current, and voltage ratings.
3. Short-circuit current rating of panelboards and overcurrent protective devices.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Printout of software application and graphic screens.
4. Device address list.

### 1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

### 1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Acuity Brands, Inc.; Lighting Control & Design, Inc.
2. Eaton Corporation; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Siemens Energy & Automation, Inc.
5. Square D; a brand of Schneider Electric.

## 2.2 SYSTEM DESCRIPTION

A. Input signal from field-mounted or on-board signal source shall open or close one or more electrically operated circuit breakers in the lighting control panelboards. Any combination of inputs shall be programmable to any combination outputs.

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. Comply with 47 CFR, Subpart A and Subpart B, for Class A digital devices.

## 2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

## 2.4 PANELBOARDS

A. The lighting panelboards may contain remotely operated circuit breakers and standard branch circuit breakers specified in Section 26 24 16 "Panelboards."

B. Assemblies: Comply with UL 67 and NEMA PB 1.

C. Surge Protective Device: Field mounted, complying with Section 26 43 13 "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."

D. Surge Protective Device: Integrally mounted, complying with UL 1449 Type 1.

1. Comply with IEEE C62.41, Category C, 200-kA short-circuit current rating.
2. Non-modular type with the following features and accessories:

   a. Digital-display indicator lights for power and protection status.

E. Enclosures: Comply with UL 50 and NEMA 250.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt 10-kA symmetrical short-circuit current available at terminals.

## 2.5 CIRCUIT BREAKERS

A. Remotely operated branch circuit breakers used for lighting control shall provide branch-circuit overcurrent protection.

B. Labeled with SWD and HID Ratings: Comply with UL 489 for 15- and 20-A, single-pole branch devices.

C. Switching Endurance Rating: Not less than 50,000 full-load open/close/open remote operations.

D. Remotely Operated Circuit Breakers: Manual override switch or handle position shall enable or disable the remote operation of the device and allow breaker handle to manually control the breaker's on-off status.

## 2.6 CONTROLLERS

A. Description: Controllers shall contain the power supply and electronic control for operating and monitoring remotely operated branch circuit breakers.

1. Comply with UL 916; with a microprocessor-based, solid-state, 365-day timing and control unit.
2. Power Supply: Powered from the panelboard, sized to provide control power for the operation of the remotely operated circuit breakers, controller, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.
3. Integral keypad and digital-display front panel for local setup, including the following:

   a. Blink notice, time adjustable from software.
   b. Ability to log and display remotely operated breaker on-time.
   c. Capability for accepting downloadable firmware so that the latest production features may be added in the future without replacing the module.

4. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation.

B. Timing Unit:

1. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
2. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
3. 16 independent schedules, each having 24 time periods.
4. Schedule periods settable to the minute.
5. Day of week, day of month, day of year with one-time or repeating capability.
6. 32 special date periods.

C. With eight inputs, each configurable to the following parameters:

1. Normally open, normally closed, two-wire maintained toggle, two-wire momentary toggle, two-wire momentary on, two-wire momentary off, or three-wire momentary operation.
2. On and off-delay timers for local override operation, adjustable from five minutes to 12 hours. Local override shall be by field-installed, two-wire momentary toggle switch.

## 2.7 MANUAL SWITCHES AND PLATES

A. Keypads: Programmable, designed to control lighting applications and functions associated with the equipment of this Section. The units shall be able to control any system output device, including remotely operated circuit breakers, relays, dimmers, and analog outputs.

B. Push-Button Switches: Modular, momentary-contact, low-voltage type.

1. Match color specified in Section 26 27 26 "Wiring Devices."
2. Integral green LED pilot light to indicate when circuit is on.
3. Internal white LED locator light to illuminate when circuit is off.

C. Manual, Maintained Contact, Full- or Low-Voltage Switch: Comply with Section 26 27 26 "Wiring Devices."

D. Wall Plates: Single and multigang plates as specified in Section 26 27 26 "Wiring Devices."

E. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

## 2.8 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 and Class 3 Control Cables: Multiconductor cable with 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 Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

# PART 3 - EXECUTION

## 3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for cable trays specified in Section 26 05 36 "Cable Trays for Electrical Systems."
3. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

## 3.2 PANELBOARD INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NECA 407.

C. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

D. Mounting Height: 90 inches (2286 mm) to top of trim above finished floor unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install filler plates in unused spaces.

## 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."

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."

C. Create a directory to indicate loads served by each circuit; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are unacceptable.

D. Panelboard Nameplates: Label each panelboard with a nameplate complying 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. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Panelboard will be considered defective if it does not pass tests and inspections.

**END OF SECTION 26 09 26**

## SECTION 26 22 00

## LOW-VOLTAGE TRANSFORMERS

### PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Indicate dimensions and weights.

1. Wiring Diagrams: Power, signal, and control wiring.

### 1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ACME Electric Corporation; Power Distribution Products Division.
2. Challenger Electrical Equipment Corp.; a division of Eaton Corp.
3. Controlled Power Company.
4. Eaton Electrical Inc.; Cutler-Hammer Products.
5. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.
6. General Electric Company.
7. Hammond Co.; Matra Electric, Inc.
8. Magnetek Power Electronics Group.
9. Micron Industries Corp.
10. Myers Power Products, Inc.
11. Siemens Energy & Automation, Inc.
12. Sola/Hevi-Duty.
13. Square D; Schneider Electric.

### 2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.

### 2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Cores: One leg per phase.

D. Enclosure: NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Transformer Enclosure Finish: Comply with NEMA 250.

F. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

G. Insulation Class: 220 deg C, UL-component-recognized insulation system with a

maximum of 80 deg C rise above 40 deg C ambient temperature.

H. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

I. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

J. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

K. Wall Brackets: Manufacturer's standard brackets.

## 2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Section 26 05 53 "Identification for Electrical Systems."

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems."

## 3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

## 3.3 ADJUSTING

A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

**END OF SECTION 26 22 00**

**SECTION 26 24 13**

**SWITCHBOARDS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

### 1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.
3. Include schematic and wiring diagrams for power, signal, and control wiring.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 1.5 QUALITY ASSURANCE

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 NEMA PB 2.

C. Comply with NFPA 70.

D. Comply with UL 891.

### 1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

C. Nominal System Voltage: 480Y/277 V.

D. Main-Bus Continuous: 2000A.

E. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

F. Enclosure: Steel, NEMA 250, Type 1.

1. Enclosure Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
2. Enclosure: Flat roof; bolt-on rear covers for each section, with provisions for padlocking.

G. Cubical Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

H. Space-Heater Control: Thermostats to maintain temperature of each section.

I. Space-Heater Power Source: 120-V external branch circuit.

J. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

K. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

L. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

M. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
3. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
4. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

N. Phase and Neutral Buses and Connections: Three phase, four wire unless otherwise indicated. Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.

1. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) minimum size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors.
2. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
3. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables.

O. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

## 2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. LED indicator lights for power and protection status.
3. Audible alarm, with silencing switch, to indicate when protection has failed.
4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device.
5. Transient-event counter set to totalize transient surges.

B. Withstand Capabilities: 5000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

C. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277-V, three-phase, four-wire circuits shall be as follows:

1. Line to Neutral: 800 V for 480Y/277.
2. Line to Ground: 800 V for 480Y/277.
3. Neutral to Ground: 800 V for 480Y/277.

## 2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: 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 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and $I^2t$ response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Suitable for number, size, trip ratings, and conductor material.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
   f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
   h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

B. High-Pressure, Butt-Type Contact Switch: Operating mechanism uses butt-type contacts and a spring-charged mechanism to produce and maintain high-pressure contact when switch is closed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

2. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.

   a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
   b. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.

3. Auxiliary Switches: Factory installed, single pole, double throw, with leads

connected to terminal block, and including one set more than quantity required for functional performance indicated.

4. Service-Rated Switches: Labeled for use as service equipment.
5. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

   a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

6. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

## 2.4 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
3. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
   a. Phase Currents, Each Phase: Plus or minus 1 percent.
   b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
   c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
   d. Megawatts: Plus or minus 2 percent.
   e. Megavars: Plus or minus 2 percent.
   f. Power Factor: Plus or minus 2 percent.
   g. Frequency: Plus or minus 0.5 percent.
   h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
   i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

## 2.5 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

## 2.6 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

B. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

## 2.7 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Receive, inspect, handle, store and install switchboards and accessories according to NECA 400.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Install spare-fuse cabinet.

H. Comply with NECA 1.

I. Comply with requirements for terminating feeder bus specified in Section 26 25 00 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

J. Comply with requirements for terminating cable trays specified in Section 26 05 36 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

## 3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

## 3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace

damaged and malfunctioning controls and equipment.

C. Switchboard will be considered defective if it does not pass tests and inspections.

**END OF SECTION 26 24 13**

**SECTION 26 24 16**

**PANELBOARDS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

### 1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 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 and the unit will be fully operational after the seismic event."

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

### 1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

B. Field quality-control reports.

C. Panelboard schedules for installation in panelboards.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 1.6 QUALITY ASSURANCE

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 NEMA PB 1.

C. Comply with NFPA 70.

### 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces

defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top or bottom as field installed conditions dictate.

D. Phase, Neutral, and Ground Buses: Tin-plated aluminum.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

## 2.2 DISTRIBUTION PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in or Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

## 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: 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 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and $I^2t$ response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
   e. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.

B. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed

panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

I. Comply with NECA 1.

## 3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

## 3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

**END OF SECTION 26 24 16**

## SECTION 26 27 13

## ELECTRICITY METERING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes equipment for electricity metering by utility company.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts and wiring diagrams.

#### 1.3 QUALITY ASSURANCE

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.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

A. Meters will be furnished by utility company.

B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

C. Meter Sockets: Comply with requirements of electrical-power utility company.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.

**END OF SECTION 26 27 13**

**SECTION 26 27 26**

**WIRING DEVICES**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Wall-switch and exterior occupancy sensors.
5. Communications outlets.

### 1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, 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 NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

### 2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5361 (single), 5362 (duplex).

### 2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.

3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.
d. Leviton; 7590.

## 2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

1) Single Pole:
a) Cooper; AH1221.
b) Hubbell; HBL1221.
c) Leviton; 1221-2.
d) Pass & Seymour; CSB20AC1.

2) Two Pole:
a) Cooper; AH1222.
b) Hubbell; HBL1222.
c) Leviton; 1222-2.
d) Pass & Seymour; CSB20AC2.

3) Three Way:
a) Cooper; AH1223.
b) Hubbell; HBL1223.
c) Leviton; 1223-2.
d) Pass & Seymour; CSB20AC3.

4) Four Way:
a) Cooper; AH1224.
b) Hubbell; HBL1224.
c) Leviton; 1224-2.
d) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221PL for 120 and 277 V.
b. Hubbell; HBL1201PL for 120 and 277 V.
c. Leviton; 1221-LH1.
d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

## 2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

## 2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: White or as selected

by Architect unless otherwise indicated or required by NFPA 70 or device listing.

2. Wiring Devices Connected to Emergency Power System: Red.

B. Wall Plate Color: For plastic covers, match device color.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. 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.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that 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 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A 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:

1. Install ground pin of vertically mounted receptacles down, 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.

### 3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

**3.3 FIELD QUALITY CONTROL**

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience 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.

C. Wiring device will be considered defective if it does not pass tests and inspections.

**END OF SECTION 26 27 26**

**SECTION 26 28 16**

**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Nonfusible switches.
2. Molded-case circuit breakers (MCCBs).
3. Enclosures.

### 1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

### 1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers 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 and the unit will be fully operational after the seismic event."

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

### 1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

### 1.6 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 1.7 QUALITY ASSURANCE

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 NFPA 70.

## PART 2 - PRODUCTS

### 2.1 NONFUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three

padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

## 2.2 MOLDED-CASE CIRCUIT BREAKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: 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 250 A and larger.

D. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

E. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

## 2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, **Type 1**.
2. Outdoor Locations: NEMA 250, **Type 3R**.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Comply with NECA 1.

## 3.2 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

## 3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

**END OF SECTION 26 28 16**

**SECTION 26 32 13**

**ENGINE GENERATORS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes packaged engine-generator sets for emergency and standby power supply with the following features:

1. Gas engine.
2. Unit-mounted cooling system.
3. Unit-mounted and Remote-mounted control and monitoring.

B. See Section 26 36 00 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of packaged engine generator and accessory indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

### 1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. 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."

b. 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. 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.

B. Source quality-control test reports.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 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. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASME B15.1.

E. Comply with NFPA 37.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110 requirements for emergency power supply system.

I. Comply with UL 2200.

J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

K. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

## 1.6 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m)

## 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Caterpillar; Engine Div.
2. Generac Power Systems, Inc.
3. Kohler Co.; Generator Division.
4. Magnetek, Inc.
5. Onan/Cummins Power Generation; Industrial Business Group.
6. Spectrum Detroit Diesel.

## 2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to

line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

## 2.3 ENGINE

A. Fuel: **Natural gas with automatic LP-gas standby**.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
3. Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:

a. Carburetor.
b. Secondary Gas Regulators: One for each fuel type.
c. Fuel-Shutoff Solenoid Valves: One for each fuel source.
d. Flexible Fuel Connectors: One for each fuel source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Adjustable isochronous, with speed sensing.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 85 dBA or less.

J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

K. Starting System: 12-V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.

4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.
5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

   a. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236.

