CITY CLERK
ORIGINAL

C-10032
06/09/2015

PROJECT SPECIFICATIONS AND CONTRACT DOCUMENTS

PROJECT NO. 131415

GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT

APRIL 2015

GLENDALE

Registered Professional Engineer (Mechanical)
CERTIFICATE NO.
33490
PHILIP J.
MOUW
Date Signed 4/8/15
ARIZONA U.S.A.

Expires 3/31/17

CITY OF GLENDALE

ENGINEERING DEPARTMENT
5850 W. Glendale Avenue, Glendale, Arizona 85301 (623) 930-3630

C-10032
06/09/15

GLENDALE AZ

Engineering Department

Memorandum

DATE: April 23, 2015
TO: All Plan and Specification Holders
FROM: Engineering
SUBJECT: PROJECT NO. 131415 – GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT REPLACEMENT

ADDENDUM NO. 1

In accordance with the contract documents "Information for Bidders," Page 4, Paragraph 12 CHANGES TO PLANS AND DOCUMENTS, the following revisions to the plans and specifications shall become a part of the contract documents and the bidder shall acknowledge receipt thereof as directed in Paragraph 13 of the Information for Bidders.

SITE VISIT:

A visit of the project site has been scheduled for Tuesday, April 28, 2015 at 8:00 AM. Interested parties should meet at the main entrance on the west side of the building at 6835 North 57th Drive, Glendale, Arizona prior to that time.

BID DATE:

The bid due date has been changed to Thursday, April 30, 2015 at 9:00 AM. The bid opening will be at 9:00 AM on Thursday, April 30, 2015 in Conference Room 3A in Glendale City Hall, 5850 W. Glendale Ave., Glendale, AZ.

BACKGROUND CHECK:

All on-site workers will have to successfully pass a background check. The form and background checks will be provided by the City to the successful bidder.

PLAN HOLDERS LIST:

Please note the attached plan holders list.

END OF ADDENDUM

Expires 3/31/17

PLAN HOLDERS

PROJECT NO/NAME: **131415-Glendale Public Safety Data Room CRAC Unit**
ENGINEER/CONSULTANT: MIKE JOHNSON
ENGINEER'S ESTIMATE: $440,000.00
PLANS & SPECS (NON-REFUNDABLE): $20.00
PRE BID CONFERENCE DATE/TIME: 4/23/15 @ 10AM
BID OPENING DATE: **APRIL 28TH AT 9AM**

DATE	SET NO.	COMPANY NAME & ADDRESS		PHONE/FAX		ADDENDUM NUMBER	ADDENDUM DATE	ADDENDUM VIA FAX/EMAIL
		PROJECT MANAGER -	PH	623-930-3630	GEN			
	1	MIKE JOHNSON	FAX		SUB			
			EMAIL		Plan Room			
	2	Dodge 3315 Central ave Hot Springs AR 71913	PH	501 321 2956	GEN			
			FAX	501 625 3544	SUB			
			EMAIL	bbranna.trio@constructive.com	SUPP			
					Plan Room			
	3	Blue Book PO Box 500 Jefferson Valley NY 10535	PH	800 431 2584 x 317	GEN			
			FAX	914 243 4936	SUB			
			EMAIL	caslese@thebluebook.com	SUPP			
					Plan Room			
4/20	4	VENTURA PACIFIC DEVELOPMENT 3770 N 7TH STREET PHX AZ 85014	PH	602-920-4166	GEN			
			FAX	602-274-6180	SUB			
			EMAIL	JERRY@VENTURACONTRACTING.COM	SUPP			
					Plan Room			
4/23	6	Harris Mechanical S.W. 2225 W. Parkside Lane Phx, Az 85027	PH	623-344-1480	GEN			
			FAX	623 344 1513	SUB			
			EMAIL	atilley@hmcc.com	SUPP			
					Plan Room			
4/23	7	Chuck moore IMCOR 1841 West Washington Phx.	PH	602 763 4481	GEN			
			FAX		SUB			
			EMAIL	Chuck.moore@imcor-az.com	SUPP			
					Plan Room			
4/23	8	Vince Palermo Benson 2065 W. 013150 Ave Gilbert	PH	480-737-0112	GEN			
			FAX	480-892-8689	SUB			
			EMAIL	vince.palermo@bensonsys.com	SUPP			
					Plan Room			
	5		PH		GEN			
			FAX		SUB			
			EMAIL		SUPP			
					Plan Room			
	9		PH		GEN			
			FAX		SUB			
			EMAIL		SUPP			
					Plan Room			
	10		PH		GEN			
			FAX		SUB			
			EMAIL		SUPP			
					Plan Room			

Engineering Department

Memorandum

DATE: April 28, 2015
TO: All Plan and Specification Holders
FROM: Engineering
SUBJECT: PROJECT NO. 131415 – GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT REPLACEMENT

ADDENDUM NO. 2

In accordance with the contract documents "Information for Bidders," Page 4, Paragraph 12 CHANGES TO PLANS AND DOCUMENTS, the following revisions to the plans and specifications shall become a part of the contract documents and the bidder shall acknowledge receipt thereof as directed in Paragraph 13 of the Information for Bidders.

BID DATE:

The bid due date remains unchanged as Thursday, April 30, 2015 at 9:00 AM. The bid opening will be at 9:00 AM on Thursday, April 30, 2015 in Conference Room 3A in Glendale City Hall, 5850 W. Glendale Ave., Glendale, AZ.

LIGHTNING PROTECTION:

Provide materials and labor to extend the existing roof mounted Lightning Protection System to each of the new rooftop-mounted condensing units. Bond the horizontal copper cable system to each end of the condensing unit metal support stand and each condensing unit. Maintain the existing Lightning Protection System integrity and match existing material sizes and roof mounting methods. Route the horizontal interconnecting conductors on the existing roof system with tie-down pads applied with mastic. Utilize mechanical connectors to tie the horizontal cables to the existing cable system.

Manufacturers shall be accredited firms listed as a manufacturer of lightning protection systems by Underwriters' Laboratories, Inc., and the Lightning Protection Institute, in their latest edition of "Electrical Equipment List."

ELECTRICAL CONDUIT ROUTING:

The new feeder/branch circuit routing to the CRAC and ACC units from the existing Panel EDP shall be overhead from the Parking Structure Level Electrical Room and suspended across to the existing building wall above. Route new conduits vertically within the existing building wall and chase up to the 2nd Level Central Plant Room. Route overhead to the roof mounted ACC units and Server Room CRAC units. Provide material and labor for all metal drilling, concrete core drilling, interior wall removal, and repair. Include trim repair as well as paint to match existing surfaces.

UNIT SUPPORT FRAME:

The existing roof joists are spaced at approximately 67 inches north-south. The proposed ACC units are approximately 203 inches long. The new roof support frame has to span three roof joists and extend the length of the ACC units being provided. The new roof support frame will be approximately 134 inches by 203 inches. All dimensions should be field verified with the actual roof joist spacing and the length of the units being provided.

ROOF PIPING PENETRATION FRAMING:

Provide structural framing around the new roof penetration for the refrigerant piping per the attached sketch, SSK-1.

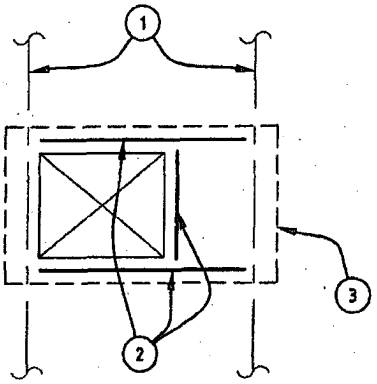
END OF ADDENDUM

Expires 3/31/17

GF GROUP
Structural Engineers
16597 N. 92nd St., #111
Scottsdale, Arizona 85260
Telephone: 480•941•2367
Facsimile: 480•941•0646

TO: LSW ENGRS AZ.
ATTN: PHILIP MOUW

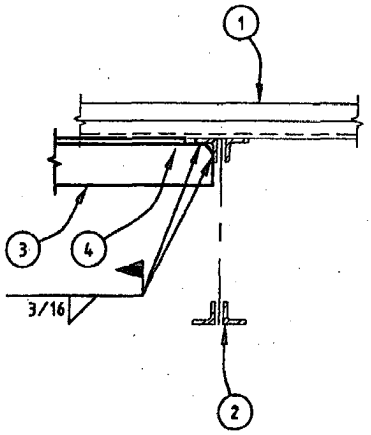
CC:



1. EXISTING STEEL JOIST.
2. L 4x4x5/16 .. SEE DETAIL (B) FOR CONNECTION TO STEEL JOIST
3. INDICATES RELIEF VENT/EXHAUST VENT OR PIPING PER MECH'L. DRAWINGS. (18"SQ MAX)

A ROOF OPENING

215038-10S3



1. EXISTING METAL DECK
2. EXISTING STEEL JOIST OR BEAM.
3. NEW FRAMING AT MECH'L OPENING.
4. COPE AS REQUIRED.

B NEW FRAMING TO EXISTING

215038-X-3S32

Title:	NEW MECH'L OPNG's ON ROOF				
Reference:				Sketch Number	SSK-1
Date:	4/28/15	Job No.	214180		
Project:	GLENDALE PSB	6835 N. 57th DR GLENDALE, AZ			

Registered Professional Engineer (Structural) CERTIFICATE NO. 18707 DEVON W. FURSTENAU Date Signed 4/28/15 ARIZONA, U.S.A.

EXP. DEC 31 2017

BID DOCUMENTS

PROJECT 131415

GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT

APRIL 2015

CITY OF GLENDALE
ENGINEERING DEPARTMENT

PROPOSAL

Place _____

Date _____

Proposal of _____, a Corporation organized and existing under the laws of the State of Arizona. a partnership consisting of _____; or an individual trading as _____.

TO THE HONORABLE MAYOR AND COUNCIL
CITY OF GLENDALE
GLENDALE, ARIZONA

Gentlemen:

The undersigned hereby proposes and agrees to furnish any and all required labor, materials, construction equipment, transportation and services for the construction of: **PROJECT 131415 - GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT**, in strict conformity with the plans and specifications for the following unit prices:

(Extension of these unit prices on the basis of estimated quantities and the totaling of these extensions are for the purpose of comparing bids only. The mathematics of such extensions and totaling will be checked and corrected by the Engineering Department, before evaluating the bids, and the lowest of such corrected and checked totals will determine the lowest bids.)

CITY OF GLENDALE

PROJECT NUMBER 131415

GLENDALE PUBLIC SAFETY BLDG. DATA ROOM CRAC UNIT REPLACEMENT PROJECT

BID SCHEDULE

BASE BID

ITEM NO.	DESCRIPTION	QTY	TOTAL COST
1	Mobilization / Demobilization	LS	
2	Demolition	LS	
3	Structural Steel	LS	
4	Finishes	LS	
5	Mechanical	LS	
6	New CRAC Units	LS	
7	Electrical	LS	
8	Misc. Items	LS	
9	Owner's Contingency	LS	$ 40,000.00
TOTAL BASE BID COST:			

The undersigned hereby declares that he has visited the site(s) and has carefully examined the contract documents relating to the work covered by the above bid or bids.

Upon receipt of notice of the acceptance of this bid, we will execute the formal contract attached within ten (10) days, and will deliver a one hundred percent (100%) Performance Bond for the faithful performance of this Contract, together with a one hundred percent (100%) Payment Bond and Certificate of Insurance.

The bid security attached, with endorsement, in the sum of ten percent (10%) of the total bid, is to become the property of the City of Glendale, Arizona, in the event the Contract and Bonds are not executed within the time set forth, as liquidated damages for the delay and additional work caused thereby.

The undersigned has checked carefully all the above figures and understands that the City of Glendale, Arizona, will not be responsible for any errors or omissions on the part of the undersigned in making up this bid.

The undersigned understands that the Mayor and Council of the City of Glendale, Arizona, reserves the right to reject any or all bids or to waive any informalities or irregularities in the bid.

Respectfully submitted,

Arizona Contractor's Classification and License No.

_____

_____
Contractor

By _____

_____

_____
(Complete business address)

Telephone Number: _____
Fax Number _____

Bidder shall signify receipt of all Addenda here (if any):

_____

_____

Failure to acknowledge receipt of all Addenda shall render the bid proposal non-responsive and will be rejected.

Acknowledged by _____

STATUTORY BID BOND
PURSUANT TO TITLE 34, CHAPTER 2, ARTICLE 1
OF THE ARIZONA REVISED STATUTES
(Penalty of this bond must not be less than 10% of the bid amount)

KNOW ALL MEN BY THESE PRESENTS:

That we, _____(hereinafter "Principal") as Principal, and _____, (hereinafter called the Surety) a corporation organized and existing under the laws of the State of _____, with its principal offices in the City of _____, as Surety, are held and firmly bound unto the City of Glendale (hereinafter "Obligee") in the amount of_____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said Principal has submitted a bid for: **PROJECT 131415 - GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT**

NOW, THEREFORE, if the Obligee shall accept the proposal of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of the proposal and give the Bonds and Certificates of Insurance as specified in the Standard Specifications with good and sufficient Surety for the faithful performance of the Contract and for the prompt payment of labor and material furnished in the prosecution of the contract, or in the event of the failure of the Principal to enter into such contract and give the Bonds and Certificates of Insurance, if the Principal pays to the Obligee the difference not to exceed the penalty of the bond between the amount specified in the Proposal and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by the Proposal, then this obligation is void. Otherwise, it remains in full force and effect provided, however, that this bond is executed pursuant to the provisions of Section 34-201, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of the section to the extent as if it were copied at length herein.

Witness our hands this ____ day of _____, 20__.

_____
PRINCIPAL

By: _____

_____
SURETY SEAL

_____
AGENCY OF RECORD

PROJECT SPECIFICATIONS AND CONTRACT DOCUMENTS

MAYOR
Jerry P. Weiers

COUNCIL MEMBERS
Jaime Aldama
Samuel U. Chavira
Ian Hugh
Gary D. Sherwood
Lauren Tolmachoff
Bart Turner

ACTING CITY MANAGER
Richard A. Bowers

CITY ATTORNEY
Michael D. Bailey

CITY CLERK
Pamela Hanna

CITY ENGINEER
David D. Beard

GLENDALE AZ

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PROJECT 131415

GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT

APRIL 2015

CITY OF GLENDALE
ENGINEERING DEPARTMENT

NOTICE TO CONTRACTORS

Sealed bids shall be either mailed to the City of Glendale Engineering Department, 5850 West Glendale Avenue, Glendale, Arizona, 85301, or hand-delivered to the Engineering Department office, third floor, 5850 West Glendale Avenue, Glendale, Arizona, for furnishing all plant, material, equipment and labor, and to complete construction of: **PROJECT NO. 131415 - GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT.** Furnish and install two (2) new air-cooled CRAC units to replace the two (2) existing air-cooled CRAC units that serve the second floor data room of the Public Safety Building as per design drawings and specifications. The new outdoor air cooled condensing unit shall be mounted on the roof above the data room.

Bids must be received by the Engineering Department of the City of Glendale no later than 9:00a.m., April 28, 2015. Any bid received after that time will not be considered and will be returned to the bidder. At that time, the bids will be publicly opened and read aloud in the Engineering Department Conference Room, 5850 West Glendale Avenue, Glendale, Arizona.

A pre-bid conference will be held on April 23, 2015, at 10:00a.m., in the Engineering Department Conference Room, 5850 West Glendale Avenue, Glendale, Arizona. Bidders, contractors, and other interested parties are invited to attend this conference which will be conducted by the Owner and Engineer to answer any questions.

Plans, specifications and contract documents may be examined, and copies may be obtained at City of Glendale Engineering Department, 5850 West Glendale Avenue, Glendale, Arizona. A non-refundable charge of $20.00 shall be paid for each set of plans and specifications issued from this office.

Each bid shall be in accordance with the plans, specifications and contract documents, and shall be set forth and submitted on the BID DOCUMENTS included with the project specifications book. The BID DOCUMENTS may be removed from the project specifications book and submitted independently of such book. Each bid shall be accompanied by a proposal guarantee, in the form of a certified or cashier's check or bid bond for ten percent (10%) of the amount of bid, made payable to the order of the City of Glendale, Arizona, to insure that the successful bidder will enter into the contract if awarded to him and submit the required Certificate of Insurance, Payment Bond and Performance Bond. All proposal guarantees, except those of the three lowest qualified bidders, will be returned immediately following the opening and checking of proposals. The proposal guarantees of the three lowest qualified bidders will be returned immediately after the contract documents have been executed by the successful bidder. The proposal guarantee shall be declared forfeited as liquidated damages if the successful bidder refuses to enter into said contract or submit the Certificate of Insurance, Payment Bond and Performance Bond after being requested to do so by the City of Glendale, Arizona.

The City of Glendale reserves the right to reject any or all bids or waive any informality or irregularity in a bid. No bidder may withdraw his bid for a period of fifty (50) days after opening and reading of the bids.

The City of Glendale is an equal opportunity employer and minority business enterprises and women's business enterprises are encouraged to submit bids.

CITY OF GLENDALE, ARIZONA

Published: April 9 and 16, 2015
The Glendale Star

INFORMATION FOR BIDDERS

1. ELIGIBILITY OF CONTRACTORS: When calling for bids for contracts for public work to be performed on behalf of the State or any political subdivision thereof, which will be paid for from public funds, no bid shall be considered for performance of a contract, including construction work which is not submitted by a bidder duly licensed as a contractor in this State. No bid shall be awarded to any contractor or entity not authorized to do business in the State of Arizona by the Arizona Corporation Commission, as required by statute.

2. PROPOSAL: Bids to receive consideration shall be made in accordance with the following instructions:

(a) Before submitting a bid, bidders shall carefully examine the plans and specifications and contract documents, visit the site of the work, fully inform themselves as to all existing conditions and limitations.

(b) Bids shall be submitted on the "PROPOSAL" forms provided and delivered to the City of Glendale Engineering Department on or before the day and hour set in the "NOTICE TO CONTRACTORS," as published. Bids shall be enclosed in a sealed envelope marked on the outside lower right-hand corner indicating:

1. The bidder's name and address.
2. The project number.
3. The title of the project.
4. The time and date the bids are to be received.

(c) It is the sole responsibility of the bidder to see that his bid is received in proper time. Any bids received after the scheduled closing time for receipt of bids will be returned to the bidder unopened.

(d) The signatures of all persons shall be in longhand. Any interlineations, alterations, or erasures must be initialed by the signer of the bid.

(e) Bids shall not contain any recapitulations of the work to be done. No oral, telegraphic, telephonic, or modified proposals will be considered.

3. BID SECURITY: Each proposal shall be accompanied by a proposal guarantee in the form of a certified or cashier's check or bid bond, with a properly executed Power of Attorney attached, in an amount equal at least to ten percent (10%) of the proposal payable without condition to the City. If a bid bond is submitted with the bid it shall be issued by a company licensed with the Arizona Department of Insurance and authorized to issue such bonds in this state. **NO BONDS ISSUED BY INDIVIDUAL SURETIES WILL BE ACCEPTED. The company issuing the bid bond shall have a rating of not less than A- in the BEST rating available at the time this project was let to bid**. The proposal guarantee shall guarantee that the bidder, if awarded the contract, will, within ten (10) working days after the award, execute such contract in accordance with the proposal and in manner and form required by the contract documents, and will furnish good and sufficient bond for the faithful performance of the same, a payment bond and a certificate of insurance. The bid securities of the three (3) lowest bidders will be retained until the contract is awarded, or other disposition made thereof. The bid securities of all bidders, except the three (3) lowest, will be returned promptly after the canvass of bids. In the event the Contractor fails, within ten (10)

working days after the award, to execute said Contract and deliver the Performance and Labor and Material Payment Bonds and the Certificate of Insurance, the Bid Security shall become the property of the City.

4. WITHDRAWAL OF BID: Any bidder may withdraw his bid, either personally, by telegram or by written request, at any time prior to the scheduled closing time for receipt of bids. No bid may be withdrawn by telephone. Any bid withdrawn will not be opened and will be returned to the bidder. After opening and reading of the bids, no bidder may withdraw his bid for a period of fifty (50) days from the date of opening and reading.

5. LATE BIDS: Bids received after the scheduled closing time for receipt of bids, as contained in the "Notice to Contractors," will not be considered and will be returned to the bidder.

6. AWARD OR REJECTION OF BIDS: The contract will be awarded to the lowest and best qualified responsive bidder complying with these instructions and with the "NOTICE TO CONTRACTORS." The City of Glendale, Arizona, however, reserves the right to accept or reject any or all bids or to waive any or all informalities or irregularities in the bid. Alternates may be accepted depending upon the availability of City funds. Accepted alternates will be considered in determining the lowest responsive and responsible bidder.

7. BIDDERS INTERESTED IN MORE THAN ONE BID: No person, firm or corporation shall be allowed to make, file, or be interested in more than one (1) bid for the same work unless alternate bids are called for in the specifications or any addenda. A person, firm, or corporation who has submitted a sub-proposal to a bidder, or who has quoted prices on materials to a bidder is not thereby disqualified from submitting a sub-proposal or quoting prices to other bidders.

8. CONTRACT AND BONDS: The form of contract, which the successful bidder as Contractor will be required to execute and the forms of bonds which he shall be required to furnish are included in the contract documents and should be carefully examined by the bidder. The successful bidder shall use the forms provided or such other forms as are acceptable by the City. The Contract and Performance and Labor and Material Payment Bonds will be executed in three (3) original counterparts. All bonds shall be issued by companies licensed with the Arizona Department of Insurance and authorized to issue such bonds in this state. **NO BONDS ISSUED BY INDIVIDUAL SURETIES WILL BE ACCEPTED. The company issuing any bond shall have a rating of not less than A- in the BEST rating available at the time this project was let to bid.**

9. INSURANCE REQUIREMENTS: Contractor, and each Sub-contractor performing work or providing materials related to this Agreement must procure and maintain the insurance coverages described (collectively, "Contractor's Policies"), until each Parties' obligations under this Agreement are completed. Contractor must at all times relevant hereto carry a commercial general liability policy with a combined single limit of at least $1,000,000 per occurrence and $2,000,000 annual aggregate. **Contracts in excess of $250,000 shall require $2,000,000 single occurrence/$5,000,000 annual aggregate.**

Sub-contractors must at all times relevant hereto carry a general commercial liability policy with a combined single limit of at least $1,000,000 per occurrence.