## 2.4 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level [**1**] [**2**] system, and the following:

   1. AC voltmeter.
   2. AC ammeter.
   3. AC frequency meter.
   4. DC voltmeter (alternator battery charging).
   5. Engine-coolant temperature gage.
   6. Engine lubricating-oil pressure gage.
   7. Running-time meter.
   8. Ammeter-voltmeter, phase-selector switch(es).
   9. Generator-voltage adjusting rheostat.
   10. Fuel tank derangement alarm.
   11. Fuel tank high-level shutdown of fuel supply alarm.
   12. Generator overload.

E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

   1. Overcrank shutdown.
   2. Coolant low-temperature alarm.
   3. Control switch not in auto position.
   4. Battery-charger malfunction alarm.
   5. Battery low-voltage alarm.

G. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

## 2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.

   1. Tripping Characteristic: Designed specifically for generator protection.
   2. Trip Rating: Matched to generator rating.
   3. Mounting: Adjacent to or integrated with control and monitoring panel.
   4. Provide two circuit breakers for feeding both 'Emergency' and 'Standby' transfer switches.

B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

## 2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Dripproof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

## 2.7 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## 2.8 FINISHES

A. Indoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

## 2.9 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
2. Report factory test results within 10 days of completion of test.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Section 23 21 13 "Hydronic Piping."

1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Section 23 21 13 "Hydronic Piping."

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

F. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

G. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

H. Connect engine exhaust pipe to engine with flexible connector.

I. Connect fuel piping to engines with a gate valve and union and flexible connector.

1. Natural-gas piping, valves, and specialties for gas distribution are specified in Section 23 11 23 "Facility Natural-Gas Piping."
2. LP-gas piping, valves, and specialties for gas piping are specified in Section 23 11 26 "Facility Liquefied-Petroleum Gas Piping."

J. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

K. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

L. Identify system components according to Section 23 05 53 "Identification for HVAC Piping and Equipment" and Section 26 05 53 "Identification for Electrical Systems."

## 3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
c. Verify acceptance of charge for each element of the battery after discharge.
d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

G. Remove and replace malfunctioning units and retest as specified above.

H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

I. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

## 3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section 01 79 00 "Demonstration and Training."

**END OF SECTION 26 32 13**

**SECTION 26 36 00**

**TRANSFER SWITCHES**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes automatic transfer switches rated 600 V and less.

### 1.2 ACTION SUBMITTALS

A. Product Data: Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

### 1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. 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. Dimensioned 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.

B. Field quality-control test reports.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA ICS 1.

C. Comply with NFPA 70.

D. Comply with NFPA 99.

E. Comply with NFPA 110.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AC Data Systems, Inc.
   b. Caterpillar; Engine Div.
   c. Emerson; ASCO Power Technologies, LP.
   d. Generac Power Systems, Inc.
   e. GE Zenith Controls.
   f. Kohler Power Systems; Generator Division.
   g. Onan/Cummins Power Generation; Industrial Business Group.
   h. Russelectric, Inc.
   i. Spectrum Detroit Diesel.

### 2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament

lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Switching. Where four-pole switches are indicated, provide overlapping neutral contacts.

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

J. Battery Charger: For generator starting batteries.

1. Float type rated 2 A.
2. Ammeter to display charging current.
3. Fused ac inputs and dc outputs.

K. Enclosures: General-purpose NEMA 250, Type 1 complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

## 2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase.

F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated.

G. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup

value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

## 2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

B. Identify components according to Section 26 05 53 "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

## 3.2 CONNECTIONS

A. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

## 3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.

5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

   a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
   b. Simulate loss of phase-to-ground voltage for each phase of normal source.
   c. Verify time-delay settings.
   d. Verify pickup and dropout voltages by data readout or inspection of control settings.
   e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
   f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

   a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

## 3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 01 79 00 "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

**END OF SECTION 26 36 00**

**SECTION 26 51 00**

**INTERIOR LIGHTING**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

### 1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

### 1.4 QUALITY ASSURANCE

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 NFPA 70.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

### 2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. LED Fixtures: Comply with UL 8750. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

E. 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.

F. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

### 2.3 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. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

## 2.4 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

## 2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with 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 (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

**3.2 FIELD QUALITY CONTROL**

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

**END OF SECTION 26 51 00**

# DIVISION 27
## COMMUNICATIONS

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

**SECTION 27 05 28**

**PATHWAYS FOR COMMUNICATIONS SYSTEMS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Surface pathways.
4. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 26 05 33 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

### 1.2 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets.

### 1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, equipment racks and their mounting provisions, including those for internal components, from manufacturer.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS AND FITTINGS

A. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. EMT: Comply with ANSI C80.3 and UL 797.

D. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

   a. Material: Steel.
   b. Type: Setscrew or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

E. Joint Compound for GRC: 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. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

D. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated

according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.3 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish.

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

E. Metal Floor Boxes:

1. Material: sheet metal
2. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, round.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

I. Gangable boxes are prohibited.

J. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. 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.

# PART 3 - EXECUTION

## 3.1 PATHWAY APPLICATION

A. Indoors: Apply pathway 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.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: GRC.
6. 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.

B. Minimum Pathway Size: 1 inch trade size.

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Install surface pathways only where indicated on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

## 3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
3. Arrange pathways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

H. Stub-ups to Above Recessed Ceilings:

1. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

I. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

J. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

K. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

L. 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.

M. Spare Pathways: Install pull wires in empty pathways. Cap underground pathways designated as spare above grade alongside pathways in use.

N. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.

O. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound.

P. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

Q. Expansion-Joint Fittings:

1. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.

b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.

c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
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 time of installation. Install conduit supports to allow for expansion movement.

R. Mount boxes at heights indicated on Drawings in accordance with ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

S. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

**END OF SECTION 27 05 28**

## SECTION 27 05 44

## SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

### PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

### PART 2 - PRODUCTS

### 2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized-steel sheet.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

### 2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

### 2.3 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

## 2.4 SILICONE SEALANTS

A. 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 that are not fire rated.
2. Sealant shall have VOC content of 40 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

# PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

   a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00 "Joint Sealants."
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve-seal system.

## 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing

elements to expand and make watertight seal.

**END OF SECTION 27 05 44**

# DIVISION 28
## ELECTRONIC SAFETY AND SECURITY

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

## SECTION 28 05 13

## CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

### 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. UTP cabling.
2. RS-232 cabling.
3. RS-485 cabling.
4. Low-voltage control cabling.
5. Control-circuit conductors.
6. Fire alarm wire and cable.
7. Identification products.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

#### 1.5 FIELD CONDITIONS

A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

B. Environmental Limitations: Do not deliver or install UTP cable and connecting materials until wet work in spaces is complete and dry, and temporary 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 PERFORMANCE REQUIREMENTS

A. 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-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

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.

#### 2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Section 06 10 00 "Rough Carpentry."

#### 2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. ADC.
2. AMP Netconnect; a brand of Tyco Electronics Corporation.
3. Belden Inc.
4. Berk-Tek; a Nexans company.
5. CommScope, Inc.
6. Draka Cableteq USA.
7. Genesis Cable Products; Honeywell International, Inc.
8. Mohawk; a division of Belden Networking, Inc.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M; Communication Markets Division.

B. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   a. Multipurpose: Type MP or MPG.
   b. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.

## 2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. AMP Netconnect; a brand of Tyco Electronics Corporation.
4. Belden Inc.
5. Dynacom Inc.
6. Hubbell Incorporated; Hubbell Premise Wiring.
7. Leviton Commercial Networks Division.
8. Molex Premise Networks; a division of Molex, Inc.
9. Panduit Corp.
10. Siemon.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 50 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

## 2.5 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

## 2.6 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM or CMG.

1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

## 2.7 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG,

stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) and No. 18 AWG, stranded (19x30)] tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

## 2.8 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 and 2 Control Circuits: Stranded copper, Type THHN-THWN, complying with UL 83, in raceway.

## 2.9 FIRE ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Comtran Corporation.
2. Draka Cableteq USA.
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.
5. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

## 2.10 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Brady Worldwide, Inc.
2. HellermannTyton North America.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

## 2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

### 3.2 WIRING METHOD

A. Install wiring in metal pathways and wireways.

1. Minimum conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Install cable, concealed in accessible ceilings, walls, and floors when possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
4. Install conductors parallel with or at right angles to sides and back of enclosure.
5. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks.
6. Mark each terminal according to system's wiring diagrams.
7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.

C. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

D. UTP Cable Installation: Install using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.

1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

3. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
4. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

## 3.4 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

**3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS**

A. 120-V Power Wiring: Install according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

**3.6 FIRESTOPPING**

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

**3.7 GROUNDING**

A. For low-voltage wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

**3.8 IDENTIFICATION**

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

**3.9 FIELD QUALITY CONTROL**

A. Perform the following tests and inspections:

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

**END OF SECTION 28 05 13**

## SECTION 28 31 11

## DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

### PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Notification appliances.
5. Remote annunciator.
6. Addressable interface device.
7. Digital alarm communicator transmitter.

### 1.2 SYSTEM DESCRIPTION

A. Noncoded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

### 1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 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 and the unit will be fully operational after the seismic event."

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

   a. Trained and certified by manufacturer in fire-alarm system design.
   b. NICET-certified fire-alarm technician, Level III minimum.

### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

C. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

   a. Frequency of testing of installed components.
   b. Frequency of inspection of installed components.
   c. Requirements and recommendations related to results of maintenance.
   d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

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.

## 1.8 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. AMSECO - a Potter brand; Potter Electric Signal Company.
2. Bosch Security Systems.
3. Commercial Products Group/CPG Life Safety Signals.
4. Faraday; Siemens Building Technologies, Inc.
5. Federal Signal Corporation.
6. Fire Control Instruments, Inc.; a Honeywell company.
7. Fire Lite Alarms; a Honeywell company.

8. GAMEWELL; a Honeywell company.
9. GE Infrastructure; a unit of General Electric Company.
10. Gentex Corporation.
11. Harrington Signal, Inc.
12. NOTIFIER; a Honeywell company.
13. Siemens Building Technologies, Inc.; Fire Safety Division.
14. Silent Knight; a Honeywell company.
15. SimplexGrinnell LP; a Tyco International company.

## 2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices[ **and systems**]:

1. Manual stations.
2. Smoke detectors.
3. Duct smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm-notification appliances.
2. Identify alarm at the fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Record events in the system memory.

C. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

D. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

## 2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

   a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, [**1**] [**2**] [**3**] line(s) of [**40**] [**80**] characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
   a. Notification Appliance Circuits: Style Y.
   b. Signaling Line Circuits: Style 4.
   c. Install no more than 50 addressable devices on each signaling line circuit.

D. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

E. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module.

Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

F. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

G. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism, requiring two actions to initiate an alarm, pull-lever type with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit..
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

## 2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

## 2.6 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification

appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

E. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-(25-mm-) high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.

## 2.7 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Surface cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

## 2.8 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to circuit-breaker shunt trip for power shutdown.

## 2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.

G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

H. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

I. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

### 3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

### 3.3 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

### 3.4 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

   a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
   b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

C. Fire-alarm system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

**END OF SECTION 28 31 11**

# DIVISION 31
## EARTHWORK

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

## PART 1 - GENERAL

SECTION INCLUDES:

Subsoil and topsoil materials.

RELATED SECTIONS

Section 312323.13 Backfilling

Section 312316.13 Trenching

REFERENCES

AASHTO T180 - Moisture-Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in. (457 mm) Drop.

ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 Kg.) Rammer and 12 inch (304.8 mm) Drop.

ABSE/ASTM D1556 - Test Methods for Density of Soil in Place by the Sand-Cone Method.

ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457mm) Drop.

ASTM D2167 – Test Methods for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

ASTM D2487 – Classification of Soils for Engineering Purposes.

ASTM D2922 – Test Methods for Density of Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

## PART 2 - PRODUCTS

SOIL MATERIALS

Subsoil Type S1: Conforming to Hidalgo County Public Work's standard.

Topsoil Type S3: Conforming to Hidalgo County Public Work's standard.

SOURCE QUALITY CONTROL

Tests and analysis of soil material will be performed in accordance with ANSI/ASTM D698 or ANSI/ASTM D1557 or AASHTO T180 or ASTM D2167 or ASTM D2922 or ASTM D3017. If tests indicate materials do not meet specified requirements, change material and retest at no cost to Owner.

## PART 3 - EXECUTION

STOCKPILING

Stockpile in sufficient quantities to meet project schedule and requirements.

Separate differing materials with dividers or stockpile apart to prevent mixing.

Direct surface-water away from stockpile site to prevent erosion or deterioration of materials.

STOCKPILE CLEANUP

Remove stockpile; leave area in a clean and neat condition. Grade the site surface to prevent freestanding surface water.

**END OF SECTION**

## PART 1 – GENERAL

REFERENCES

American Society for Testing and Materials (ASTM):

ASTM D1140-54 – Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75-um) Sieve.

ASTM D1557-78 – Standard Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (457-mm) Drop.

ASTM D4253-83 – Standard Test Methods for Maximum Index Density of Soils Using a Vibratory Table.

ASTM D4318-84 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

DEFINITIONS

Influence Zone under Foundations, Pavements, or Sidewalks: Area below foundation or pavement and sidewalk sub-base bounded by one horizontal to two vertical slope extending outwards from 1-ft beyond outer edge of foundation, pavement or sidewalk.

Influence Zone Around Piping or Electrical Ducts: Area below limits bounded by line 12 in. above pipe or duct and by one horizontal to two vertical slope extending outwards from that line 1-ft beyond outer edge of pipe or duct.

Unsuitable Material: Topsoil, peat, organic soils, and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by ENGINEER.

SUBMITTALS

Test Results

Submit in accordance with the general conditions.

QUALITY ASSURANCE

Testing shall be provided by the CONTRACTOR in accordance with this section and the plans.

PROJECT/SITE CONDITIONS

Notify corporations, companies, individuals or authorities owning above or below ground conduits, wires, pipes or other utilities running to property or encountered during grading operations.

Cap or remove and relocate services in accordance with instructions by owners of said services.

Protect, support, and maintain conduits, wires, pipes or other utilities that are to remain in accordance with requirements of owners of said services.

## PART 2 – PRODUCTS

FILL MATERIALS

Conform to requirements of Section 310022.

## PART 3 – EXECUTION

EXAMINATION

Examine surfaces to receive fill to determine existence of areas loosened by frost action, softened by flooding or weather or of unsuitable materials.

PREPARATION

Fill settled areas where excavations or trenches were backfilled and holes made by demolition, tree removal, and site preparation work.

Natural soils or compacted fill softened by frost, flooding or weather shall be removed, replaced, and compacted.

Remove unsuitable material from under walks, parking, and driveway areas.

Proof roll areas to receive refill material to detect soft or loose zones prior to placing fill. Remove and replace soft or loose zones.

Keep construction site free draining.

Plow, step, or bench slopes steeper than one vertical to four horizontal.

Disc level surfaces

Grading within influence zone of existing or future structures or piping and electrical ducts shall be in accordance with Section 310022.

PLACING FILL

Conform to requirements of Section 310022.

FIELD QUALITY CONTROL

Rough Grading Tolerances:

Grade to four inches below finished grade in areas to receive topsoil, but not unless new grade is less than four inches above existing grade. Grade to bottom of the base-course in areas to receive pacing or riprap. Maximum allowable variation from design elevation is one inch in ten feet Degree of finish shall be ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified.

Rough grading areas, including excavated and filled sections and adjacent transition areas shall be reasonably smoothed, compacted, and free from irregular surface changes. Conform to requirements of Section 310022.

ADJUSTMENT AND CLEANING

Excess Material:

OWNER has first right to excess grading material suitable for backfilling or site grading, not required at job site.

Remove material not required by OWNER from site.

Stockpile material suitable for backfill where indicated on Drawings or designated by ENGINEER. Place no fill where trenches for sewers, water lines, or other utilities will be located.

Remove material not suitable for backfilling or site grading and unsuitable materials from site.

Rough grade areas within grading lines and areas which are disturbed to achieve grade lines and grades as indicated on Drawings, with allowance for thickness of pavements, sidewalks, and topsoil.

# SECTION 312300 - EXCAVATION AND GRADING

## PART 1- GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. The work covered by this section consists of excavating and properly utilizing of satisfactorily disposing of all excavated material, of whatever character, within the limits of the work and the constructing, shaping and finishing of all earthwork on the entire length of the project in accordance with specification requirements herein outlined and in conformity with the required lines, grades, and typical cross sections shown on the plans.

## PART 2- PRODUCTS

2.01 MATERIALS:

A. All excavated shall material be unclassified, and shall include all materials encountered regardless of their nature or the manner in which they are removed, except those covered by pay items.

## PART 3- EXECUTION

3.01 CONSTRUCTION METHODS:

A. All proposed detention ponds, drainage ditches and other excavations shall be shaped in conformity with the typical sections shown on the plans and to the lines and grades established by the Engineer.

B. All unstable or otherwise objectionable material shall be removed from and replaced with approved material.

C. All holes, ruts, and depressions shall be filled with approved material.

D. The surface shall be finished to the lines and grades as established, and be in conformity with the typical sections shown on the plans.

E. Any deviation in excess of one-half (1/2) inch in cross-section and in a length of sixteen (16) feet measured longitudinally shall be corrected by loosening, adding, or removing material, reshaping and compacting by sprinkling and rolling.

F. Material removed may be utilized if approved by the Inspector.

G. All other material required for completion of the work shall also be subject to approval by the Inspector.

H. Unless otherwise indicated on plans, areas that are to receive embankment, shall be placed in layers not to exceed 6” in thickness for the full width of the individual cross section and in, such lengths as are best suited to the sprinkling and compaction methods utilized.

I. Each embankment layer will be compacted to 95% of standard proctor density at moisture content between -2% and +3% of optimum moisture.

J. Unsuitable excavation or excavation in excess of that needed for construction shall be known as “Waste” and shall become the property of the Contractor.

K. It shall become the CONTRACTOR’S sole responsibility to properly dispose of this material.

## PART 4- MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT:

A. No bid item is established for these items, this work shall be considered subsidiary to the contract and no direct payment will be made.

# SECTION 312316- EXCAVATION

## PART 1 - GENERAL

SECTION INCLUDES

Excavation for slabs-on-grade and paving.

Excavation for site structures.

RELATED SECTIONS

Section 312500 Temporary Erosion Control

Section 312200 Site Grading

FIELD MEASURMENTS

Verify that survey benchmark and intended elevations for the Work are as indicated.

Verify location of all underground utilities and/or structures. Notify respective utility companies 48 hours in advance of proposed activity.

## PART 2 - PRODUCTS

Not Used.

## PART 3 - EXECUTION

PREPARATION

Identify required lines, levels, contours, and datum.

Identify known underground, above ground, and aerial utilities. Stake and flag locations.

Notify respective utility companies and location centers to locate utilities in the vicinity of the work.

Protect above and below grade utilities, which are to remain.

Protect plant life, lawns, and other features remaining as a portion of final landscaping.

Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

Any pavement surfaces or underground structures removed during excavation shall be replaced or placed back in proper working order.

EXCAVATION

Underpin adjacent structures, which may be damaged by excavation work, including utilities and pipe chases.

Excavate subsoil required to accommodate slabs-on-grade, paving and site structures, and construction operations.

Machine slope banks to angle of repose or less, until shored.

Grade the top perimeter of excavation to prevent surface water from draining into excavation.

Remove lumped subsoil, boulders, and rock.

Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

Correct unauthorized excavation at no extra cost to Owner.

Correct areas over-excavated by error, and no extra cost to Owner.

Remove excavated material from site.

FIELD QUALITY CONTROL

Field inspection may be performed under provisions of contract.

Provide for visual inspection of bearing surfaces.

PROTECTION

Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

## PART 1 - GENERAL

SECTION INCLUDES

Trenching for utilities.

Compacted bedding under fill over utilities to subgrade elevations or finished grade elevations.

Backfilling and compaction.

RELATED SECTIONS

Section 314000 Trench Safety System

Section 312323.13 Backfilling: General backfilling

REFERENCES

ANSI/ASTM C136 - Methods for Sieve Analysis of Fine and Coarse Aggregates.

ANSI/ASTM D698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) Drop.

ANSI/ASTM D1556 – Test Methods for Density of Soil in Place by the Sand-Cone Method.

ASNI/ASTM D1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18 inch (457 mm) Drop.

SUBMITTALS

Submit under provisions of the contract or as requested by the Engineer.

Samples: Submit 10 lb. sample of each type of Type fill to testing laboratory, in airtight containers.

FIELD MEASUREMENTS

Verify that survey benchmark and intended elevations for the Work are as shown on drawings.

## PART 2 - PRODUCTS

FILL MATERIALS

Types A, B, C, D, E, Common Fill, and Lean Concrete materials as specified in Section 02223.

BED MATERIALS

Type 1 Material: As specified for Type A in Section 312323.13.

Type 2 Material: As specified for Type B in Section 312323.13.

Type 3 Material: As specified for Type C in Section 312323.13.

Type 4 Material: As specified for Type D in Section 312323.13.

Type 5 Material: As specified for Type E in Section 312323.13.

Subsoil (Common Fill) Material: As specified in Section 312323.13.

Concrete: Lean concrete with a compressive strength of 2,000 psi and as indicated on plans.

## PART 3 - EXECUTION

EXAMINATION

Verify fill materials to be reused, is acceptable.

PREPARATION

Identify required lines, levels, contours, and datum.

Maintain and protect existing utilities remaining, which pass through work area.

Protect plant life, lawns, and other features remaining as a portion of final landscaping.

Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

Protect above and below grade for utilities that are to remain.

Cut out soft areas of subgrade not capable of insitu compaction. Backfill with Type 4 fill and compact to density equal to or greater than the requirements for subsequent backfill material.

EXCAVATION

Excavate subsoil required for storms sewer, gravity sanitary sewer, water, and gas to points of connection to building or utility system.

Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

Excavation shall not interfere with normal 45 degree bearing splay of foundations.

Hand trim for bell and spigot pipe joints. Remove loose matter.

Remove lumped subsoil, boulders, and rock.

BEDDING

Support pipe and conduit during placement and compaction of bedding fill.

BACKFILLING

Backfill trenches to contours and elevations with unfrozen materials.

Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

Place geotextile fabric over Type A fill prior to placing next lift of fill, over perforated pipe.

Granular Fill: Place and compact materials in continuous layers not exceeding 6 inches compacted depth.

Soil Fill: Place and compact material in continuous layers not exceeding 12 inches compacted depth.

Employ a placement method that does not disturb or damage conduit or pipe in trench, and any improvements adjacent to trench work.

Maintain optimum moisture content of backfill materials to attain required compaction density.

Remove surplus backfill materials from site.

TOLERANCES

Top Surface of Backfilling: Under Paved Areas: Plus or minus one inch from required elevations.
Top Surface of General Backfilling: Plus or minus one inch from required elevations.

Correct unauthorized excavation at no cost to Owner.

Correct areas over-excavated by error at no cost to Owner.

Stockpile excavated material in area designated on-site and remove excess material not being used, from site. Remove excavated material from site.

FIELD QUALITY CONTROL

Field inspection and testing will be performed under provisions of the Contract and upon request of the Engineer.

Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and ANSI/ASTM D1557.

Compaction testing will be performed in accordance with ANSI/ASTM D1556; ANSI/ASTM D1557; ANSI/ASTM D698.

If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

PROTECTION OF FINISHED WORK

Protect finished Work under provisions of the Contract.

Re-compact fills subjected to vehicular traffic.

## PART 1 - GENERAL

SECTION INCLUDES

Site structure backfilling to subgrade elevations or finish elevations.

Trench filling and backfilling.

Fill under slabs-on-grade and paving.

Consolidation and compaction.

Fill for over-excavation.

RELATED SECTIONS

Section 312316 Excavation

Section 312316.13 Trenching: Backfilling of utility trenches

Section 033000 Cast-in-Place Concrete: Concrete materials

REFERENCES

ANSI.ASTM C136 - Methods for Sieve Analysis of Fine and Coarse Aggregates.

ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) Drop.

ANSI/ASTM D1556 - Test Methods for Density of Soil in Place by the Sand-Cone Method.

ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18 inch (457mm) Drop.

## PART 2 - PRODUCTS

FILL MATERIALS

Type A Gravel: Washed natural stone; free of shale, clay, friable material, sand, debris; graded in accordance with ANSI/ASTM C136 within the following limits:

| Sieve Size | Percent Passing |
|---|---|
| 2 ½ inch | 100 |
| 2 inch | 60 - 90 |
| 1 ¼ inch | 25 - 50 |
| 1 inch | 30 - 45 |
| ¾ inch | 0 |

Type B Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded in accordance with ANSI/ASTM C136, to the following:

1. Minimum Size: 1/4 inch.
2. Maximum Size: 5/8 inch

Type C Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI/ASTM C136, within the following limits:

| Sieve Size | Percent Passing |
|---|---|
| 6 inch | 100 |
| ¾ inch | 100 |
| No. 4 | 30 - 80 |
| No. 40 | 5 - 30 |
| No. 200 | 0 - 5 |

Type D Coarse Aggregate Type A1, as indicated in Section 321100.

Type E Select Fill: Material shall consist of homogenous soil free of organic matter and rocks larger than 6 inches in diameter and possessing Plasticity Index from 3% to 15%, and with a liquid limit of 30% or less.

Subsoil (Common Fill): Reused or imported, free of gravel larger than 3-inch size, and debris.

Concrete: Lean concrete with a compressive strength of 2,000 psi, as indicated on plans.

## PART 3 - EXECUTION

EXAMINATION

Verify fill materials to be reused are acceptable.

Verify foundation perimeter drainage installation has been inspected.

Verify underground tanks are anchored to their own foundation to avoid floatation after backfilling.

PREPARATION

Generally, compact subgrade to density requirements for subsequent backfill materials.

Cut out soft areas of subgrade not capable of insitu compaction. Backfill with Type C fill, and compact to a density equal to, or greater than the requirements for subsequent backfill material.

Prior to placement of aggregate base course material at gravel paved areas, compact subsoil to 95 percent

of its maximum dry density in accordance with ANSI/ASTM D698.

BACKFILLING

Backfill areas to contours and elevations with unfrozen materials.

Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

Place geotextile fabric over Type A fill prior to placing the next lift of fill.

Granular Fill: Place and compact materials in continuous layers not exceeding 6 inches compacted depth.

Soil Fill: Place and compact material in continuous layers not exceeding 12 inches compacted depth.

Employ a placement method that does not disturb or damage protective cover and utilities in trenches.

Maintain optimum moisture content of backfill materials to attain required compaction density.

Backfill against supported foundation walls. Do not backfill against unsupported foundation walls.

Backfill simultaneously on each side of unsupported foundation walls until all supports are in place.

Slope grade away from site structures minimum 3in 10 feet, unless noted otherwise on plans.

Make grade changes gradual. Blend slope into level areas.

Remove surplus backfill materials from site.

TOLERANCES

Top Surface of Backfilling Under Paved Areas: Plus or minus one inch from required elevations.