This commercial general liability insurance must include independent contractors' liability, contractual liability, broad form property coverage, products and completed operations, XCU

hazards if requested by the City, and a separation of insurance provision.

These limits may be met through a combination of primary and excess liability coverage.

Auto. A business auto policy providing a liability limit of at least $1,000,000 per accident for Contractor and $1,000,000 per accident for Sub-contractors and covering owned, non-owned and hired automobiles.

Workers' Compensation and Employer's Liability. A workers' compensation and employer's liability policy providing at least the minimum benefits required by Arizona law.

Equipment Insurance. Contractor must secure, pay for, and maintain all-risk insurance as necessary to protect the City against loss of owned, non-owned, rented or leased capital equipment and tools, equipment and scaffolding, staging, towers and forms owned or rented by Contractor or its Sub-contractors.

10. SUBCONTRACTORS LISTING AND CERTIFICATION OF CONTRACT COMPLIANCE: The contractor will be required to furnish the form of subcontractors listing and certification of contract compliance with the executed contract documents. This information is requested for tracking and insurance purposes only.

11. INTERPRETATION OF PLANS AND DOCUMENTS: If any person contemplating a bid for proposed contract is in doubt as to the true meaning of any part of the plans, specifications, or other proposed contract documents, or finds discrepancies in or omissions from the plans and specifications, he may submit to the Engineering Department, a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. Questions received less than ninety-six (96) hours before the bid opening time may not be answered. Any interpretation or correction of the documents will be made only by Addendum, duly issued and a copy of such Addendum will be mailed or delivered to each person receiving a set of such documents. The City of Glendale will not be responsible for any other explanations or interpretations of the proposed documents.

12. CHANGES TO PLANS AND DOCUMENTS: Any changes to the plans and documents shall be made only by Addendum. No verbal or other changes to the plans and documents will be valid. A copy of each Addendum will be mailed or delivered as provided in Section 13 below.

13. ADDENDUM: Any addenda will be faxed, mailed or delivered to all who are known by the City to have received a complete set of bid documents, and to offices where bid documents have been filed for review purposes. It is the responsibility of each bidder to ascertain that he has received all addenda issued by telephoning the office identified in the NOTICE TO CONTRACTORS as the location where bid documents are available prior to submitting his bid.

Bidders shall acknowledge all addenda in the appropriate location on the "PROPOSAL" form. Failure to acknowledge receipt of Addenda shall render the bid proposal non-responsive and it will be rejected.

14. ASSIGNMENT OF CONTRACT: No assignment by the Contractor of any contract to be entered into hereunder, or any part thereof, or of funds to be received thereunder by the Contractor, will be recognized by the Owner by the Owner unless such assignment has had prior approval of the Owner, and the Surety has been given due notice of such assignment in writing and has consented

thereto in writing.

15. PLANS AND SPECIFICATIONS TO SUCCESSFUL BIDDER: The successful bidder may obtain five (5) sets of plans and specifications for this project from the City.

16. TIME OF COMPLETION: The Contractor shall commence work under this project on or before the tenth day following receipt of the Notice to Proceed for that project from the City of Glendale and shall fully complete all work under the project within ninety-eight (98) consecutive calendar days from and including the date of receipt of such Notice to Proceed. Time is of the essence in the completion of all work required under this contract. The Contractor shall, at all times, during the continuance of the contract, prosecute the work with such force and equipment as is sufficient to complete all work within the time specified.

17. CITY OF GLENDALE TRANSACTION PRIVILEGE TAX: The City of Glendale transaction privilege tax shall **NOT** be waived under the provisions of this contract. The current privilege tax rate can be obtained from the City of Glendale Sales Tax and Licenses Department. The Contractor shall be responsible for reporting and payment of all city, county, state or federal taxes.

18. PRE-BID CONFERENCE: A pre-bid conference will be held on April 23, 2015, at 10:00a.m., in the Engineering Department Conference Room, 5850 West Glendale Avenue, Glendale, Arizona. Bidders, contractors, and other interested parties are invited to attend this conference which will be conducted by the Owner and Engineer to answer any questions.

19. ALTERNATES: Alternate proposals will not be considered unless called for in the documents or any addenda thereto. When alternates are requested, all requested alternates or alternate bid items, unless otherwise stated, shall be bid. If no change in the base bid will occur with the alternate, enter "No Change."

20. APPROVAL OF SUBSTITUTIONS: The materials, products and equipment described in the Documents and Addenda establish a standard or required function, dimension, appearance and quality to be met by any proposed substitution. No substitute will be considered, before bid opening, unless written request for approval has been received by the City Engineer at least ten (10) working days prior to the scheduled closing time for receipt of bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including any drawings, cuts, performance and test data and any other information necessary for evaluation of the substitute. Bidder shall not be entitled to approval of a substitute.

If a substitute is approved, the approval shall be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

21. USE OF "EQUALS": When the specifications for materials, articles, products and equipment state "or equal," contractor may bid upon, and use materials, articles, products and equipment which will perform equally the duties imposed by the general design. The City Engineering Department will have the final approval of all materials, articles, products and equipment proposed to be used as an "equal." It shall not be purchased or installed without the prior written approval from the City Engineering Department.

Approvals for "equals," before bid opening, may be requested in writing to the City Engineering

Department for approval. Requests must be received at least ten (10) days prior to the date set for opening the Bid Proposals. The request shall state the name of the material, article, product or equipment for which the item is sought to be considered an equal and a complete description of the proposed equal including any drawings, cuts, performance and test data and any other information necessary for approval of the equal. All approvals will be issued in the form of an addendum.

22. EXAMINATION OF CONTRACT DOCUMENTS AND VISIT SITE: Before submitting a Bid Proposal, bidders should carefully examine the Contract Documents, visit the site of the work, fully inform themselves as to all existing conditions and limitations. No consideration will be granted for any alleged misunderstanding of the material, articles or piece of equipment to be furnished or work to be done. It is understood that the tender of the Bid Proposal carries with it the agreement to all items and conditions referred to herein or indicated in the Contract Documents.

23. BIDDERS IN DEFAULT: No bid will be awarded to any person, firm or corporation that is not authorized by the Arizona Corporation Commission to do business in the State of Arizona, in arrears or is in default to the City of Glendale upon any debt or contract, or that is a defaulter as surety or otherwise upon any obligation to the City of Glendale, or has failed to faithfully perform any previous contract with the City of Glendale.

END OF INFORMATION FOR BIDDERS

PROPOSAL

Place Glendale Public Safety Bldg. Data Room CRAC

Date April 30, 2015

Proposal of Ventura Pacific Development, Inc., a Corporation organized and existing under the laws of the State of Arizona. a partnership consisting of _____; or an individual trading as _____.

TO THE HONORABLE MAYOR AND COUNCIL
CITY OF GLENDALE
GLENDALE, ARIZONA

Gentlemen:

The undersigned hereby proposes and agrees to furnish any and all required labor, materials, construction equipment, transportation and services for the construction of: **PROJECT 131415 - GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT**, in strict conformity with the plans and specifications for the following unit prices:

(Extension of these unit prices on the basis of estimated quantities and the totaling of these extensions are for the purpose of comparing bids only. The mathematics of such extensions and totaling will be checked and corrected by the Engineering Department, before evaluating the bids, and the lowest of such corrected and checked totals will determine the lowest bids.)

CITY OF GLENDALE

PROJECT NUMBER 131415

GLENDALE PUBLIC SAFETY BLDG. DATA ROOM CRAC

UNIT REPLACEMENT PROJECT

BID SCHEDULE

BASE BID

ITEM NO.	DESCRIPTION	QTY	TOTAL COST
1	Mobilization / Demobilization	LS	$ 15,122.00
2	Demolition	LS	$ 18,539.79
3	Structural Steel	LS	$ 14,649.30
4	Finishes	LS	$ 4,892.94
5	Mechanical	LS	$ 40,571.00
6	New CRAC Units	LS	$ 119,556.00
7	Electrical	LS	$ 28,536.00
8	Misc. Items	LS	$ 3,198.97
9	Owner's Contingency	LS	**$ 40,000.00**
TOTAL BASE BID COST:			$ 285,066.00

The undersigned hereby declares that he has visited the site(s) and has carefully examined the contract documents relating to the work covered by the above bid or bids.

Upon receipt of notice of the acceptance of this bid, we will execute the formal contract attached within ten (10) days, and will deliver a one hundred percent (100%) Performance Bond for the faithful performance of this Contract, together with a one hundred percent (100%) Payment Bond and Certificate of Insurance.

The bid security attached, with endorsement, in the sum of ten percent (10%) of the total bid, is to become the property of the City of Glendale, Arizona, in the event the Contract and Bonds are not executed within the time set forth, as liquidated damages for the delay and additional work caused thereby.

The undersigned has checked carefully all the above figures and understands that the City of Glendale, Arizona, will not be responsible for any errors or omissions on the part of the undersigned in making up this bid.

The undersigned understands that the Mayor and Council of the City of Glendale, Arizona, reserves the right to reject any or all bids or to waive any informalities or irregularities in the bid.

Respectfully submitted,

Arizona Contractor's Classification and License No.

ROC 259314 KB-01

Ventura Pacific Development, Inc.
Contractor

By _____

3770 North 7th Street, Suite 200

Phoenix, AZ 85014
(Complete business address)

Telephone Number: 602-274-0180
Fax Number 602-274-0181

Bidder shall signify receipt of all Addenda here (if any):

Addendum No. 1 dated 4/23/15 (2 pages)

Addendum No. 2 dated 4/28/15 (3 pages)

Failure to acknowledge receipt of all Addenda shall render the bid proposal non-responsive and will be rejected.

Acknowledged by _____

CITY OF GLENDALE

Subcontractor Listing and Certification of Contract Compliance

PROJECT 131415 - GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT

The undersigned contractor hereby submits the following list of firms to be employed as subcontractors on the above referenced project:

SUBCONTRACTOR	WORK ELEMENTS	CONTRACT VALUE	DBE(Y/N)*	AGENCY**
Benson Systems	CRAC Units	$ 166,855	N	N/A
Cactus Welding	Steel	$ 11,910	N	N/A
Crane Rental Service	Crane	$ 6,573	N	N/A
Roof USA	Roofing	$ 2,600	N	N/A

The undersigned hereby certifies that all subcontracts shall be in writing and shall provide that all work to be performed shall be in accordance with the terms of the Contract. All subcontracts shall be subject to approval by the City. Certified copies of all subcontracts shall be furnished to the Engineer; however, prices may be omitted. Subcontracts shall conform to the regulations governing employment of labor.