FIELD QUALITY CONTROL

Field inspection and testing may be performed under provisions of the contract.

Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and ANSI/ASTM D1557.

Compaction testing will be performed in accordance with ANSI/ASTM D1556; ANSI/ASTM D1557; ANSI/ASTM D698.

If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

PROTECTION OF FINISHED WORK

Protect finished work under provisions of the contract.

Re-compact fills subjected to vehicular traffic.

**END OF SECTION**

## PART 1- GENERAL

1.01 GENERAL DESCRIPTION:

A. "Temporary Erosion Control Sediment and Water Pollution Control" shall be coordinated with the permanent soil-erosion-control features specified elsewhere in the contract to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post construction period.

B. These control measures shall at no time be used as a substitute for the permanent control measures unless otherwise directed by the Engineer and they shall not include measures taken by the Contractor at his expense under Sub articles 4(a) through (e) to control conditions created by his construction operations

C. The temporary measures shall include dikes, dams, berms, sediment basins, fiber mats, jute netting, temporary seeding, straw mulch, asphalt mulch, plastic liners, rubble liners, baled-hay retards, dikes, slope drains, and other devices specified by the Engineer.

## PART 2- PRODUCTS

2.01 MATERIALS

A. The materials will be specified in the plans, standard specifications, special specifications or special provisions, the Engineer may specify other materials and work as the need arises.

B. The estimated items of temporary erosion control will be indicated on the plans; however, the Engineer may increase or decrease the quantity of these items as the need arises.

C. The Engineer has the authority to define erodible earth and the authority to limit the surface area of erodable earth material exposed by preparing right of way, clearing and grubbing, the surface area of erodible-earth material exposed by excavation, borrow and embankment construction operations (except for commercial operations) and to direct the Contractor to provide temporary pollution-control measures to prevent contamination of adjacent steams, other water- courses, lakes, ponds or other areas of water impoundment.

## PART 3- EXECUTION

3.01 TEMPORARY CONSTRUCTION

A. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains and use of temporary mulches, mats, seeding or other control devices or methods directed by the Engineer as necessary to control soil erosion.

## PART 4- MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT:

A. No bid item is established for these items, this work shall be considered subsidiary to the contract and no direct payment will be made.

**END OF SECTION**

**SECTION 31 31 16**

**TERMITE CONTROL**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Stainless steel mesh barrier for termite control below and above grade. At penetrations of all interior and the exterior foundation perimeter of new construction, as indicated in the drawings.

B. Related Sections:
   1. Section 01 60 00 – Product Requirements: Substitution procedures.
   2. Section 03 30 00 - Cast-In-Place Concrete: Slabs on grade and foundations.
   3. Section 04 20 00 – Unit Masonry.
   4. Section 06 10 00 – Rough Carpentry: Wood framing.
   5. Section 31 23 23.13 Backfilling: Backfill materials.
   6. Section 31 21 23 – Excavation and Grading.

### 1.2 REFERENCES

A. National Pest Management Association:
   1. ICC – International Code Congress.
   2. NPMA WDO - Wood Destroying Organism Library.

### 1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Stainless Steel Mesh:
      a. Submit manufacturer's data on stainless steel mesh and accessories.
      b. Governing ICC ES Report for product to be installed.
      c. Shop Drawings:
         1) Submit scaled shop drawings prepared specifically for Project to illustrate details, dimensions, and other data necessary to fully describe installation of termite control.
         2) Provide details of each proposed assembly identifying intended products and other similar information.
         3) Show adjacent or related portions of Work coordinated in a complete manner.
         4) Coordinate Shop Drawings submittal with submittals for related ports of works, including:
            a) Section 03 30 00 – Cast-in-Place Concrete.
            b) Section 04 20 00 – Unit Masonry.
            c) Section 06 10 00 – Rough Carpentry.

C. Test Reports: Indicate regulatory agency approval reports.

D. Manufacturer's Application Instructions:
   1. Manufacturer's instructions for installation/application. Include Manufacturer's storage and handling requirements, site preparation and care, cleaning instructions, and other recommendations.

E. Manufacturer's Certificate:
   1. Certify products furnished comply with requirements.

F. Installer's Certificate:
   1. Certify installer/applicator is licensed for termite control at the project location.
   2. Certify installer/applicator is trained and approved by manufacturer with not less than 5 completed projects similar in scope and complexity to the project requirements. Submit list of complete projects of similar scope and complexity.

G. Warranty: Submit sample warranty.

### 1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Project Closeout: Requirements for submittals.

B. Project Record Documents: Include record document.

C. Warranty: Submit warranty dated to commence upon Substantial Completion of the project.

### 1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the Work of this section with minimum 3 years documented experience, trained and approved by manufacturer with a minimum of 5 completed projects of similar size and scope to the requirements of this project. Installer shall have not less than a Level 3 accreditation.

### 1.6 SEQUENCING

A. Section 01 10 00 - Summary: Work sequence.

B. Sequence installation with following in order to maintain integrity of each component:
   1. Expansion joints: Install stainless steel mesh barrier.
   2. Electrical, plumbing and HVAC equipment, conduit and piping: Install stainless steel mesh barrier.
   3. Under-slab moisture barrier as specified in Section 03 10 10.
   4. Reinforcing steel.

### 1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum two weeks prior to commencing work of this section.

C. Required attendees: Owner, Architect, Structural Engineer, General Contractor, sub-contractor installing concrete, mechanical, plumbing, and electrical installers, and installer of the work of this section.

### 1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish ten year warranty. Manufacturer to certify that stainless steel mesh will prevent infestation of subterranean and Formosan termites.

C. Warranty: Include coverage for damage and repairs to building and building contents caused by termites. Repair damage. Re-treat where required.

D. Inspect and report annually, during warranty period, to Owner in writing.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. Stainless Steel Mesh Barrier System:
   1. Manufacturer:
      a. Termi-mesh manufactured by Termimesh, LLC.
      b. Substitutions: Section 01 60 00 - Product Requirements.
   2. Stainless Steel mesh:
      a. Product: Termi-Mesh, Termistop Wire Diameter: 0.08 in.
      b. Marine Grade, Type 725
      c. Mesh Size: 0.025 x 0.018 inches.
   3. Accessories:
      a. Stainless Steel Clamps: As recommended by stainless steel mesh barrier manufacturer.
      b. Parging Compound: Specialized bonding cement as recommended by stainless steel mesh barrier manufacturer.
      c. Bonding Cement: As recommended by stainless steel mesh manufacturer.

B. Design Criteria:
   1. Place Mesh barrier across openings, joints, penetrations, and other termite entry points to building. Clamp, parge adhere, bond and/or embed mesh to surface surrounding opening. Metal mesh barrier shall be provided at, but not limited to, the following locations:
      a. Penetrations through ground floor slabs/foundations.
      b. Expansion and control joints on ground floor slabs and foundations: Saw cut joints do not require treatment unless deeper than ¼" in depth.
      c. Perimeter exterior masonry adjacent to grade
      d. Perimeter footings to adjacent concrete flatwork.
      e. Other areas determined by Manufacturer's representative to be hidden entry for termites.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify final grading and excavation are complete.

C. Examine substrates, areas, and conditions under which application of termite control shall be performed.
   1. Examine interface with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.

### 3.2 PREPARATION

A. General Requirements: Remove extraneous sources of wood cellulose and other termite edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations/slabs.

### 3.3 INSTALLATION

A. Install mesh barrier system in compliance with Manufacturer's written instructions in a manner that will prevent termite penetration of slab and below grade walls where future construction is indicated.

B. Place metal mesh barrier where indicated on shop drawings to provide a continuous barrier to entry of subterranean termites.

C. Fit mesh tightly around pipe or other penetrations, and terminate at slab and foundation perimeters.

D. Install mesh under perimeter of concrete slab edges and joints after vapor barrier and reinforcing steel are in place, and comply with Manufacturer's written installation methods.

E. Apply corrosion resistant material to steel reinforcing to prevent direct contact with metal mesh.

F. Install mesh, clamps, and parging compound to provide permanent installation capable of preventing termite entry above slab at locations indicated. Provide barrier within slab thickness where possible.

G. Install mesh with no gaps, penetrations, or damage.

H. Apply Manufacturer provided identification tape above concrete level to mark barrier locations.

**3.4 PROTECTION OF FINISHED WORK**

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished Work.

B. Protect installed mesh termite control system, attachments, and accessories before, during, and after work of other trades. In the event other trades, following installation of mesh, move or damage mesh, clamps, or parging mix, immediately contact mesh installer for recommendation of necessary repairs.

**END OF SECTION**

**SUMMARY**

This section shall cover CONTRACTORS furnishing a Trench Safety System, and all labor and materials for installation and maintenance of the Trench Safety System.

**APPLICATION**

For any trench excavation at a depth of five (5) feet or greater or where shown on plans, provide trench safety system. Trench safety system shall be in accordance with details shown on CONTRACTOR'S Trench Excavation and Shoring Safety Plan.

**QUALITY ASSURANCE**

Trench safety system to meet appropriate requirements established in Section 756.022 of the Texas Health and Safety Code and Occupational Safety and Health Administration (OSHA) Safety and Health Regulations, 29 CFR 1926, Subpart P – Excavations, Trenching and Shoring, as may be amended, and OSHA's proposed standards on trenching excavation published in Volume 54, No. 209 of the Federal Register, October 31, 1989; Pages 45959-45991. Those standards are incorporated into these specifications by reference. Should the applicable OSHA standards be modified or amended, the more stringent standards shall apply.

**SUBMITTALS**

The CONTRACTOR shall provide upon request a Trench Excavation and Shoring Safety Plan for the Project. The Plan shall incorporate the detailed plans and specifications for a Trench Safety System conforming to OSHA standards. The Plan shall account for project site conditions, CONTRACTOR'S trench construction means, methods, techniques or procedures, the relationship of spoil to edge of trench, and CONTRACTOR'S equipment to be used in construction of project facilities requiring trench Safety System(s). CONTRACTOR shall submit a certificate signed and sealed by a Registered Professional Engineer licensed in the State of Texas stating that CONTRACTOR'S Trench Safety System Plan has been designed in conformance with appropriate OSHA standards and applicable specifications as required by this item. CONTRACTOR'S Trench Safety System Plan shall demonstrate the type(s) of Trench Safety System to be used on the project.

**MATERIALS**

The CONTRACTOR shall furnish the materials used in the Trench Safety System, as approved by the OWNER, to comply with the requirements of the work of the CONTRACTOR as specified therein.

Timber

Trench sheeting materials to be full size, a minimum of two inches in thickness, solid and sound, free from weakening defects such as loose knots and splits.

Steel Sheet Piling

Steel sheet piling shall at a minimum conform to one of the following specifications:

ASTM A328
ASTM A572, Grade 50
ASTM A690

Steel for stringers (walers) and cross braces shall conform to ASTM A588.

Steel Trench Boxes

Portable steel trench box shall at a minimum be constructed of steel conforming to ASTM Specification A-36. Connecting bolts used shall conform to Specifications ASTM A-307. Welds to conform to requirements of AWS Specification D1.1

Other Materials

Other materials to be utilized shall at a minimum conform to applicable ASTM standards.

INSTALLATION

Trench safety system shall be constructed, installed, and maintained in accordance with the Trench Safety System Plan prepared by the CONTRACTOR'S Registered Professional Engineer.

Timber Sheeting

Timber sheeting and size of uprights, stringers (walers), and cross bracing to be installed in accordance with CONTRACTOR'S plan. In no case shall the sizes of the timber sheeting members be less than, or the spacing greater than, those given in Table P-2 in OSHA Part 1926, Sub-part P – Excavation, Trenching and Backfilling. Place cross braces in a horizontal position, space them vertically, and secured to prevent sliding, falling, or kick-outs. Cross braces and stringers (walers) to be placed at splices of uprights, in addition to other locations required.

Steel Sheet Piling

Steel sheet piling of equal or greater strength

may be used in lieu of timber trench shoring shown in the OSHA tables (proposed standards). Drive steel sheet piling to at least minimum depth below trench bottom as recommended by CONTRAC- TOR'S Registered Professional Engineer providing design. Place cross braces in A true horizontal position, space them vertically and secure them to prevent Sliding, falling, or kick-outs. Cross-braces to be placed at each end or stringers (walers), in addition to other locations required.

Trench Boxes

Portable trench box may be used in lieu of timber trench shoring shown in the OSHA tables (proposed standards) and shall be designed to provide equal or greater protection than timber trench shoring shown in the OSHA tables. In cases where top of portable trench box will be below top of trench, the trench must be sloped to the maximum allowable slope for the soil conditions existing on the Project. In areas where a sloped trench will affect the integrity of existing structures, CONTRACTOR to protect structures prior to sloping trench.

Trench Jacks

When jacks are used for cross bracing and/or stringers (walers), the trench jacks Shall provide protection greater than or equal to the timber cross bracing shown in the OSHA tables (proposed standards). Trench jacks to be placed at each end of stingers (walers) in addition to other locations required.

SUPERVISION

CONTRACTOR must provide competent supervisory personnel at each trench while work is in progress to ensure CONTRACTOR's methods, procedures, equipment, and materials pertaining to the safety systems in this item are sufficient to meet requirements of Texas Law and OSHA Standards.

MAINTENANCE OF SAFETY SYSTEM

The safety system shall be maintained in the condition as shown on the Trench Excavation and Shoring Safety Plan as designed by the CONTRACTOR's Registered Professional Engineer. The CONTRACTOR shall take all necessary precaution to ensure no loads, except those provided for in the plan, are imposed upon the trench safety system.