Ventura Pacific Development, Inc.
Name of Firm

DBE?(Y/N)*: N Agency**: N/A

Jerry Reichenberger
Signature

Estimator
Title

*Firms certified as Disadvantaged Business Enterprises. **Indicate certifying agency, e.g., ADOT, MCHD, COP, etc. **This information is requested for tracking purposes only.** The City of Glendale is an equal opportunity employer and minority business enterprises and women's business enterprises are encouraged to submit bids.

Project 131415

CONSTRUCTION AGREEMENT

This Construction Agreement ("Agreement") is entered into and effective between the CITY OF GLENDALE, an Arizona municipal corporation ("City"), and Ventura-Pacific Development, Inc., an Arizona corporation ("Contractor") as of the 9th day of June, 2015

RECITALS

A. City intends to undertake a project for the benefit of the public and with public funds that is more fully set forth in the **Notice to Contractors** and the attached **Exhibit A** ("Project");

B. City desires to retain the services of Contractor to perform those specific duties and produce the specific work as set forth in the Project, the plans and specifications, the **Information for Bidders,** and the **Maricopa Association of Governments** ("MAG") **General and Supplemental Conditions and Provisions**;

C. City and Contractor desire to memorialize their agreement with this document.

AGREEMENT

In consideration of the Recitals, which are confirmed as true and correct and incorporated by this reference, the mutual promises and covenants contained in this Agreement, and other good and valuable consideration, City and Contractor agree as follows:

1. Project.

1.1 Scope. Contractor will provide all services and material necessary to assure the Project is completed timely and efficiently consistent with Project requirements, including, but not limited to, working in close interaction and interfacing with City and its designated employees, and working closely with others, including other contractors, providers or consultants retained by City.

1.2 Documents. The following documents are, by this reference, entirely incorporated into this Agreement and attached Exhibits as though fully set forth herein:

(A) Notice to Contractors;
(B) Information for Bidders;
(C) MAG General Conditions, Supplemental General Conditions, Special and Technical Provisions;
(D) Proposal;
(E) Bid Bond;
(F) Payment Bond;
(G) Performance Bond;
(H) Certificate of Insurance;
(I) Appendix; and
(J) Plans and Addenda thereto.

Should a conflict exist between this Agreement (and its attachments), and any of the incorporated documents as listed above, the provisions of this Agreement shall govern.

1.3 Project Team.

(A) Project Manager. Contractor will designate an employee as Project Manager with sufficient training, knowledge, and experience to, in the City's opinion, to complete the project and handle all aspects of the Project such that the work produced by Contractor is consistent with applicable standards as detailed in this Agreement.

(B) Project Team.

(1) The Project manager and all other employees assigned to the project by Contractor will comprise the "Project Team."

(2) Project Manager will have responsibility for and will supervise all other employees assigned to the project by Contractor.

(C) Sub-contractors.

(1) Contractor may engage specific technical contractor (each a "Sub-contractor") to furnish certain service functions.

(2) Contractor will remain fully responsible for Sub-contractor's services.

(3) Sub-contractors must be approved by the City, unless the Sub-contractor was previously mentioned in the response to the solicitation.

(4) Contractor shall certify by letter that contracts with Sub-contractors have been executed incorporating requirements and standards as set forth in this Agreement.

2. **Schedule.** The Project will be undertaken in a manner that ensures it is completed in a timely and efficient manner. If not otherwise stated in **Exhibit A**, the Project shall be completed by no later than within ninety-eight (98) consecutive calendar days from and including the date of receipt of the Notice to Proceed.

3. **Contractor's Work.**

3.1 **Standard.** Contractor must perform services in accordance with the standards of due diligence, care, and quality prevailing among contractors having substantial experience with the successful furnishing of services and materials for projects that are equivalent in size, scope, quality, and other criteria under the Project and identified in this Agreement.

3.2 **Licensing.** Contractor warrants that:

(A) Contractor and Sub-contractors will hold all appropriate and required licenses, registrations and other approvals necessary for the lawful furnishing of services ("Approvals"); and

(B) Neither Contractor nor any Sub-contractor has been debarred or otherwise legally excluded from contracting with any federal, state, or local governmental entity ("Debarment").

(1) City is under no obligation to ascertain or confirm the existence or issuance of any Approvals or Debarments or to examine Contractor's contracting ability.

(2) Contractor must notify City immediately if any Approvals or Debarment changes during the Agreement's duration and the failure of the Contractor to notify City as required will constitute a material default of this Agreement.

3.3 **Compliance.** Services and materials will be furnished in compliance with applicable federal, state, county and local statutes, rules, regulations, ordinances, building codes, life safety codes, or other standards and criteria designated by City.

3.4 **Coordination; Interaction.**

(A) If the City determines that the Project requires the coordination of professional services or other providers, Contractor will work in close consultation with City to proactively interact with any other contractors retained by City on the Project ("Coordinating Entities").

(B) Subject to any limitations expressly stated in the budget, Contractor will meet to review the Project, schedules, budget, and in-progress work with Coordinating Entities and the City as often and for durations as City reasonably considers necessary in order to ensure the timely work delivery and Project completion.

(C) If the Project does not involve Coordinating Entities, Contractor will proactively interact with any other contractors when directed by City to obtain or disseminate timely information for the proper execution of the Project.

3.5 **Hazardous Substances.** Contractor is responsible for the appropriate handling, disposal of, and if necessary, any remediation and all losses and damages to the City, associated with the use or release of hazardous substances by Contractor in connection with completion of the Project.

3.6 **Warranties.** At any time within two years after completion of the Project, Contractor must, at Contractor's sole expense and within 20 days of written notice from the City, uncover, correct and remedy all defects in Contractor's work. City will accept a manufacturer's warranty on approved equipment as satisfaction of the Contractor's warranty under this subsection.

3.7. **Bonds.** Upon execution of this Agreement, and if applicable, Contractor must furnish Payment and Performance bonds as required under A.R.S. § 34-608.

4. Compensation for the Project.

4.1 **Compensation.** Contractor's compensation for the Project, including those furnished by its Sub-contractors will not exceed $285,066.00, as specifically detailed in the Contractor's bid and set forth in **Exhibit B** ("Compensation").

4.2 **Change in Scope of Project.** The Compensation may be equitably adjusted if the originally contemplated scope of services as outlined in the Project is significantly modified by the City.

(A) Adjustments to the Scope or Compensation require a written amendment to this Agreement and may require City Council approval.

(B) Additional services which are outside the scope of the Project and not contained in this Agreement may not be performed by the Contractor without prior written authorization from the City.

5. Billings and Payment.

5.1 Applications.

(A) The Contractor will submit monthly invoices (each, a "Payment Application") to City's Project Manager and City will remit payments based upon the Payment Application as stated below.

(B) The period covered by each Payment Application will be one calendar month ending on the last day of the month.

5.2 Payment.

(A) After a full and complete Payment Application is received, City will process and remit payment within 30 days.

(B) Payment may be subject to or conditioned upon City's receipt of:

(1) Completed work generated by Contractor and its Sub-contractors; and

(2) Unconditional waivers and releases on final payment from Sub-contractors as City may reasonably request to assure the Project will be free of claims arising from required performances under this Agreement.

5.3 **Review and Withholding.** City's Project Manager will timely review and certify Payment Applications.

(A) If the Payment Application is rejected, the Project Manager will issue a written listing of the items not approved for payment.

(B) City may withhold an amount sufficient to pay expenses that City reasonably expects to incur in correcting the deficiency or deficiencies rejected for payment.

(C) Contractor will provide, by separate cover, and concurrent with the execution of this Agreement, all required financial information to the City, including City of Glendale Transaction Privilege License and Federal Taxpayer identification numbers.

(D) City will temporarily withhold Compensation amounts as required by A.R.S. 34-221(C).

6. Termination.

6.1 For Convenience. City may terminate this Agreement for convenience, without cause, by delivering a written termination notice stating the effective termination date, which may not be less than 15 days following the date of delivery.

(A) Contractor will be equitably compensated any services and materials furnished prior to receipt of the termination notice and for reasonable costs incurred.

(B) Contractor will also be similarly compensated for any approved effort expended and approved costs incurred that are directly associated with Project closeout and delivery of the required items to the City.

6.2 For Cause. City may terminate this Agreement for cause if Contractor fails to cure any breach of this Agreement within seven days after receipt of written notice specifying the breach.

(A) Contractor will not be entitled to further payment until after City has determined its damages. If City's damages resulting from the breach, as determined by City, are less than the equitable amount due but not paid Contractor for Service and Repair furnished, City will pay the amount due to Contractor, less City's damages.

(B) If City's direct damages exceed amounts otherwise due to Contractor, Contractor must pay the difference to City immediately upon demand; however, Contractor will not be subject to consequential damages more than $1,000,000 or the amount of this Agreement, whichever is greater.

7. Insurance.

7.1 Requirements. Contractor must obtain and maintain the following insurance ("Required Insurance"):

(A) Contractor and Sub-contractors. Contractor, and each Sub-contractor performing work or providing materials related to this Agreement must procure and maintain the insurance coverages described below (collectively, "Contractor's Policies"), until each Parties' obligations under this Agreement are completed.

(B) General Liability.

(1) Contractor must at all times relevant hereto carry a commercial general liability policy with a combined single limit of at least $1,000,000 per occurrence and $2,000,000 annual aggregate.

(2) Sub-contactors must at all times relevant hereto carry a general commercial liability policy with a combined single limit of at least $1,000,000 per occurrence.

(3) This commercial general liability insurance must include independent contractors' liability, contractual liability, broad form property coverage, products and completed operations, XCU hazards if requested by the City, and a separation of insurance provision.

(4) These limits may be met through a combination of primary and excess liability coverage.

(C) Auto. A business auto policy providing a liability limit of at least $1,000,000 per accident for Contractor and 1,000,000 per accident for Sub-contractors and covering owned, non-owned and hired automobiles.

(D) Workers' Compensation and Employer's Liability. A workers' compensation and employer's liability policy providing at least the minimum benefits required by Arizona law.

(E) Equipment Insurance. Contractor must secure, pay for, and maintain all-risk insurance as necessary to protect the City against loss of owned, non-owned, rented or leased capital equipment and tools, equipment and scaffolding, staging, towers and forms owned or rented by Contractor or its Sub-contractors.

(F) Notice of Changes. Contractor's Policies must provide for not less than 30 days' advance written notice to City Representative of:

(1) Cancellation or termination of Contractor or Sub-contractor's Policies;

(2) Reduction of the coverage limits of any of Contractor or and Sub-contractor's Policies; and

(3) Any other material modification of Contractor or Sub-contractor's Policies related to this Agreement.

(G) Certificates of Insurance.

(1) Within 10 business days after the execution of the Agreement, Contractor must deliver to City Representative certificates of insurance for each of Contractor and Sub-contractor's Policies, which will confirm the existence or issuance of Contractor and Sub-contractor's Policies in accordance with the provisions of this section, and copies of the endorsements of Contractor and Sub-contractor's Policies in accordance with the provisions of this section.

(2) City is and will be under no obligation either to ascertain or confirm the existence or issuance of Contractor and Sub-contractor's Policies, or to examine Contractor and Sub-contractor's Policies, or to inform Contractor or Sub-contractor in the event that any coverage does not comply with the requirements of this section.