INSPECTION

CONTRACTOR shall make daily inspection of trench safety system to ensure that the system meets OSHA requirements. Daily inspections to be made by competent personnel. If evidence or possible cave-ins or slides is apparent, all work in the trench shall cease until necessary precautions have been taken to safeguard personnel entering trench. CONTRACTOR to maintain permanent record of daily inspections.

REMOVAL

Bed and backfill pipe to a point at least one (1) foot above top of pipe or other embedded items prior to removal of any portion of trench safety system. Bedding and backfill to be in accordance to other applicable specification items. Backfilling and removal of trench supports shall be in accordance with CONTRACTOR's Trench Excavation and Shoring Safety Plan. Removal of trench safety system to be accomplished in such a manner to cause no damage to pipe or other embedded items. Remove no braces or trench supports until all personnel have evacuated the trench. Backfill the trench to within five (5) feet of natural ground prior to removal of entire trench safety system.

MEASURMENT AND PAYMENT

The Trench Safety System and related items shall be measured and paid as follows:

Measurement

Measure "Trench Safety System" by linear foot of trench excavated along where safety system was used. Shoring of trench at manholes and other line structures to be included in the lineal foot cost.

Payment

The work performed in conformance with this specification shall be paid as follows:

Pay for "Trench Safety System" measured as stated above by the linear feet of trench excavated along where safety system was used as shown on PROPOSAL. Payment shall be full compensation for all work described herein. There shall be no increase in the Contract price because of the incorporation of CONTRACTOR's Trench Excavation and Shoring

Safety Plan or CONTRACTOR's detailed plans and specifications for the trench safety system into the bid documents and the Construction Contract. There shall be no increase in the contract price because of modifications to CONTRACTOR's plans and/or CONTRACTOR's detail or plans and specifications for the trench safety system, whether or not the result of unforeseen or differing site or soil conditions. Pay for "Design of Trench Safety System Plan" developed by CONTRACTOR's Registered Professions Engineer shall be incidental to Trench Safety System as shown on Bid Proposal. Payment shall be full compensation for all professional services relating to the CONTRACTOR's submittal to OWNER of the Trench Safety System Plan, upon Owner's request.

**END OF SECTION**

# DIVISION 32
## EXTERIOR IMPROVEMENTS

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

## PART 1 - GENERAL

SECTION INCLUDES:

Aggregate materials as indicated on plans.

RELATED SECTIONS:

Section 312323.13 Backfilling

Section 312316.13 Trenching

Section 331100 Water Lines

REFERENCES

AASHTO – M147 – Materials for Aggregate and Soil-Aggregate.

AASHTO T180 – Moisture-Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in. (457 mm) Drop.

ANSI/ASTM C136 - Methods for Sieve Analysis of Fine and Coarse Aggregates.

ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 kg.) Rammer and 12 inch (304.8 mm) Drop.

ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18 inch (457 mm) Drop.

ASTM D2167 – Test Methods for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

ASTM D2487 – Classification of Soils for Engineering Purposes.

ASTIM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

ASTM D3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

ASTM D4318 – Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

SUBMITTALS

Submit under provisions of the contract and upon request of the Engineer.

Samples: Submit, in airtight containers, 10 lb. sample of each type of fill to testing laboratory or as directed by the Engineer.

Materials Source: Submit name of imported materials suppliers. Provide materials from same source throughout the work. Change of source requires Engineer approval.

## PART 2 - PRODUCTS

AGGREGATE MATERIALS

Course Aggregate Type A1 (Gravel): AASHTO M147, Grade A; passing the No. 40 sieve with a liquid limit of not more than 35; a plasticity index of not more than 10 in accordance with ADTM D4318.

Coarse Aggregate Type A2 (Gravel): Coarse Stone: Natural washed stone; free of shale, clay, friable material and debris; graded in accordance with ANSI/ASTM C136; within the following limits:

| Sieve Size | Percent Passing |
|---|---|
| 2 ½ inch | 100 |
| 2 inch | 60 - 90 |
| 1 ¼ inch | 25 - 50 |
| 1 inch | 30 - 45 |
| ¾ inch | 0 |

Aggregate Type A3 (Pea Gravel): Natural stone; washed; free of clay, shale, organic matter; graded in accordance with ANSI/ASTM C136; to the following limits:

Minimum Size: 1/4 inch
Maximum Size: 5/8 inch

Fine Aggregate Type A4 (Sand): Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ANSI/ASTM C136; within the following limits:

| Sieve Size | Percent Passing |
|---|---|
| 6 inch | 100 |
| ¾ inch | 100 |
| No. 4 | 30 - 80 |
| No. 40 | 30 |
| No. 200 | 0 - 5 |

SOURCE QUALITY CONTROL

Field inspection and testing may be performed under provisions of the contract and upon request of the Engineer.

Tests and analysis of aggregate material will be performed in accordance with ANSI/ASTM D698; ASTM D1557; ASTM D2167; ASTM D2922; ASTMD3017; ASTM D4318; ASTM C136.

If tests indicate materials do not meet specified requirements, change material and retest.

## PART 3 - EXECUTION

STOCKPILING

Stockpiling materials on site at locations that will not interfere with other construction activity and that will not create a hazard or nuisance to the general public.

Stockpile materials, that are to be relocated by the Engineer, shall be relocated at no additional cost to the Owner.

Stockpile in sufficient quantities to meet project schedule and requirements.

Separate differing materials with dividers or stockpile apart to prevent mixing.

Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

STOCKPILE CLEANUP

Remove stockpile; leave area in a clean and neat condition. Grade site surface to prevent freestanding surface water.

**END OF SECTION**

**SECTION 32 31 13**

**CHAIN LINK FENCES AND GATES**

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts.

### 1.2 REFERENCES

A. ASTM International:
1. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
5. ASTM A817 - Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.
6. A1011/A1011M-07 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
7. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
8. ASTM F552 - Standard Terminology relating to Chain Link Fencing.
9. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
10. ASTM F626 - Standard Specification for Fence Fittings.
11. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
12. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
13. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
14. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.

B. Chain Link Fence Manufacturers Institute:
1. CLFMI - Product Manual.

### 1.3 SYSTEM DESCRIPTION

A. Fence Height: 6 feet nominal.

B. Line Post Spacing: At intervals not exceeding 10 feet.

C. Fence Post and Rail Strength: Conform to ASTM F1043 Light Industrial Fence quality.

### 1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

### 1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

C. Operation and Maintenance Data: Procedures for submittals.

### 1.6 QUALITY ASSURANCE

A. Supply material in accordance with CLFMI - Product Manual.

B. Perform installation in accordance with ASTM F567.

### 1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

### 1.8 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer's name.

D. Store fence fabric and accessories in secure and dry place.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers:
1. Anchor Fence Inc.
2. General Wire & Supply Company.
3. Hoover Fence Company.
4. Master Halco.
5. Mechants Metals
6. Sonco Worldwide.
7. Substitutions: Section 01 60 00 - Product Requirements.

**2.2 MATERIALS AND COMPONENTS**

A. Materials and Components: Conform to CLFMI Product Manual.

B. Fabric Size: CLFMI Light Industrial service.

C. Intermediate Posts: Type I round.

D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round

E. Barbed Wire: ASTM A121 Coating Type Z, galvanized steel: 12 gage thick wire, 2 strands, 4 points at 3 inch oc.

F. Concrete: ASTM C94/C94M Normal Portland Cement, 2,500 psi strength at 28 days, 3 inch slump, ¾ inch nominal sized coarse aggregate.

**2.3 ACCESSORIES**

A. Caps: Cast steel galvanized: sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

C. Extension Arms: Galvanized pressed steel to accommodate 3 strands of barbed wire, single arm, sloped to 45 degrees.

**2.4 FINISHES**

A. Components and Fabric: Galvanized to ASTM A123/A123M for components; ASTM A153/A153M for hardware; ASTM A392 for fabric; 2.0 oz/sq ft coating.

B. Hardware: Galvanized to ASTM A153/A153M, 2.0 oz/sq ft coating.

C. Accessories: Same finish as framing.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

A. Install framework, fabric, and accessories in accordance with ASTM F567.

B. Set corner, intermediate, terminal, and gate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

C. Line Post Footing Depth Below Finish Grade: Three feet.

D. Corner, and Terminal Post Footing Depth Below Finish Grade: Three feet.

E. Install top rail through line post tops and splice with 6 inch long rail sleeves.

F. Place fabric on outside of posts and rails.

G. Do not stretch fabric until concrete foundation has cured 28 days.

H. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

I. Position bottom of fabric 2 inches above finished grade.

J. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

K. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

L. Install bottom tension wire stretched taut between terminal posts.

M. Install support arms sloped outward and attach barbed wire; tension and secure.

N. Connect to existing fence at new terminal post.

O. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures.

P. Excavate holes for posts to diameter and spacing indicated on Drawings without disturbing underlying materials.

Q. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

**3.2 ERECTION TOLERANCES**

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch.

C. Maximum Offset From Indicated Position: 1 inch.

**3.3 SCHEDULES**

A. Remove section of fencing surrounding pool area and replace with as indicated on Contract Drawings.

**END OF SECTION**

# DIVISION 33
## UTILITIES

THE AGREEMENT, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, SUPPLEMENTARY CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AND ALL ADDENDA ARE A PART OF THE CONTRACT. THE CONTRACTOR SHALL CONSULT THEM IN DETAIL FOR INSTRUCTIONS PERTAINING TO THE WORK. THE CONTRACTOR SHALL ALSO CONSULT ALL OTHER DIVISIONS AND SECTIONS OF THE PROJECT MANUAL, AND ALL DRAWINGS IN THE EXECUTION OF THE WORK OF THE CONTRACT.

THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, SYSTEMS, EQUIPMENT, ITEMS, ARTICLES, OPERATIONS, AND/OR METHODS LISTED, IMPLIED, MENTIONED, OR SCHEDULED IN THE CONTRACT DOCUMENTS AND/OR NECESSARY AND/OR REQUIRED FOR THE SATISFACTORY COMPLETION OF THE WORK.

THE LISTING OF WORK, REQUIREMENTS, AND PRODUCTS IN THIS SECTION IS NOT INTENDED TO BE CONCLUSIVE. THE CONTRACTOR SHALL CHECK ALL OTHER PARTS OF THE CONTRACT DOCUMENTS AND SHALL PROVIDE ALL MISCELLANEOUS ITEMS OF WORK AND PRODUCTS NECESSARY FOR THE SATISFACTORY COMPLETION OF THE WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

GENERAL

DESCRIPTION

This section covers the testing of pipe materials, joints, or other materials incorporated into on-site and off-site piping and leakage tests to determine water tightness. The Contractor shall furnish all the necessary equipment and be responsible for conducting all low-pressure air tests. In addition the Contractor is responsible for any necessary repair work on sections that do not pass the test, at no additional cost to the Owner.

All pipelines shall be tested. Test pressure, duration, and media shall be as specified by the Engineer and at minimum State and local authority requirements. Care should be exercised to isolate equipment not rated for the specified test pressure to avoid damage to the equipment.

PRESSURE CONDUIT LEAKAGE TESTS

The pipe to be tested must be sufficiently backfilled to prevent movement while under pressure.

Leakage tests for all piping specified to be "Hydrostatically Tested" shall be made by filling the main with water and increasing the pressure to the testing pressure specified by the Engineer in conformance to AWWA C600.

Pressure Mains shall be tested at a pressure of at least 1.5 times the normal working pressure, but not less than 150 psi.

The main shall be filled and flushed to remove as much trapped air and debris as possible prior to beginning the pressure test.

The main shall be pressurized to the required minimum pressure and shall be monitored for a period of two hours, minimum.

The maximum leakage per hour for buried piping shall be calculated by the following formulas:

All rubber gasket or o-ring joints

$$L = \frac{(N*D*\sqrt{P})}{7,400}$$

L= Allowable Leakage (gallons per hour)
N= Number of Joints in Pipeline Tested
D= Nominal Diameter (inches)
P= Test Pressure (psi)

Leakage of all exposed piping shall be zero throughout the duration of the test.

The main shall not be accepted until the actual leakage is equal to or less than the allowable. In addition, all obvious leaks shall be repaired.

LEAKS ENCOUNTERED IN FINAL INSPECTION

In addition to passing the above described leakage tests, all obvious running leaks which may be observed in the final inspection shall be satisfactorily repaired.

RETEST

The test equipment used shall be certified, as satisfactory by the Engineer at the beginning of the project. The Engineer or his representative may at any time require a calibration check of the instrumentation used.

CLEANING UP

As the Construction work progresses, the Contractor shall backfill the trenches, remove excess excavated materials and other debris and do sufficient cleanup and blading of the trench surfaces to make the streets and alleys suitable for safe use of traffic.

After the construction work is completed and before final acceptance by the Owner, the Contractor shall remove all rubbish, excess materials, excess materials from excavations and other debris from the site of the work and all trench surfaces shall be bladed as heretofore specified. Adjacent road ditches and slopes, which have been disturbed by this construction, shall be restored to its original shape, density and condition. The cost of clean up shall be included in the bid prices for the various units of work. After the clean up has been completed, but before final acceptance by the Owner, the entire line must be tested to see that there are no obstructions in the line. Water for this testing shall be the responsibility of the Contractor.

DISINFECTION

Following satisfactory completion of the acceptance test, all potable water lines shall be disinfected in accordance with Section 330075 and the requirements of the State and local utility authority.