(3) Contractor's failure to secure and maintain Contractor Policies and to assure Sub-contractor policies as required will constitute a material default under this Agreement.

(H) Other Contractors or Vendors.

(1) Other contractors or vendors that may be contracted by Contractor with in connection with the Project must procure and maintain insurance coverage as is appropriate to their particular agreement.

(2) This insurance coverage must comply with the requirements set forth above for Contractor's Policies (e.g., the requirements pertaining to endorsements to name the parties as additional insured parties and certificates of insurance).

(I) Policies. Except with respect to workers' compensation and employer's liability coverages, the City must be named and properly endorsed as additional insureds on all liability policies required by this section.

(1) The coverage extended to additional insureds must be primary and must not contribute with any insurance or self insurance policies or programs maintained by the additional insureds.

(2) All insurance policies obtained pursuant to this section must be with companies legally authorized to do business in the State of Arizona and acceptable to all parties.

7.2 Sub-contractors.

(A) Contractor must also cause its Sub-contractors to obtain and maintain the Required Insurance.

(B) City may consider waiving these insurance requirements for a specific Sub-contractor if City is satisfied the amounts required are not commercially available to the Sub-contractor and the insurance the Sub-contractor does have is appropriate for the Sub-contractor's work under this Agreement.

(C) Contractor and Sub-contractors must provide to the City proof of Required Insurance whenever requested.

7.3 Indemnification.

(A) To the fullest extent permitted by law, Contractor must defend, indemnify, and hold harmless City and its elected officials, officers, employees and agents (each, an "Indemnified Party," collectively, the

"Indemnified Parties"), for, from, and against any and all claims, demands, actions, damages, judgments, settlements, personal injury (including sickness, disease, death, and bodily harm), property damage (including loss of use), infringement, governmental action and all other losses and expenses, including attorneys' fees and litigation expenses (each, a "Demand or Expense"; collectively, "Demands or Expenses") asserted by a third-party (i.e. a person or entity other than City or Contractor) and that arises out of or results from the breach of this Agreement by the Contractor or the Contractor's negligent actions, errors or omissions (including any Sub-contractor or other person or firm employed by Contractor), whether sustained before or after completion of the Project.

(B) This indemnity and hold harmless policy applies even if a Demand or Expense is in part due to the Indemnified Party's negligence or breach of a responsibility under this Agreement, but in that event, Contractor shall be liable only to the extent the Demand or Expense results from the negligence or breach of a responsibility of Contractor or of any person or entity for whom Contractor is responsible.

(C) Contractor is not required to indemnify any Indemnified Parties for, from, or against any Demand or Expense resulting from the Indemnified Party's sole negligence or other fault solely attributable to the Indemnified Party.

7.4 **Waiver of Subrogation.** Contractor waives, and will require any Subcontractor to waive, all rights of subrogation against the City to the extent of all losses or damages covered by any policy of insurance.

8. Immigration Law Compliance.

8.1 Contractor, and on behalf any subcontractor, warrants, to the extent applicable under A.R.S. § 41-4401, compliance with all federal immigration laws and regulations that relate to their employees as well as compliance with A.R.S. § 23-214(A) which requires registration and participation with the E-Verify Program.

8.2 Any breach of warranty under subsection 8.1 above is considered a material breach of this Agreement and is subject to penalties up to and including termination of this Agreement.

8.3 City retains the legal right to inspect the papers of any Contractor or subcontractor employee who performs work under this Agreement to ensure that the Contractor or any subcontractor is compliant with the warranty under subsection 8.1 above.

8.4 City may conduct random inspections, and upon request of City, Contractor shall provide copies of papers and records of Contractor demonstrating continued compliance with the warranty under subsection 8.1 above. Contractor agrees to keep papers and records available for inspection by the City during normal business hours and will cooperate with City in exercise of its statutory duties and not deny access to its business premises or applicable papers or records for the purposes of enforcement of this section 8.

8.5 Contractor agrees to incorporate into any subcontracts under this Agreement the same obligations imposed upon Contractor and expressly accrue those obligations directly to the benefit of the City. Contractor also agrees to require any subcontractor to incorporate into each of its own subcontracts under this Agreement the same obligations above and expressly accrue those obligations to the benefit of the City.

8.6 Contractor's warranty and obligations under this section to the City is continuing throughout the term of this Agreement or until such time as the City determines, in its sole discretion, that Arizona law has been modified in that compliance with this section is no longer a requirement.

8.7 The "E-Verify Program" above means the employment verification program administered by the United States Department of Homeland Security, the Social Security Administration, or any successor program.

9. Conflict. Contractor acknowledges this Agreement is subject to A.R.S. § 38-511, which allows for cancellation of this Agreement in the event any person who is significantly involved in initiating, negotiating, securing, drafting, or creating the Agreement on City's behalf is also an employee, agent, or consultant of any other party to this Agreement.

10. Non-Discrimination Policies. Contractor must not discriminate against any employee or applicant for employment on the basis of race, religion, color sex or national origin. Contractor must develop, implement and maintain non-discrimination policies and post the policies in conspicuous places visible to employees and applicants for employment. Contractor will require any Sub-contractor to be bound to the same requirements as stated within this section.

11. Notices.

11.1 A notice, request or other communication that is required or permitted under this Agreement (each a "Notice") will be effective only if:

(A) The Notice is in writing, and

(B) Delivered in person or by private express overnight delivery service (delivery charges prepaid), certified or registered mail (return receipt requested).

(C) Notice will be deemed to have been delivered to the person to whom it is addressed as of the date of receipt, if:

(1) Received on a business day, or before 5:00 p.m., at the address for Notices identified for the Party in this Agreement by U.S. Mail, hand delivery, or overnight courier on or before 5:00 p.m.; or

(2) As of the next business day after receipt, if received after 5:00 p.m.

(D) The burden of proof of the place and time of delivery is upon the Party giving the Notice.

(E) Digitalized signatures and copies of signatures will have the same effect as original signatures.

11.2 **Representatives.**

(A) Contractor. Contractor's representative ("Contractor's Representative") authorized to act on Contractor's behalf with respect to the Project, and his or her address for Notice delivery is:

Ventura-Pacific Development, Inc.
Attn: Douglas Peery
3770 North 7th Street, Suite 200
Phoenix, Arizona 85014

(B) City. City's representative ("City's Representative") authorized to act on City's behalf, and his or her address for Notice delivery is:

City of Glendale
Attn: Mike Johnson
5850 West Glendale Avenue
Glendale, Arizona 85301

With required copies to:

City of Glendale
City Manager
5850 West Glendale Avenue
Glendale, Arizona 85301

City of Glendale
City Attorney
5850 West Glendale Avenue
Glendale, Arizona 85301

(C) Concurrent Notices.

(1) All notices to City's representative must be given concurrently to City Manager and City Attorney.

(2) A notice will not be considered to have been received by City's representative until the time that it has also been received by City Manager and City Attorney.

(3) City may appoint one or more designees for the purpose of receiving notice by delivery of a written notice to Contractor identifying the designee(s) and their respective addresses for notices.

(D) **Changes.** Contractor or City may change its representative or information on Notice, by giving Notice of the change in accordance with this section at least ten days prior to the change.

12. Financing Assignment. City may assign this Agreement to any City-affiliated entity, including a non-profit corporation or other entity whose primary purpose is to own or manage the Project.

13. Entire Agreement; Survival; Counterparts; Signatures.

13.1 Integration. This Agreement contains, except as stated below, the entire agreement between City and Contractor and supersedes all prior conversations and negotiations between the parties regarding the Project or this Agreement.

(A) Neither Party has made any representations, warranties or agreements as to any matters concerning the Agreement's subject matter.

(B) Representations, statements, conditions, or warranties not contained in this Agreement will not be binding on the parties.

(C) Any solicitation, addendums and responses submitted by the Contractor are incorporated fully into this Agreement as Exhibit A. Any inconsistency between Exhibit A and this Agreement will be resolved by the terms and conditions stated in this Agreement.

13.2 Interpretation.

(A) The parties fairly negotiated the Agreement's provisions to the extent they believed necessary and with the legal representation they deemed appropriate.

(B) The parties are of equal bargaining position and this Agreement must be construed equally between the parties without consideration of which of the parties may have drafted this Agreement.

(C) The Agreement will be interpreted in accordance with the laws of the State of Arizona.

13.3 Survival. Except as specifically provided otherwise in this Agreement each warranty, representation, indemnification and hold harmless provision, insurance requirement, and every other right, remedy and responsibility of a Party, will survive completion of the Project, or the earlier termination of this Agreement.

13.4 Amendment. No amendment to this Agreement will be binding unless in writing and executed by the parties. Any amendment may be subject to City Council approval.

13.5 Remedies. All rights and remedies provided in this Agreement are cumulative and the exercise of any one or more right or remedy will not affect any other rights or remedies under this Agreement or applicable law.

13.6 Severability. If any provision of this Agreement is voided or found unenforceable, that determination will not affect the validity of the other provisions, and the voided or unenforceable provision will be reformed to conform to applicable law.

13.7 Counterparts. This Agreement may be executed in counterparts, and all counterparts will together comprise one instrument.

14. Dispute Resolution. Each claim, controversy and dispute ("Dispute") between Contractor and City will be resolved in accordance with Exhibit C. The final determination will be made by the City.

15. Exhibits. The following exhibits, with reference to the term in which they are first referenced, are incorporated by this reference.

Exhibit A	Project
Exhibit B	Compensation
Exhibit C	Dispute Resolution

Project 131415

The parties enter into this Agreement as of the date shown above.

City of Glendale,
an Arizona municipal corporation

By: Richard A. Bowers
Its: Acting City Manager

ATTEST:

City Clerk (SEAL)

APPROVED AS TO FORM:

City Attorney

Ventura-Pacific Development, Inc.,
an Arizona corporation

By: Douglas Peery
Its: President

WOMEN-OWNED/MINORITY BUSINESS [ ] YES [X] NO
CITY OF GLENDALE TRANSACTION PRIVILEGE TAX NO. [redacted]
FEDERAL TAXPAYER IDENTIFICATION NO. [redacted]

Project 131415

EXHIBIT A
CONSTRUCTION AGREEMENT

PROJECT

Furnish and install two (2) new air-cooled CRAC units to replace the two (2) existing air-cooled CRAC units that serve the second floor data room of the Public Safety Building as per design drawings and specifications. The new outdoor air cooled condensing unit shall be mounted on the roof above the data room.

EXHIBIT B
CONSTRUCTION AGREEMENT

COMPENSATION

METHOD AND AMOUNT OF COMPENSATION

By bid, including all services, materials and costs.

NOT-TO-EXCEED AMOUNT

The total amount of compensation paid to Contractor for full completion of all work required by the Project during the entire term of the Project must not exceed $285,066.00

DETAILED PROJECT COMPENSATION

As shown on Page 8 of the Bid Schedule.

EXHIBIT C
CONSTRUCTION AGREEMENT

DISPUTE RESOLUTION

1. Disputes.

1.1 Commitment. The parties commit to resolving all disputes promptly, equitably, and in a good-faith, cost-effective manner.