# SECTION 330600 – PVC PIPE

## PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Polyvinyl chloride pressure pipe for water distribution and sanitary sewers in nominal diameters 4 inches through 24 inches.

B. Polyvinyl chloride sewer pipe for sanitary sewers in nominal diameters 4 inches though 48 inches.

1.2 REFERENCES

A. ANSI A21.10 (AWWA C110) – Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids.

B. ANSI A21.11 (AWWA C111) – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

C. ASTM D2241 – Standard Specification for Polyvinyl Chloride Plastic Pipe (SDRPR).

D. ASTM D2321–Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

E. ASTM D2444 – Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

F. ASTM D3034 - Specification for Type PSM Polyvinyl Chloride Sewer Pipe and Fittings.

G. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastromeric Seals.

H. ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

I. ASTM F477- Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastromeric Seals.

J. ASTM F679- Specification for Polyvinyl Chloride Large – Diameter Plastic Gravity Sewer Pipe and Fittings.

K. AWWA C900- Polyvinyl Chloride Pressure Pipe, 4 in. through 12 in. for Water Distribution.

L. AWWA C905 – Polyvinyl Chloride Water Transmission Pipe, Nominal Diameters 14 in. through 36 in.

M. UNI-B-11 – Recommended Standard Specification for Polyvinyl Chloride Water Transmission Pipe (Nominal Diameters 14” – 36”).

N. UNI-B-13 – Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

1.3 SUBMITTALS

A. Submittals shall conform to requirements of the general conditions.

B. Submit shop drawings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.4 SOURCE QUALITY CONTROL

A. Submit manufacturer’s affidavit that PVC pipe meets requirements of AWWA C900 or AWWA C905 for pressure pipe applications or the appropriate ASTM standard specified for gravity sewer pipe.

B. Submit certification of National Sanitations Foundation (NSF) approval for pipe to be used for potable water service.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with the manufacturer's recommendations.

**PART 2 - PRODUCTS**

2.1 WATER SERVICE PIPE

A. Pipe 4 in. through 12 in.: AWWA C900, Class 150, DR 18; nominal 20 foot lengths; cast iron equivalent outside diameters.

B. Pipe 16 in. through 24 in.: AWWA C905, Class 235, DR 18; nominal 20 foot lengths; cast iron equivalent outside diameters.

C. Joints: ASTM D3139; push-on type joints in integral bell or separate sleeve couplings. Gaskets and seals: ASTM F477; elastromeric; factory installed and glued in place. Do not use socket type or solvent weld type joints.

2.2 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fittings: ANSI A21.10; ductile iron; ANSI A21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating.

B. Coatings and Linings:
1. Conform to requirements of Section 02610 – Ductile-Iron Pipe and Fittings.
2. Provide cement-lined fittings for potable water service.
3. Provide polyethylene-lined fittings for wastewater and sludge service.

2.3 GRAVITY SANITARY SEWER PIPE

A. Provide one of the following types/brands of pipe:

| Wall Construction | Manufacturer | Product Options | ASTM Designation | SDR/Stiffness (Min.) | Diameter Size Range |
|---|---|---|---|---|---|
| Solid | J-M Pipe<br>Certainteed<br>Can-Tex | Approved equal | D3034 | SDR 26/PS 115 | 6" to 10" |
| | Carlon<br>Diamond | Approved equal | D3034 | SDR 26/PS 115 | 12" to 15" |
| Solid (Pressure-rated) | J-M Pipe<br>Certainteed<br>Can-Tex | Approved equal | F679 | SDR 35/PS 46 | 18" to 27" |
| | Carlon<br>Diamond | Approved equal | AWWA C900<br>AWWA C905 | SDR 26/PS 115 | 4" to 12"<br>14" to 36" |

B. Joints: Spigot and integral wall section bell with solid cross section elastromeric or rubber ring gasket conforming to requirements of ASTM D3212, factory-assembled and securely locked or glued in place to prevent displacement.

C. Fittings: Provide PVC gravity sewer sanitary bends, tee or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection, molded or factory fabricated. Saddle-type wye fittings are not acceptable.

**PART 3 - EXECUTIONS**

3.1 INSTALLATION

A. Conform to the requirements of Section 02668-Water Lines, Section 02675-Disinfection of Water Lines, and Section 02800-Pipe Testing and Clean-up.

3.2 FIELD QUALITY CONTROL

A. Conform to the requirements of Section 02668-Water Lines, Section 02675-Disinfection of Water Lines, and Section 02800-Pipe Testing and Clean-up.

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## PART 1 - GENERAL

REFERENCES

Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

WORK INCLUDED

New Pipe, fittings, thrust blocks, trenching, and backfill for domestic water line AND fire line, including related appurtenances.

Valves, meters, connections, bore and casings, and fire hydrants and related appurtenances.

RELATED WORK

Section 314000 - Trench Safety System

Section 312316 – Excavation

Section 312323.13 – Backfilling

Section 312316.13 – Trenching

Section 331300 – Disinfections of Water Lines

Section 330100– Pipe Testing and Cleanup

Section 033000 – Cast-In-Place Concrete

Provide all equipment and materials, and do all work necessary to construct the water line complete, including connections to existing pipelines and testing, all as indicated on the Drawings and as specified.

Unless otherwise indicated on Drawings, water lines shall be installed to a point 5 feet beyond the outer face of the foundation wall.

UNIT PRICE – MEASUREMENT AND PAYMENT

Pipe and Fittings:

Basis of Measurement: By Linear Feet.

Basis of Payment: Includes hand trimming excavation, pipe, bedding, concrete thrust blocks, complete in place.

Valves:

Basis of Measurement: By the unit.

Basis of Payment: Includes valve, fittings and accessories, and installation, complete in place.

Hydrant:

Basis of Measurement: By the unit.
Basis of Payment: Includes hand trimming excavation, gravel sump, hydrant, valve, connection and accessories, complete in place.

REFERENCED STANDARDS

ANSI/AWWA C105 – Polyethylene Encasement for Ductile Iron Piping for Water and Other liquids.

ANSI/AWWA C111 – Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

ANSI/AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

ANSI/AWWA C502 - Dry Barrel Fire Hydrants.

ANSI/AWWA C509 – Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.

ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

ASTM D2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

ASTM D3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

ASTM D3139 – Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

UL 246 – Hydrants for Fire – Protection Service.

SUBMITTALS

Submit under provisions of the contract and upon request of the Engineer.
Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

Manufacturer's Certificate: Upon the Engineer's request, manufacturer to certify that products provided meet or exceed specified requirements.

The contractor shall notify the City of Edinburg sufficiently in advance of connecting new water line

to existing water main. All work and materials shall be subject to approval of City of Edinburg.

The Contractor shall be responsible for making all arrangements with CITY OF EDINBURG.

PROJECT RECORD DOCUMENTS

Submit under provisions of the contract and upon request of the Engineer.

Accurately record actual locations of piping mains, valves, connections, and invert elevations.

Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

QUALITY ASSURANCE

Perform Work in accordance with CITY OF Edinburg and TCEQ.

Valves: Manufacturer's name and pressure rating marked on valve body.

DELIVERY, STORAGE, AND HANDLING

Deliver, store, protect and handle products according to manufacturers' recommended practice.

Deliver and store valves in shipping containers with labeling in place.

**PART 2 - PRODUCTS**

PIPE

Ductile Iron Pipe: ANSI/AWWA C151.
Fittings: Ductile or Grey iron, standard thickness, as indicated on plans.
Joints: ANSI/AWWA C111, rubber gasket with rods.
Jackets: ANSI/AWWA C105 polyethylene jacket, double layer, half lapped, 10-mil polyethylene tape.

PVC Pipe: ANSI/AWWA C900 Class 150.
Fittings: ANSI/AWWA C111, cast iron
Joints: ASTM D3139 compression gasket ring.

GATE VALVES – 3 Inches and Over

ANSI/AWWA C509, Iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends, control rod, extension box and valve key.

Each valve shall be provided with a valve box. Box shall be cast iron and shall be an adjustable telescoping, heavy pattern type.

Box shall be designed and constructed to prevent the direct transmission of traffic loads to the piping or valve.

Upper section of box shall be a flange with sufficient bearing area to prevent undue settlement. Lower section of box shall be designed to enclose the valve operation nut and stuffing box, and rest on the backfill.

Boxes shall be adjustable by 6 in. vertically without reduction of the lap between sections to less than 4 in.

Inside diameter of box shall be as required to suit finish ground elevation.

Box cover shall be close fitting and substantially dirt tight. Top of cover shall be flush with top of box rim.

HYDRANT

Manufacturers:

Mueller Co. or approved equal.

Hydrant: ANSI/AWWA C502, UL 246, dry barrel type, inside dimension of 7 inches minimum, with minimum 6 inches diameter valve seat opening; minimum net water area of barrel not less than 190 percent of valve opening; 6 inch bell or mechanical joint inlet connection with accessories, gland bolts, and gaskets.

Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.

Hose and Steamer Connection: Match sizes with utility company, two hose nozzles, one-pumper nozzle.

Finish: Primer and two coats of enamel to color required by City of Edinburg.

Tapping sleeve and valve shall consist of a split cast-iron sleeve tee with mechanical joint ends on the main and a flange on the branch, and a tapping type gate valve with one flange and one mechanical joint end. Valve shall conform to the requirements specified above for gate valve. The Contractor shall be responsible for verifying the outside diameter of the pipe to be tapped. Valve shall have oversized seat to permit the use of full size cutters. Tapping sleeve and valve shall be manufactured by Mueller Co. or approved equal.

BEDDING MATERIALS

Bedding: Fill Type A as specified in Section 310023 and as indicted on plans.

ACCESSORIES

Concrete for Thrust Blocks: Concrete type specified in Section 03300. Concrete shall have a minimum strength of 2,000 psi. and as indicated on plans.

**PART 3 - EXECUTION**

EXAMINATION

Verify existing conditions.

Verify that municipal utility water main size, location and invert are as indicated.

PREPARATION

Ream pipe and tube ends and remove burrs.

Remove scale and dirt, on inside and outside, before assembly.

Prepare pipe connections to equipment with flanges or unions.

BEDDING

Excavate pipe trench in accordance with Section 02225 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.

Backfill around sides and up to top of pipe with fill material tampered in place and compacted to 95 percent.

Maintain optimum moisture content of bedding material to attain required compaction density.

INSTALLATION – PIPE

Maintain separation of water main from sewer piping of nine (9) feet in accordance with Texas Commission on Environmental Quality.

Install pipe to indicated elevation to within tolerance of 5/8 inches.

Install ductile iron piping and fittings to ANSI/AWWA C600.

Route pipe in straight line do not exceed joint deflections recommended by manufacturer.

Install pipe to allow for expansion and contraction without stressing pipe or joints.

Install access fittings to permit disinfections of water system performed under Section 02675. Cost to be incidental to placement of pipe.

Form and place concrete for thrust blocks at each elbow or change of direction of pipe main, as indicated on plans.

Establish elevations of buried piping to ensure not less than three (3) feet of cover over top of pipe.

Backfill trench in accordance with Section 310023.

INSTALLATION – VALVES AND HYDRANTS

Set valves on solid bearing.

Center and plumb valve box over valve. Set box cover flush with finished grade.

Set hydrants plumb and locate pumper nozzle perpendicular to roadway or driveway.

Set hydrants to grade, with nozzles at least 20 inches above ground.

Locate control valve 36 inches away from hydrant.

Paint hydrants in accordance with City of Rio Grande City Utility requirements.

Tapping sleeve and valve shall be installed in accordance with the valve manufacturers' recommendations. The tapping sleeve shall be bolted around the existing water main and bolts tightened. Valve shall be bolted to the flanged outlet of the sleeve with the valve open, the tapping machine bolted on the tap made. The cutter shall then be withdrawn, the valve closed, and the tapping machine removed.

DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

Flush and disinfect system in accordance with Section 02675 and in accordance with City of edinburg.

SERVICE CONNECTIONS

Provide water service to utility company requirements with compound water meter with by-pass valves and sand strainer, in concrete meter vault as indicated on plans.

FIELD QUALITY CONTROL

Field inspection and testing may be performed under provisions of Contract.

Compaction testing may be performed in accordance with ASTM D2922, ASTM D3017.

If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

# SECTION 331200 - GATE VALVES

## PART 1 - GENERAL

SUMMARY

Section Includes:

1. Gate valves for buried water lines.

REFERENCES

American Water Works Association (AWWA):

1. AWWA C509-87 – Resilient Seated Gate Valves for Water and Sewage System

2. AWWA C111-85 – Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings

3. AWWA C115-88 – Standard for Flanged Ductile Iron Pipe with Threaded Flanges

American Standard Testing Methods (ATSM):

1. ASTM A48-83 – Standard Specification for Gray Iron Casting

2. ASTM A307-90 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi. Tensile Strength.

SUBMITTALS

Product Data:

1. Submit in accordance with the standard general conditions.

Operation and Maintenance (O&M) Data:

1. Submit in accordance with the standard general conditions.

## PART 2 - PRODUCTS

MANUFACTURERS

Mueller
DESCRIPTION

Type: Non-rising stem, resilient seat.

Pressure Ratings:

1. 2 in. through 12 in: 200 psi.

2. 14 in. through 48 in.: 150 psi

Model: Mueller, A-2360

CONSTRUCTION

Comply with AWWA C509.

Provide with clear water way equal to full nominal diameter of valve.

For interior or exposed installations, provide hand wheel with arrow cast in metal to indicate direction of opening. Opening effort shall not exceed 80 lbs. Provide enclosed spur or bevel gearing as required with gear cases.