1.2 Application. The provisions of this Exhibit will be used by the parties to resolve all controversies, claims, or disputes ("Dispute") arising out of or related to this Agreement-including Disputes regarding any alleged breaches of this Agreement.

1.3 Initiation. A party may initiate a Dispute by delivery of written notice of the Dispute, including the specifics of the Dispute, to the Representative of the other party as required in this Agreement.

1.4 Informal Resolution. When a Dispute notice is given, the parties will designate a member of their senior management who will be authorized to expeditiously resolve the Dispute.

(A) The parties will provide each other with reasonable access during normal business hours to any and all non-privileged records, information and data pertaining to any Dispute in order to assist in resolving the Dispute as expeditiously and cost effectively as possible;

(B) The parties' senior managers will meet within 10 business days to discuss and attempt to resolve the Dispute promptly, equitably, and in a good faith manner, and

(C) The Senior Managers will agree to subsequent meetings if both parties agree that further meetings are necessary to reach a resolution of the Dispute.

2. Arbitration.

2.1 Rules. If the parties are unable to resolve the Dispute by negotiation within 30 days from the Dispute notice, and unless otherwise informal discussions are extended by the mutual agreement, the Dispute will be decided by binding arbitration in accordance with Construction Industry Rules of the AAA, as amended herein. Although the arbitration will be conducted in accordance with AAA Rules, it will not be administered by the AAA, but will be heard independently.

(A) The parties will exercise best efforts to select an arbitrator within 5 business days after agreement for arbitration. If the parties have not agreed upon an arbitrator within this period, the parties will submit the selection of the arbitrator to one of the principals of the mediation firm of Scott & Skelly, LLC, who will then select the arbitrator. The parties will equally share the fees and costs incurred in the selection of the arbitrator.

(B) The arbitrator selected must be an attorney with at least 15 years experience with commercial construction legal matters in Maricopa County, Arizona, be independent, impartial, and not have engaged in any business for or adverse to either Party for at least 10 years.

2.2 Discovery. The extent and the time set for discovery will be as determined by the arbitrator. Each Party must, however, within ten (10) days of selection of an arbitrator deliver to the other Party copies of all documents in the delivering party's possession that are relevant to the dispute.

2.3 Hearing. The arbitration hearing will be held within 90 days of the appointment of the arbitrator. The arbitration hearing, all proceedings, and all discovery will be conducted in Glendale, Arizona unless otherwise agreed by the parties or required as a result of witness location. Telephonic hearings and other reasonable arrangements may be used to minimize costs.

2.4 Award. At the arbitration hearing, each Party will submit its position to the arbitrator, evidence to support that position, and the exact award sought in this matter with specificity. The arbitrator must select the award sought

by one of the parties as the final judgment and may not independently alter or modify the awards sought by the parties, fashion any remedy, or make any equitable order. The arbitrator has no authority to consider or award punitive damages.

2.5 Final Decision. The Arbitrator's decision should be rendered within 15 days after the arbitration hearing is concluded. This decision will be final and binding on the Parties.

2.6 Costs. The prevailing party may enter the arbitration in any court having jurisdiction in order to convert it to a judgment. The non-prevailing party shall pay all of the prevailing party's arbitration costs and expenses, including reasonable attorney's fees and costs.

3. **Services to Continue Pending Dispute.** Unless otherwise agreed to in writing, Contractor must continue to perform and maintain progress of required services during any Dispute resolution or arbitration proceedings, and City will continue to make payment to Contractor in accordance with this Agreement.

4. **Exceptions.**

4.1 Third Party Claims. City and Contractor are not required to arbitrate any third-party claim, cross-claim, counter claim, or other claim or defense of a third-party who is not obligated by contract to arbitrate disputes with City and Contractor.

4.2 Liens. City or Contractor may commence and prosecute a civil action to contest a lien or stop notice, or enforce any lien or stop notice, but only to the extent the lien or stop notice the Party seeks to enforce is enforceable under Arizona Law, including, without limitation, an action under A.R.S. § 33-420, without the necessity of initiating or exhausting the procedures of this Exhibit.

4.3 Governmental Actions. This Exhibit does not apply to, and must not be construed to require arbitration of, any claims, actions or other process filed or issued by City of Glendale Building Safety Department or any other agency of City acting in its governmental permitting or other regulatory capacity.

BOND NUMBER 2143267

INDIVIDUAL SURETIES WILL NOT BE ACCEPTED

STATUTORY PERFORMANCE BOND PURSUANT TO TITLE 34, CHAPTER 2, ARTICLE 2, OF THE ARIZONA REVISED STATUTES

(Penalty of this bond must be 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENTS:

That Ventua Pacific Development, Inc. (hereinafter called the Principal), as Principal, and Old Republic Surety Company a corporation organized and existing under the laws of the State of Wisconsin with its principal office in the City of Brookfield, (hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Glendale, a municipal corporation, (hereinafter called the Obligee), in the amount of Two Hundred Eighty Five Thousand Sixty Sixty and 00/100******** Dollars ($285,066.00**), for the payment whereof; the said Principal and Surety bind themselves, and their heirs, administrators, 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 15thday of June 20 15 , to construct **PROJECT 131415 - GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT** , which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract any extension thereof, with or without notice to the Surety, and during the life of any guaranty required under the contract and shall also perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived; then the above obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, of the Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of said Title, Chapter, and Article, to the extent as if it were copied at length herein.

The prevailing party or any party which recovers judgment on this bond shall be entitled to such reasonable attorney's fees as may be fixed by the court or a judge thereof.

Witness our hands this 22nd day of June, 2015.

Ventura Pacific Development, Inc.

Principal Seal

By

Surety Patricia A. Stump Attorney in Fact Seal

Crest Insurance Group, L.L.C.

Agency of Record

5285 E. Williams Circle, #4500

Tucson, AZ 85711

Agency Address

Telephone Number: 520-881-5760

INDIVIDUAL SURETIES WILL NOT BE ACCEPTED

STATUTORY PAYMENT BOND PURSUANT TO TITLE 34,
CHAPTER 2, ARTICLE 2, OF THE ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENTS:

That, Ventura Pacific Development, Inc. (hereinafter called the Principal), as Principal, and Old Republic Surety Company, a corporation organized and existing under the laws of the State of Wisconsin with its principal office in the City of Brookfield, (hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Glendale, a municipal corporation, (hereinafter called the Obligee), in the amount of ********** Dollars ($285,066.00**), for the payment whereof; the said Principal and Surety bind themselves, and their heirs, administrators, 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 15th day of June, 20 15, to construct **PROJECT 131415 - GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT** which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall promptly pay all monies due to all persons supplying labor or materials to him or his subcontractors in the prosecution of the work provided for in said Contract, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond having been required of the said Principal in order to comply with the provisions of Title 34, Chapter 2, Article 2, of the Arizona Revised Statutes, all rights and remedies on this bond shall inure solely to such persons and shall be determined in accordance with the provisions, conditions, and limitations of said Title, Chapter and Article, to the same extent as if they were copied at length herein.

The prevailing party or any party which recovers judgment on this bond shall be entitled to such reasonable attorney's fees as may be fixed by the court or a judge thereof.

Witness our hands this 22nd day of June, 20 15.

Ventura Pacific Development, Inc.
Principal Seal

By _____

Surety Patricia A. Stump Attorney in Fact Seal

Crest Insurance Group, L.L.C.
Agency of Record

Agency Address

5285 E. Williams Circle, #4500
Tucson, AZ 85711

Telephone 520-881-5760

OLD REPUBLIC SURETY COMPANY

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That OLD REPUBLIC SURETY COMPANY, a Wisconsin stock insurance corporation, does make, constitute and appoint:

PATRICIA A. STUMP, MELODY J. STOCKTON, RUDY M. MATHEWS, OF TUCSON, AZ

its true and lawful Attorney(s)-in-Fact, with full power and authority, not exceeding $50,000,000, for and on behalf of the company as surety, to execute and deliver and affix the seal of the company thereto (if a seal is required), bonds, undertakings, recognizances or other written obligations in the nature thereof, (other than bail bonds, bank depository bonds, mortgage deficiency bonds, mortgage guaranty bonds, guarantees of installment paper and note guaranty bonds, self-insurance workers compensation bonds guaranteeing payment of benefits, asbestos abatement contract bonds, waste management bonds, hazardous waste remediation bonds or black lung bonds), as follows:

ALL WRITTEN INSTRUMENTS IN AN AMOUNT NOT TO EXCEED AN AGGREGATE OF TWO MILLION DOLLARS($2,000,000)---------- FOR ANY SINGLE OBLIGATION, REGARDLESS OF THE NUMBER OF INSTRUMENTS ISSUED FOR THE OBLIGATION.

and to bind OLD REPUBLIC SURETY COMPANY thereby, and all of the acts of said Attorneys-in-Fact, pursuant to these presents, are ratified and confirmed. This document is not valid unless printedon colored background and is multi-colored. This appointment is made under and by authority of the board of directors at a special meeting held on February 18, 1982. This Power of Attorney is signed and sealed by facsimile under and by the authority of the following resolutions adopted by the board of directors of the OLD REPUBLIC SURETY COMPANY on February 18, 1982.

RESOLVED that, the president, any vice-president, or assistant vice president, in conjunction with the secretary or any assistant secretary, may appoint attorneys-in-fact or agents with authority as defined or limited in the instrument evidencing the appointment in each case, for and on behalf of the company to execute and deliver and affix the seal of the company to bonds, undertakings, recognizances, and suretyship obligations of all kinds; and said officers may remove any such attorney-in-fact or agent and revoke any Power of Attorney previously granted to such person.

RESOLVED FURTHER, that any bond, undertaking, recognizance, or suretyship obligation shall be valid and binding upon the Company
(i) when signed by the president, any vice president or assistant vice president, and attested and sealed (if a seal be required) by any secretary or assistant secretary; or
(ii) when signed by the president, any vice president or assistant vice president, secretary or assistant secretary, and countersigned and sealed (if a seal be required) by a duly authorized attorney-in-fact or agent; or
(iii) when duly executed and sealed (if a seal be required) by one or more attorneys-in-fact or agents pursuant to and within the limits of the authority evidenced by the Power of Attorney issued by the company to such person or persons.

RESOLVED FURTHER, that the signature of any authorized officer and the seal of the company may be affixed by facsimile to any Power of Attorney or certification thereof authorizing the execution and delivery of any bond, undertaking, recognizance, or other suretyship obligations of the company; and such signature and seal when so used shall have the same force and effect as though manually affixed.

IN WITNESS WHEREOF, OLD REPUBLIC SURETY COMPANY has caused these presents to be signed by its proper officer, and its corporate seal to be affixed this 19TH day of AUGUST, 2014.

Phyllis M. Johnson
Assistant Secretary

OLD REPUBLIC SURETY COMPANY

Alan Pavlic
President

STATE OF WISCONSIN, COUNTY OF WAUKESHA-SS

On this 19TH day of AUGUST, 2014, personally came before me, Alan Pavlic and Phyllis M. Johnson, to me known to be the individuals and officers of the OLD REPUBLIC SURETY COMPANY who executed the above instrument, and they each acknowledged the execution of the same, and being by me duly sworn, did severally depose and say; that they are the said officers of the corporation aforesaid, and that the seal affixed to the above instrument is the seal of the corporation, and that said corporate seal and their signatures as such officers were duly affixed and subscribed to the said instrument by the authority of the board of directors of said corporation.

Kathryn R. Pearson
Notary Public
My commission expires: 9/28/2014
(Expiration of notary commission does not invalidate this instrument)

CERTIFICATE

I, the undersigned, assistant secretary of the OLD REPUBLIC SURETY COMPANY, a Wisconsin corporation, CERTIFY that the foregoing and attached Power of Attorney remains in full force and has not been revoked; and furthermore, that the Resolutions of the board of directors set forth in the Power of Attorney, are now in force.

52-5558

Signed and sealed at the City of Brookfield, WI this 22 day of June, 2015.

Assistant Secretary

CREST INSURANCE GROUP, LLC

THIS DOCUMENT HAS A COLORED BACKGROUND AND IS MULTI-COLORED ON THE FACE. THE COMPANY LOGO APPEARS ON THE BACK OF THIS DOCUMENT AS A WATERMARK. IF THESE FEATURES ARE ABSENT, THIS DOCUMENT IS VOID.

ORSC 22262 (5-10)

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 6/24/2015

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

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

PRODUCER Crest Insurance Group, LLC 5285 East Williams Circle Suite 4500 Tucson AZ 85711	CONTACT NAME: Lori Steiner PHONE (A/C, No, Ext): 520-881-5760 FAX (A/C, No): 520-325-3757 E-MAIL ADDRESS: lsteiner@crestins.com
	INSURER(S) AFFORDING COVERAGE — NAIC #
	INSURER A : Cincinnati Insurance Company — 10677
INSURED 70VENTPAC1 Ventura Pacific Development, Inc 3770 N. 7th Street, Suite 200 Phoenix AZ 85014	INSURER B : CopperPoint General Insurance Compa
	INSURER C :
	INSURER D :
	INSURER E :
	INSURER F :

COVERAGES **CERTIFICATE NUMBER:** 892930176 **REVISION NUMBER:**

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

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY X PRO-JECT LOC OTHER:	Y		EPP0221820	12/8/2014	12/8/2015	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG $	$1,000,000 $500,000 $10,000 $1,000,000 $2,000,000 $2,000,000
A	AUTOMOBILE LIABILITY X ANY AUTO ALL OWNED AUTOS SCHEDULED AUTOS HIRED AUTOS NON-OWNED AUTOS	Y		EBA0221820	12/8/2014	12/8/2015	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) $	$1,000,000 $ $ $ $
A	X UMBRELLA LIAB X OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $			EPP0221820	12/8/2014	12/8/2015	EACH OCCURRENCE AGGREGATE $	$5,000,000 $5,000,000 $
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N N/A (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below			1009241	8/15/2014	8/1/2015	X PER STATUTE OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $1,000,000 $1,000,000 $1,000,000
A	Installation Floater			EPP0221820	12/8/2014	12/8/2015	Limit $150,000	Ded $1,000

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

RE:Project 131415-Public Safety Building Data Room CRAC Units- Certificate holder and others when required in a written contract or agreement are Additional Insured (General Liability & Automobile Liability).applies. This form is subject to all policy forms, terms, endorsements, conditions definitions & exclusions.

CERTIFICATE HOLDER

City of Glendale, Arizona
Attn: Engineering Dept.
5850 West Glendale Ave
Glendale AZ 85301

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Jane Authorized Signature

ACORD®

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 6/19/2015

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

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

PRODUCER	CONTACT NAME: Lori Steiner
Crest Insurance Group, LLC 5285 East Williams Circle Suite 4500 Tucson AZ 85711	PHONE (A/C, No, Ext): 520-881-5760 FAX (A/C, No): 520-325-3757 E-MAIL ADDRESS: lsteiner@crestins.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Cincinnati Insurance Company	10677
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INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED	
Ventura Pacific Development, Inc 3770 N. 7th Street, Suite 200 Phoenix AZ 85014	70VENTPAC1

COVERAGES **CERTIFICATE NUMBER:** 673240576 **REVISION NUMBER:**

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

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY [X] PRO-JECT [ ] LOC OTHER:	Y		EPP0221820	12/8/2014	12/8/2015	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG $	$1,000,000 $500,000 $10,000 $1,000,000 $2,000,000 $2,000,000 $
A	AUTOMOBILE LIABILITY X ANY AUTO ALL OWNED AUTOS [ ] SCHEDULED AUTOS HIRED AUTOS [ ] NON-OWNED AUTOS	Y		EBA0221820	12/8/2014	12/8/2015	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) $	$1,000,000 $ $ $ $
A	X UMBRELLA LIAB [X] OCCUR EXCESS LIAB [ ] CLAIMS-MADE DED [ ] RETENTION $			EPP0221820	12/8/2014	12/8/2015	EACH OCCURRENCE AGGREGATE $	$5,000,000 $5,000,000 $
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? [ ] N / A (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below			1009241	8/15/2014	8/1/2015	X PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $1,000,000 $1,000,000 $1,000,000
A	Installation Floater			EPP0221820	12/8/2014	12/8/2015	Limit $150,000	Ded $1,000

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

RE:Project 131415-Public Safety Building Data Room CRAC Units- Certificate holder and others when required in a written contract or agreement are Additional Insured (General Liability & Automobile Liability).applies. This form is subject to all policy forms, terms, endorsements, conditions definitions & exclusions.

CERTIFICATE HOLDER

City of Glendale, Arizona
Attn: Engineering Dept.
5850 West Glendale Ave
Glendale AZ 85301

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Cody Ritchil

CITY OF GLENDALE, ARIZONA
PUBLIC WORKS/ENGINEERING DEPARTMENT

CONTRACTOR'S AFFIDAVIT
REGARDING
SETTLEMENT OF CLAIMS

PROJECT 131415 - GLENDALE PUBLIC SAFETY BUILDING DATA ROOM CRAC UNIT

To the City of Glendale, Arizona

Gentlemen:

This is to certify that all lawful claims for materials, rental of equipment and labor used in connection with the construction of the above project, whether by subcontractor or claimant in person, have been duly discharged.

The undersigned, for the consideration of $_____ , as set out in the final pay estimate, as full and complete payment under the terms of the contract, hereby waives and relinquishes any and all further claims or right of lien under, in connection with, or as a result of the above described project. The undersigned further agrees to indemnify and save harmless the City of Glendale against any and all liens, claims of liens, suits, actions, damages, charges, costs, litigation expenses, attorneys' fees and any other and expenses whatsoever, which said City may suffer arising out of the failure of the undersigned to pay for all labor performance and materials furnished for the performance of said installation.

Signed and dated at _____ , this _____ day of _____ , 20___.

_____
Contractor

By _____

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

The foregoing instrument was subscribed and sworn to before me this ___ day of _____, 20 .

_____
Notary Public

My Commission Expires: _____

SUPPLEMENTAL GENERAL CONDITIONS

1. GENERAL: By Ordinance No. 1110 New Series, the City of Glendale adopted the "Uniform Standard Specifications for Public Works Construction," which are sponsored and distributed by the Maricopa Association of Governments. Copies of these documents, with revisions, are on file in the office of the City Engineer of the City of Glendale, and are hereby made a part of these Contract Documents.

Whenever in the Uniform Standard Specifications, the words "The Contracting Agency" are used, the meaning shall be the City of Glendale.

In all cases where ASTM, AASHTO, AWWA, USAG, Federal, City of Phoenix, MAG Specifications, Maricopa County, Arizona State Highway, City of Glendale or other standard specifications are referred to, unless otherwise stated, revisions, supplements or addenda issued on or before the date of this contract, shall prevail. In the event of any conflict between these project specifications and the requirements of the plans, detail drawings, MAG Standard Details and Specifications, these project specifications shall prevail.

2. DEFINITIONS: The following terms, as used in or pertaining to the Contract Documents, are defined as follows:

CITY: The word "City" refers to the City of Glendale, Arizona. The official representative of said City in these proceedings shall be the City Engineer.

CONTRACTOR: The word "Contractor" means the person, firm, or corporation with whom the Contract is made by the City.

MATERIALS: The term "Materials" includes, in addition to materials incorporated in the project, equipment and other material used and/or consumed in the performance of the work.

SUBCONTRACTOR: The word "Subcontractor" includes those having a direct contract with the Contractor and those who furnish material worked to a special design according to the plans and/or specifications for this work, but does not include those who merely furnish materials not so worked.

ENGINEER: The word "Engineer" means a person, firm or corporation duly authorized by the City, to act for the City in staking out the work, inspecting materials and construction, and interpreting plans and specifications.

CONTRACT DOCUMENTS: The words "Contract Documents" mean the Notice to Contractors, Information for Bidders, "Uniform Standard Specifications for Public Works Construction," MAG General Conditions, Supplemental General Conditions, Special Provisions, Supplemental Specifications, Proposal, Contract, Payment Bond, Performance Bond, Certificates of Insurance, Plans and Addenda thereto.

3. PROPOSAL QUANTITIES: It is expressly understood and agreed by the parties hereto that the quantities of the various classes of work to be done and material to be furnished under this Contract, which have been estimated as stated in the Proposal, are only approximate and are to be used SOLELY for the purpose of comparing, on a consistent basis, the proposals offered for the work under this Contract; and the Contractor further agrees that the City will not be held responsible if any of the quantities shall be found incorrect; and the Contractor will not make any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work as estimated and the work actually done. If any error, omission, or mis-statement is found to occur in the estimated quantities, the same shall not invalidate this Contract or release the Contractor from the execution and completion of the whole or any part of the work in accordance with the specifications and the plans herein mentioned, or for the prices herein agreed upon and fixed therefore, or excuse him from any of the obligations or liabilities hereunder, or entitle him to any damages or compensation except as may be provided for in this Contract.

4. WITHDRAWAL OF PROPOSALS: No proposal shall be withdrawn following the opening and reading of the bids for a period of 50 days from the date of opening without the consent of the contracting agency through the body or agent duly authorized to accept or reject the proposal.

5. LOSSES AND DAMAGES: All loss or damage arising out of the nature of the work to be done or from the action of the elements, or from any unforeseen circumstances in the prosecution of the same, or from any unusual obstructions or difficulties which may be encountered in and/or during the prosecution of the work, or from any casualty whatsoever of every description, shall be sustained and borne by the Contractor at his own cost and expense except as otherwise provided by the contract documents or the laws of the State of Arizona.

6. DUST PREVENTION: The Contractor shall take whatever steps, procedures or means required to prevent abnormal dust conditions due to his construction operations in connection with this contract. The dust control measures shall be maintained at all times during construction of the project, to the satisfaction of the Engineer, in accordance with the requirements of the "Maricopa County Health Department Air Pollution Control Regulations" which have been adopted pursuant to A.R.S. § 36-779.

The Contractor shall be required to obtain the necessary permit from the Maricopa County Air Pollution Control Bureau, 1001 N. Central Ave., Phoenix, Arizona 85004 - telephone (602) 506-6727.