Provide bypasses on 14-in. and larger valves. Mount directly to valve body with cast iron flanged connection.

End Connection: Mechanical joints in accordance with AWWA C111.

Stuffing Boxes:

1. Provide O-ring seal type with two rings.

2. Upper ring serving as dust seal and lower ring as pressure seal.

Bolts and Nuts: ASTM A307, galvanized.

Non-Rising Stems: cast integral stem collar.

Gates and Gate Rings.

1. Construct of high strength cast iron or bronze.

2. Apply resilient seat to body and/or gate.

3. Resilient seat shall seal against corrosion resistant surface.

4. Bond rubber material seats in accordance with ASTM D429.

5. Use non-corrosive hardware for mechanically attached resilient seats.

## PART 3 - EXECUTION

INSTALLATION

Install in accordance with manufacturer's written instructions and approved submittals.

Provide valve boxes for buried valves.

# SECTION 331300 – DISINFECTION OF WATER LINES

## PART 1 - GENERAL

SECTION INCLUDES

Disinfections of potable water lines and mains.

Testing and reporting of results.

RELATED SECTIONS

Section 331100 - Water Lines

UNIT PRICE – MEASURMENT AND PAYMENT

Disinfections:

Basis of Measurement: By the linear foot and incidental to waterline.
Basis of Payment: Includes preparation, disinfections, testing and reporting. Cost incidental to the waterline.

REFERENCES

ANSI/AWWA B300 - Standard for Hypo chlorites

ANSI/AWWA B301 - Standard for Liquid Chlorine

ANSI/AWWA B302 - Standard for Ammonium Sulfate

ANSI/AWWA B303 - Standard for Sodium Chlorite

ANSI.AWWA C651 - Standards for Disinfecting Water Mains

SUBMITTALS

Test Reports: Indicate results comparative to specified requirements.

Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.

PROJECT RECORD DOCUMENTS

Submit under provisions of the Contract and upon request of the Engineer.

Disinfections report and record:
Type and form of disinfectant used.
Date and time of disinfectant injection starts and the time of completion.
Test locations.
Initial and 24 hour disinfectant residuals (quantity in treated water) in pip for each outlet tested.
Date and time of flushing start and completion.
Disinfectant residual after flushing in pip for each outlet tested.
Bacteriological report; record:
Date issued, project name, and testing laboratory name, address, and telephone number.
Time and date of water sample collection.
Name of person collecting samples.
Test locations.
Initial and 24 hour disinfectant residuals in pip for each outlet tested.
Coliform bacteria test results for each outlet tested.
Certification that water conforms, or fails to conform, to bacterial standards of Utility Company or Texas Natural Resources Conservation Commission.
Bacteriologist's signature and authority.

QUALITY ASSURANCE

Perform Work in accordance with ANSI/AWWA C651.

REGULATORY REQUIREMENTS

Conform to applicable code of regulation for performing the work of this Section.

Provide certificate of compliance from Utility Company having jurisdiction indicating approval of water lines and mains.

## PART 2 PRODUCTS

DISINFECTION CHEMICALS
Chemicals: ANSI/AWWA B300, Hypo chlorite, ANSI/AWWA B301, Liquid Chlorine, ANSI/AWWA B302, Ammonium Sulfate, and ANSI/AWWA B303, Sodium Chlorite.

## PART 3 - EXECUTION

Provide and attach required equipment to perform the work of this Section.

Inject treatment disinfectant into water lines.

Maintain disinfectant in system for 24 hours.

Flush, circulate and clean until required cleanliness is achieved; use domestic water.

Replace permanent system devices removed for disinfections.

Pressure test system to psi. Repair leaks and re-test.

QUALITY CONTROL

Provide analysis and testing of treated water under provisions of Contract and upon request of the Engineer.

# SECTION 333000 - SANITARY SEWERS

## PART 1- GENERAL

1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Trenching, Backfilling and Compacting: Section 312316.13.

B. Water Lines: Section 331100.

1.02 SUBMITTAL

A. Submit manufacturer's certification that products meet specification requirements.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials on manufacturer's original skids or in original unopened protective packaging. Owner reserves the right to reject material left from another job.

B. Store materials to prevent physical damage.

C. Protect materials during transportation and installation to avoid physical damage.

1.04 GENERAL DESCRIPTION OF WORK COVERED

A. Furnish and install all sewer pipe, fittings and structures, and accessories required for sanitary sewer construction as indicated.

1.05 QUALITY ASSURANCE

A. Comply with latest published editions of American Society of Testing and Materials (ASTM) Standards:

1. ASTM D2321- Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

2. ASTM D3212- Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

3. ASTM F477- Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

4. ASTM D3034- Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

5. ASTM F794- Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

6. ASTM F679- Standard Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings (SDR35).

7. ASTM F949- Standard Specification for Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

8. ANSI A21.11- Rubber Gasket Joints for Cast Iron and Ductile- Iron Pressure Pipe and Fittings.

9. ASTM D3753- Standard Specification for Glass Fiber Reinforced Polyester Manholes.

10. ASTM C-923- Standard Specification for Resilient Manhole Connectors.

11. ASTM C-478- Specification for Pre-cast Reinforced Concrete Manhole Sections.

12. ASTM C-443- Specification for Joints for Circular Concrete Sewer and Culvert pipe using Rubber Gaskets.

13. ASTM C-1244- Specification for Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

14. AWWA C-151- Specification for Ductile Iron Pipe and Fittings.

15. ASTM D-1248- Standard specification for Polyethylene Plastics Molding and Extrusion Materials.

16. AWWA C-105- Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids.

17. AWWA C-110- Gray Iron And Ductile Iron Fittings 3-inch through 48-inch, for Water and Other Liquids.

18. ASTM D-3350- Specification for Polyethylene Plastic Pipe and Fittings Materials.

19. ASTM F-714- Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter (3-inch IPS and larger).

20. ASTM D-3261- Specification for Butt Heat Fusion Polyethyle (PE) Plastic Fittings for Polyethlene (PE) Pipe and Tubing.

21. ASTM D-1784- Rigid Poly (Vinyl Chloride) (PVC) Compounds, and Chlorinated Poly (Vinyl Chloride) (CPVC) Compound.

22. AWWA C900- Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 12-inch for water distribution.

23. AWWA C905- Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameter 14-inch through 36-inch.

**PART 2- PRODUCTS**

2.01 GENERAL REQUIREMENTS

A. Pipe furnished may be any one of materials specified herein for sanitary sewer construction unless shown otherwise on plans or bid forms.

B. All pipe shall be marked in accordance with applicable standard specification under which pipe is manufactured unless otherwise specified.

2.02 POLYETHYLENE PIPE AND FITTINGS (PE)

A. Comply with ASTM D3350 and ASTM F-714 for polyethylene (PE) solid wall pipe and fittings for use in pressure sanitary sewers. Wall thickness shall be as shown on the plans.

B. Fittings shall comply with the performance requirements of ASTM D2683 or ASTM D3261 for molded or fabricated fittings of the size and pressure class as required.

C. Provide pipe and fittings with minimum performance requirements of ASTM D1248, Type III Class C, Category 5, Grade P34 and ASTM D3350 as indicated in this specification and as shown in the plans and details.

2.03 POLYVINYL CHLORIDE PLASTIC PIPE (PVC)

A. Comply with ASTM D3033, D3034, ASTM F679, CT-1 walls, or ASTM F-794 for pipe using material conforming to ASTM D1784 for pipe and fittings.

1. Sewers 6-inches to 10-inches shall conform to ASTM D3034.

2. Sewers 12-inches to 30-inches shall conform to ASTM D3034, ASTM F-679 (T-1 wall), or ASTM F-794 for pipe using material conforming to ASTM D1784 for pipe and fitting.

3. Sewers 36-inches and larger shall conform to ASTM F-949, ASTM D3034, ASTM F-679 or ASTM F-794 for pipe using material conforming to ASTM D1784 for pipe and fitting.

B. Use single elastomeric gasket push-on joints complying with ASTM D3212.

C. Provide pipe and fittings with minimum performance capabilities of SDR-26 dimension ratio for gravity sewers of less than 10-feet in depth or cover. Where directed by the Engineer and as indicated on the plans, sewers greater than 10-feet in depth shall meet SDR26 or AWWA C900 or C905 requirements.

D. Lubricant to be in accordance with the requirements of ASTM D3212. Lubricant to be suitable for lubricating the parts of the joints in the assembly. The lubricant to not have any deteriorating effects on the gasket and pipe materials.

E. SDR 35 shall be used for service laterals.

F. Mark all pipe and fittings.

2.04 DUCTILE IRON PIPE AND FITTINGS

A. Comply with the latest published edition of American Water Works Association (AWWA) Standards:

1. AWWA C110 & C110a- Gray Iron and Ductile-Iron Fittings, 2-inch through 48-inch for water and other liquids.

2. AWWA C111- Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings.

3. AWWA C150- Thickness Design of Ductile-Iron Pipe.

4. AWWA C151- Ductile-Iron Pipe, centrifugally cast in metal mold or sand lined molds, for water or other liquids.

5. AWWA C153- Ductile-Iron Compact fittings, 3-inch through 12-inch for water and other liquids.

6. ASSA C900- Polyvinyl Chloride (PVC) Pressure Pipe 4-inches through 12-inches for water.

7. Polyethylene encasement for the protection of ductile and cast iron pipes, fittings valves, and appurtenances shall be furnished and installed in accordance with the requirements of AWWA C-105.

8. Lining and Coating- Ductile and cast iron pipes, fittings valves, and appurtenances for sanitary sewer service shall be furnished with corrosion resistant interior lining furnished by the manufacturer:

   1. Polyethylene “polybond”

   2. Polyurethane “Corropipe II TX 5”

   3. Ceramic-Epoxy “Protecto 401”

   4. Engineer Approved Equal

9. Exterior Coating- Ductile and cast iron pipes, fittings valves, and appurtenances for sanitary sewer service shall be furnished with outside surfaces coated with a bituminous coating 1 mil thick in accordance with ANSI A21.6 or ANSI A21.51.

2.05 MANHOLES, STRUCTURES AND PIPE ACCESSORIES

A. Fittings

1. Fittings allowed only on service laterals.

2. Fittings shall equal or exceed quality of pipe. Fittings shall be full-bodied gasket fittings or inserted gasketed compression fittings on line size greater than 15-inches as shown in the plans and details.

B. Pre-cast Reinforced Concrete Manholes & Sections

1. Pre-cast reinforced concrete manhole base sections, riser sections, tops, cones and special sections shall conform to the requirements of ASTM C478-93. The pre-cast sections shall have rubber gasket compression joints conforming to the material and performance requirements of ASTM C443.

2. Pre-cast Concrete Manhole Base: A steel reinforced concrete base shall be used with pre-cast concrete manhole sections. This base shall be furnished with confined O-ring joints in conformance with ASTM C443. The reinforced concrete pre-cast manhole base as shown on the plans shall be manufactured in accordance with ASTM C478.

3. Watertight, size-on-size resilient connectors allowing for differential settlement shall be used to connect pipe to manholes. Pipe to manhole connectors shall conform to ASTM C-923.

4. Minimum wall thickness will be 5-inches.

5. Concrete and reinforcing steel in foundation shall comply with Section 03300.

C. Cast-in-Place Manholes

1. Concrete and reinforcing steel shall comply with Section 03300.

2. Construction details as indicated (D-2).

3. Minimum wall thickness will be 5-inches.

4. Provide cast-in-place rubber gasket for connection of required sewer line or watertight, size-on-size resilient connectors allowing for differential settlement shall be used to connect pipe to manholes. Pipe to manhole connectors shall conform to ASTM C-923.

D. Fiberglass Manholes

1. Fiberglass manholes shall be in accordance with ASTM D3753 "Glass Fiber Reinforced Polyester Manholes, latest revision. The minimum wall thickness for all manholes at all depths shall be .40-inches. The inside diameter of the manhole barrel shall be either 48-inches or 1.5 times the nominal pipe diameter of the largest pipe, which ever is larger, or as indicated on the plan sheets.

2. Pipe Connectors- Watertight, size-on-size resilient connectors allowing for differential settlement shall be used to connect pipe to manholes. Pipe to manhole connectors shall conform to ASTM C-923 or shall be InsertaTee as shown in the plans ans specification details. Joints for sewer pipe for line and drop connections in sizes 4-inches – 15-inches shall be made by means of gasketed inserted watertight compression connection or approved equal as shown in the plans and details. Install in accordance with the manufacturer's written instructions. Connections for pipe larger than 15-inches shall be made using a pre-approved connection. Install in accordance with the manufacturer's written instructions.

E. Manhole Accessories

1. Manhole lid and cover:

a. Gray cast iron, with minimum clear opening 30-inches.

b. Use Western Iron Works A770R or approved equal with vent holes.

c. Provide anchor bolt holes for exposed manhole tops.

2. Manhole Rings:

a. Provide minimum of three throat rings between cone and manhole, maximum eight.

b. lid and cover.

3. Coating- Coating and lining of the interior vertical surfaces, if required, shall be as noted in the plans and details. Materials shall be installed and applied in accordance with the written instructions and specifications of the manufacturer at the thickness and quality as noted in the plans and details as approved by Engineer.

4. Manhole Inserts- Provide manhole insert to fit the manhole frame rim upon which the manhole cover rests.

a. Insert body shall be made of high density polyethylene copolymer material that meets ASTM D 1248, Class A, Category 5, Type III. Minimum thickness 1/8-inch.

b. Gasket shall be of closed cell neoprene and have pressure sensitive adhesive on one side and be placed under the weight-bearing surface of the insert by the manufacturer.

c. Lift strap of 1-inch woven polyethylene (seared on all cut ends to prevent unraveling). Strap shall be attached to the rising edge of the bowl off the insert by means of stainless steel rivet and washer.

d. Vent shall have 1/8-inch hole located on the side wall of the insert ¾-inch below the lip.

e. Load capacity insert shall have certified test data verifying minimum collapse load of 1500 lbs. minimum applied to a 5.50-inch square area in the center of the insert.

**PART 3- EXECUTION**

3.01 GENERAL:

A. Provide all labor, equipment and materials and install all pipe, fittings, specials and appurtenances as indicated or specified.

3.02 PIPE INSTALLATION

A. Handling

1. Handle in a manner to insure installation in sound and undamaged condition.

a. Do not drop or bump.

b. Use slings, lifting lugs, hooks and usher devices designed to protect pipe, joint elements, and coatings.

2. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.

3. Handle with equipment capable of work with adequate factor of safely against overturning or other unsafe procedures.

B. Installation

1. Installation, jointing and testing of pipe, fittings, and accessories shall be in accordance with the provisions of the applicable reference standard and in accordance with the requirements of this specification and related specifications referenced or contained in the contract documents for pressure or gravity sewers.

2. Lay pipe to slope gradient noted on the drawings.

3. Utilize equipment, methods, and materials insuring installation to lines and grades as indicated.

   a. Do not lay on blocks unless pipe is to receive total con-crete encasement.

   b. Use laser or minimum of 3 batter boards for control of line and grade.

   c. Obtain approval from Engineer for method proposed for transfer of line and grade from control to the work.

4. Install pipe of size, material, strength class, and joint type with embedment shown for plan location.

5. Insofar as possible, commence laying of pipe at downstream end of line, and, install pipe with bell ends in direction of pipe laying. Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations there from.

6. Clean interior of all pipe, fittings and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.

   a. Close open ends of pipe with snug fitting closures.

   b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.

   c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.

7. Inspect pipe prior to installation to determine if any pipe defects are present.

8. Brace or anchor as required to prevent displacement after establishing final position.

9. Perform only when weather and trench conditions are suitable.

10. Observe extra precaution when hazardous atmospheres might be encountered.

11. Sanitary sewer relation to water mains:

    a. Maintain 9-feet horizontal separation whenever possible.

    b. When conditions prevent a lateral separation of 9-feet, sewer may be installed closer to a water main if:
    (1) sewer constructed of PVC pipe meeting AWWA Specifications and having a minimum working pressure rating of 150 psi or greater and equipped with pressure type joints, and;
    (2) the sewer line and water main are separated by a minimum vertical distance of 2-feet and a minimum horizontal distance of 4-feet, measured between the nearest outside diameters of the pipes.

    c. When a sanitary sewer crosses a water line and that portion of the sewer is constructed as

described in 3.02 B.9.b. (1), the sewer may be placed no closer than 6 inches from the water line. The separation distance must be measured between the nearest outside pipe diameters. The sewer line shall be located at a lower elevation than the water line whenever possible and one length of the sewer pipe must be centered on the water line.

12. Auger or jack casing pipe in place where shown on plans.

C. Jointing

1. General requirements:

a. Locate joints to provide for differential movement at changes in type of pipe embedment, at changes from rock to soil trench bottom, and structures.

(1) Not more than 18 inches from structure wall, or

(2) Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing of structure.

b. Perform in accordance with manufacturer's recommendations.

c. Clean and lubricate all joint and gasket surfaces with lubricant recommended.

d. Utilize methods and equipment capable of fully homing or making up joints without damage.

e. Check joint opening and deflection for specification limits.

D. Closure Pieces

1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.

2. Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.

E. Temporary Plugs

1. Furnish and install temporary plugs at each end of work for removal by others when completed ahead of adjacent contract or where indicated.

2. Remove from pipe laid under adjacent contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this contract.

3. Plugs

a. Use test plugs as manufactured by pipe supplier, or

b. Fabricate by Contractor of substantial construction.

c. Must be watertight against heads up to 20 feet of water.

d. Secure in place in a manner to facilitate removal when required to connect pipe.

3.03 MANHOLE INSTALLATION

A. Foundations to be poured in place, or to be pre-cast concrete base sections in accordance with the requirements of ASTM C-478. See Standard Details included herein.

B. Construct manhole foundation and channel inverts integrally for cast in place manhole foundations. See Standard Details included herein.

C. Pre-cast manhole sections of ruse with cast in place manhole based may be installed after foundation concrete has attained 75% of design strength.

D. Forms for cast-in-place manhole may be installed after foundation concrete has attained 75% of design strength.

E. Manhole foundation and manhole may be installed simultaneously if manhole section is supported on concrete blocks and foundation concrete placed under and around bottom section.

F. Install manhole sections and joints in accordance with the requirements of the specification.

G. Heat materials for casting in place in freezing weather and protect work from cold; maintain temperature of work at 40° F. for at least 24 hours after placing.

H. Invert Channels: Inverts: The bottom of the manhole shall be provided with a "U" shaped channel that is as much as possible a smooth continuation of the inlet and outlet pipes.

1. For manholes connected to pipes less than 15-inches in diameter the channel depth shall be at least half the largest pipe diameter.

2. For manholes connected to pipes 15 to 24-inches in diameter the channel depth shall be at least three fourths the largest pipe diameter.

3. For manholes connected to pipes greater than 24-inches in diameter the channel depth shall be at least equal to the largest pipe diameter.

4. In manholes with pipes of different sizes, the tops of the pipes shall be placed at the same elevation and flow channels in the invert sloped on an even slope from pipe to pipe. The bench provided above the channel shall be sloped at a minimum of 0.5-inch per foot.

5. Where sewer lines enter the manhole higher that 24-inches above the manhole invert, the invert shall be filleted to prevent solids deposition.

6. Drop Manholes: A drop manhole as shown in the details shall be provided for a sewer entering a manhole more than 30-inches above the insert. A drop pipe of the same pipe material and size shall be provided for a sewer pipe entering a manhole more than 24-inches above the invert. The drop pipe shall be constructed on the outside of the manhole utilizing Wyes and Ells to provide a smooth drop and a clean out leg as shown on the details. The drop pipe shall be encased with concrete unless otherwise directed by the Engineer. Concrete shall extend from the bottom of the manhole base up to the bottom of the incoming sewer pipe, concrete shall also extend from the outside wall of the manhole out past the Wye on the Wye branch with a minimum of six inches (6") on each side.

I. Pipe Connection

1. Make watertight.

2. Use rubber gasket or size resilient connectors allowing for differential settlement conforming to ASTM C-9232.

3. All connectors shall be at flowing of manhole.

J. Exterior Pipe Support (Rigid Pipe)

1. Support vitrified clay pipe on concrete cradle from manhole connection to first joint on each side of manhole as indicated.

2. Provide pipe joint within 18 inches of manhole wall.

K. Castings, frames, and fittings

1. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed.

2. The unit shall be protected until mortar or concrete is set.

L. Coatings if required in the specifications and details shall be applied after Engineer's approval of structure.

3.04 ACCEPTANCE TESTS FOR SEWER PIPELINES

A. Infiltration Testing

1. General

a. Maximum infiltration for each section of sewer pipe shall not exceed 50 gal/mile/day/inch of pipe diameter.

b. Infiltration, exfiltration or air test may be used to prove compliance with infiltration requirement.

c. Acceptance of air test or exfiltration results will not preclude rejection of work if infiltration is measured and exceeds limitation.

d. After backfilling and removing debris from each section of sewer line, conduct a line acceptance test under observation of the Engineer. Copies of all test results shall be made available to the Engineer upon request. Test the sanitary sewer lines in strict accordance with the following leakage test using low pressure air. If the test results indicate an unacceptable installation, locate the source of leakage, correct the defect, and retest until the installation is proven satisfactory.

e. Tests should conform to the following requirements:

(1) Infiltration or Exfiltration Tests. The total exfiltration as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter, per mile of pipe per 24 hours at a minimum test head of two feet above the crown of the pipe at the upstream manhole.

(2) When pipes are installed below the groundwater level an infiltration test shall be used in lieu of the exfiltration test. The total infiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of two feet above the crown of the pipe at the upstream manhole, or at least two feet above existing groundwater level, whichever is greater.

(3) For construction within the 25 year flood plan, the infiltration or exfiltration shall not exceed 10 gallons per inch diameter per mile of pipe per 24 hours at the same minimum test head.

(4) If the quantity of infiltration or exfiltration exceeds the maximum quantity specified, remedial action shall be undertaken in order to reduce the infiltration or exfiltration to an amount within the limits specified.

2. Air Test

a. Furnish all facilities required including: (1) Necessary piping connections. (2) Test pumping equipment. (3) Pressure gauges or manometers. (4) Bulkheads. (5) All miscellaneous items required.

b. Obtain approval from Engineer of equipment and methods proposed for use.

c. Test pipe in sections determined by Contractor and approved by Engineer.

d. Plug ends of line and cap or plug all connections to with-stand internal test pressures.

e. Introduce low pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe. (Add 0.43 psi for each vertical foot of ground water over the top of pipe.)

f. Allow two minutes for air pressure to stabilize.

g. Time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of any ground water above pipe shall not be less than time in following table for given diameters.

**AIR TESTING TIMING**

| Pipe Diameter (Inches) | Minutes |
|---|---|
| 6 | 3.0 |
| 8 | 4.0 |
| 10 | 5.0 |
| 12 | 5.5 |
| 15 | 7.0 |
| 18 | 8.5 |
| 21 | 10.0 |
| 24 | 11.5 |
| 27 | 12.75 |
| 30 | 14.0 |
| 36 | 17.0 |

h. Repeat test as necessary after all leaks and defects have been repaired.

C. Deflection Testing

1. Perform on flexible pipe.

2. Use a mandrel to test for a maximum 5 percent deflection unless otherwise specified in the contract document.

3. The mandrel shall be sized and constructed as listed on the applicable table on page 02570-1.

4. Conduct no sooner than thirty (30) days after final backfill.

5. Use no mechanical pulling devices.

6. Uncover all irregularity or pipe deformation exceeding 5%. Replace all damaged pipe reround non-damaged pipe and tamp the embedment and initial backfill.

7. Any pipe removed shall be replaced by use of gasketed repair couplings.

8. Conduct deflection test in the presence of the Owner's or Engineer's representative.

9. Manhole Testing: Successful passage of a vacuum or hydrostatic test shall be required for acceptance of all sanitary sewer manholes and sanitary sewer structures. If a manhole fails a leakage test the manhole must be made watertight and retested. Hydrostatic testing shall be conducted by plugging with Engineer approved plugs all influent and effluent pipes in the manhole and filling the manhole with water to the top of the manhole cone with water. Additional water may be added over a twenty-four (24) hour period to compensate for absorption and evaporate losses. At the conclusion of the twenty-four (24) hour saturation period the manhole shall be filled to the top of the manhole cone and observed. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour. Any loss within a thirty (30) minute period shall be considered an unsuccessful test. Vacuum testing shall be performed in accordance with the requirements of ASTM C-1244, Specification for Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

3.05 SERVICE CONNECTIONS:

A. Install service connections at each dwelling or business place, or as directed by Engineer.

B. Services wyes: install wyes, 4-inch branch diameter unless shown otherwise on plans. See standard detail, "Typical Service Connection",

C. Risers: use in lieu of wyes for service connections where invert of sewer is 15 feet of more below ground surface or where shown on plans. See standard detail, "Typical Riser Service Connection". Place suitable stopper in end of connection, cement stopper in place with cold bituminous joint compound.

E. Backfill trench only after recording exact location of service connection. Place engineer approved maker tape above service piping in excavation within 3-feet of the surface.

F. Make no connections to house sewers or extend service connections beyond this contract without written permission of Engineer.

G. Backfill trench only after entire service line and wye connection has been inspected and approved by Engineer. Compact as specified in Section 02225, "Trenching, Backfilling and Compacting".

H. Street crossings shall have a minimum of 3 feet of cover to sub-grade unless approved by Engineer.

I. No payment for service lines will be made until all specified requirements have been met.

3.06 CONNECTIONS TO EXISTING DRAINS AND SEWER SYSTEM

A. Connect existing sanitary service drains which cross new sewer line through equal sized wye.

B. Connect no storm drains to new sewers.

C. Connections to existing manholes:

1. Cut hole in existing manhole at required elevation.

2. Insert new sewer pipe flush with inside of manhole.

3. Grout new pipe in place.

4. Reconstruct manhole bottom to suit new connection.

D. Connections to existing sewer:

1. Build new manhole around existing sewer.

2. Break out existing sewer inside of manhole and construct bottom to suit new connection.

**PART 4- MEASUREMENT AND PAYMENT**

4.01 SANITARY SEWER PIPE

A. Sanitary sewer pipe shall be measured from center of manhole to center of manhole or end of main. The sewer pipe shall be measured along the center of the pipe without considering fittings or other pipe connections. Sanitary sewer pipe will be paid at the contract bid price per linear feet complete in place at various depths for the type, size and depth constructed.

B. Compensation will be for furnishing all materials, labor, equipment, tools and incidentals required by the construction of the sanitary sewer pipe, all in accordance with the plans and these specifications.

C. If sanitary sewer pipe fails or does not pass appropriate mandrel test, Contractor shall remove and replace that part of the sewer pipe at no cost to the Owner.

4.02 SANITARY SEWER MANHOLE

A. A bid item is established for these items, this work shall be paid on a per unit basis as established on the Bid Form.