7. EXCESS MATERIAL: Excess material shall be removed from the work site and wasted at a location approved by the Engineer. Broken concrete and asphalt may be delivered to the Glendale Sanitary Landfill located at 115th Avenue and Glendale Avenue. The prevailing regulations and fee schedule will not be waived for work under this project. All materials, to be disposed of at the landfill, shall be weighed and disposed of at the prevailing rate.

8. STOCKPILE OF MATERIALS: The Contractor may place or stockpile materials in the public right-of-way, if approved by the Engineer, provided they do not prevent access to adjacent properties or prevent compliance with traffic regulations.

Traffic shall not be required to travel over stockpiled materials, and proper dust control shall be maintained.

9. REFUSE COLLECTION ACCESS: At any time the project construction shall require the closure or disruption of traffic in any roadway, alley, or refuse collection easement such that normal refuse collection will be interfered with, the Contractor shall, at least 48 hours prior to causing such closure or disruption, make arrangements with the Field Operations Department in order that refuse collection service can be maintained.

10. CLEAN-UP: After all work under this contract is completed, the Contractor shall remove all loose concrete, lumber, wire, reinforcing, debris, and other materials not incorporated in the work, from the site of the work. Clean-up shall include the removal of all excess pointing mortar materials within pipes and removal of over-size rocks and boulders left after finish grading. The contractor shall provide for the legal disposal of all waste products, debris, etc., and shall make necessary arrangements for such disposal.

11. SHOP DRAWINGS: The Contractor shall provide shop drawings as may be necessary for the prosecution of the work as required by the contract documents. The Engineer shall promptly review all shop drawings. The Engineer's approval of any shop drawing shall not release the Contractor from responsibility for deviations from the contract documents. The approval of any shop drawing which substantially deviates from the requirements of the contract documents shall be evidenced by a change order.

When submitted for the Engineer's review, shop drawings shall bear the contractor's certification that he has reviewed, checked, and approved the shop drawings and that they are in conformance with the requirements of the contract documents.

Portions of the work requiring a shop drawing or sample submission shall not begin until the shop drawing or sample submission has been approved by the Engineer. A copy of each approved shop drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

12. PROTECTION OF FINISHED OR PARTIALLY FINISHED WORK: The Contractor shall properly guard and protect all finished or partially finished work, and shall be responsible for the same until the entire contract is completed and accepted, in writing, by the City. The Contractor shall turn over the entire work in full accordance with the specifications before final settlement shall be made.

13. STATUS OF EMPLOYEES: Contractor shall be responsible for assuring the legal working status of its employees and its subcontractor's employees.

14. LAWS AND REGULATIONS: This Contract shall be governed by and constructed in accordance with the laws of the State of Arizona. The Contractor shall keep himself fully informed of all existing and future City and County Ordinances and Regulations and State and Federal Laws and Occupational Safety and Health Standards (OSHA) in any manner affecting the work herein specified. He shall at all times observe and comply with said Ordinances, Regulations, or Laws.

15. PERMITS: The City has obtained certain required permits which are included in the project specifications, but it will be the duty of the Contractor to determine that all the necessary permits have been obtained. The Contractor shall, at his own expense, obtain all required permits which have not been furnished by the City. A no-fee permit will be issued for work in the City of Glendale right-of-way and easement. (Also see Paragraph 7. Dust Prevention.)

16. ELECTRIC POWER AND WATER: The Contractor shall make his own arrangements for electric power and water. Subject to the convenience of the City, he may be permitted to connect to existing facilities where available, but he shall meter and bear the cost of such power or water. Fire hydrant meters may be obtained from the City of Glendale. Installation and removal of meters should be scheduled through the City's Water Services/Utilities Division at 930-2700. For details and current rates, please visit http://www.glendaleaz.com/CrossConnection/firehydrantmeterprogram.cfm.

17. SURVEY CONTROL POINTS AND MONUMENTS: Existing survey monuments indicated on the plans or found during construction shall be protected by the Contractor, and in the event removal is necessary, removal and replacement shall be performed by permission of the Engineer, under direct supervision of the Engineer or his authorized representative. Survey monuments shall be constructed to conform to the requirements of MAG Specifications, Section 405, and Standard Details.

18. EXISTING UTILITIES: The Contractor is hereby advised that the location of all utilities, as shown on the plans, may not be complete nor exact and the Contractor shall satisfy himself as to the exact location of the utilities by contacting Blue Stake or the utility companies before proceeding with the work. After the underground utilities are located by Blue Stake or the utility company, the contractor shall excavate in a careful and prudent manner to prevent unwillful damage to the underground utilities.

In the event the Contractor or its Subcontractor damages an existing, properly identified underground City of Glendale water or sewer line, the Contractor shall be responsible for the repairs at its expense.

The exact location of all existing underground service utilities, whether or not indicated on the plans, shall be determined by the Contractor at no expense to the City, and he shall conduct his work so as to prevent interruption of service or damage to them.

The Contractor shall protect existing utility services and be responsible for their replacement if damaged by him, or to make necessary adjustment in their location, if required, in order to complete the work for his Contract.

Utility companies and other interested parties have been provided with construction plans and the

construction schedule for this project. The Contractor shall comply with MAG Specifications 105.6 to cooperate with the utility companies.

19. MAINTENANCE OF IRRIGATION FACILITIES: Where irrigation facilities interfere with construction, the Contractor shall remove and replace the affected irrigation facilities to its original condition. Final acceptance of replaced facilities will depend upon final approval of the Engineer.

20. OVERHEAD UTILITY LINES AND POLES: Contractor is advised that when work around overhead lines and poles is required on a project the Contractor is required to coordinate with Utility Companies who own and operate overhead lines and poles. The coordination may include, but not be limited to the following activities: pole bracing, de-energizing of lines, and temporary relocations. Contractor is responsible to contact the applicable Utility Company representative and discuss his proposed construction methods; in order to determine what actions the Utility Company must take and the costs related to those actions. The Contractor shall include these costs in the applicable bid items for this project.

The primary and the backup representatives for this review and cost determinations are as follows:

Arizona Public Service:	Mr. Bobby Garza	602-371-7989
Qwest:	Mr. Ron Floyd	602-630-1932
Salt River Project:	Mr. Tim Rinn	602-236-8694
Salt River Project:	Ms. Mariann Ward	602-236-6389
Cox Communications:	Mr. Ron Pint	623-328-3529
Cox Communications:	Ms. Linda Facio	623-328-3500

21. SOUTHWEST GAS FACILITIES EXPOSED DURING CONSTRUCTION: The Contractor, upon exposing a gas line during construction, shall call SOUTHWEST GAS at 602-271-4277. The Southwest Gas patrolman will respond, usually within an hour, to inspect the line. Minor cuts or abrasions to the pipe coating will be rewrapped and tracer wire will be reconnected at no cost to the City.

22. UNDERGROUND UTILITIES' BEDDING: All water, sewer, storm drain, irrigation and other conduits installed within the City of Glendale shall be bedded from bottom of excavation to one foot above the pipe with granular bedding material meeting the requirements of Section 601.4.6 of MAG Uniform Standard Specifications. The initial bedding under the pipe shall follow City of Glendale Detail G-690.

23. SEWER SERVICE LINES: The Contractor shall be responsible for locating, and protecting from damage during construction, all sewer service lines within the project which are not owned by the City. Contractor will be permitted to review the "as-builts" to assist Contractor in locating the non-City owned sewer service lines. These "as-builts" were prepared, and supplied to the City, by private developers or contractors who installed the non-City owned sewer service lines. Therefore, the City does not guarantee or warranty the accuracy of such "as-builts" and the contractor, as a condition for being allowed to review such "as-builts", hereby agrees to hold the City harmless for any and all damages or other expenses contractor may incur as a result of any inaccuracies or incorrect information in these "as-builts".

24. RIGHTS-OF-WAY: The City will provide rights-of-way and easements for all work specified in this Contract, and the Contractor shall not enter or occupy with man, tools, equipment or materials any private ground outside the property of the City of Glendale, Maricopa County, Arizona, without the consent of the property owner.

25. SUBCONTRACTS: Subcontracts shall be in accordance with, and the Contractor shall be bound by, the following provisions:

All subcontracts shall be subject to the approval of the City.

All subcontracts shall be in writing and shall provide that all work to be performed thereunder shall be performed in accordance with the terms of the Contract.

Certified copies of any and all subcontracts shall be furnished to the City Engineering Department; however, prices may be omitted.

Subcontracts shall conform to the regulations governing employment of labor.

The subcontracting of any part of the work will in no way relieve the Contractor of his responsibility under the Contract.

26. PRE-CONSTRUCTION CONFERENCE: After completion of the Contract Documents, to include bonds, insurance and signatures, and prior to the commencement of any work on the project, the Engineer will schedule a Pre-Construction Conference. This will be held at the City of Glendale, 5850 West Glendale Avenue, Glendale, Arizona.

The purpose of this Conference is to establish a working relationship between the Contractor, Utility Companies, and the Engineer. The agenda will include critical elements of the construction schedule, procedures for handling shop drawings and other submittals, cost breakdown of major lump sum items, payment application and processing, coordination with the involved utility companies, emergency telephone numbers for all representatives involved in the course of construction, and establishment of the Notice to Proceed date.

Minimum attendance by the Contractor shall be a responsible official of the company/corporation, who is authorized to execute and sign documents on behalf of the company/corporation.

27. OVERTIME:

Regular Work Hours: The work required to be performed by the Plans and Specifications for the Project shall be performed only during regular working hours, unless the City has authorized overtime work in accordance with the procedures set forth below. Regular working hours shall be defined as one 8-1/2 hour shift per day, Monday through Friday, or, upon prior approval of the City, one 10-1/2 hour shift per day on a compressed four day work week during Monday through Friday. Regular working hours shall not include Saturdays, Sundays or City recognized legal holidays.

Authorization and Costs: If the Contractor desires to schedule work for times other than regular work hours (overtime), the Contractor shall make a written request to the City at least two business days prior to the scheduled overtime. The City reserves the right to deny the request to work overtime based on the best interest and needs of the City. If an overtime request is denied, the City may, at its sole discretion, extend the contract time at no additional costs to the City.

In the event the Contractor does perform work overtime, with or without the prior approval of the City, the Contractor shall be responsible to the City for all additional costs that may be incurred by the City as a result of the Contractor's overtime work, including costs for engineering, inspections, testing, surveying and construction administration, all in accordance with MAG Section 108.5. However, the Contractor shall not be responsible for City's costs incurred as a result of overtime work requested by the City or overtime work resulting from an emergency which is not the responsibility of the Contractor or its employees, subcontractors or suppliers. The City's cost will be billed directly to the Contractor or may, at the City's option, be deducted from monies due the Contractor.

28. CONTRACTOR'S CONSTRUCTION SCHEDULE: Concurrently, with the execution of the contract and prior to the pre construction conference, the Contractor shall submit a preliminary schedule for the Engineer's review and acceptance. The schedule shall be in sufficient detail to allow the Engineer to determine if the proposed schedule will conform to an acceptable program of construction operations, as determined by the contracting agency. Within ten calendar days after the preliminary schedule, described above, has been accepted by the Engineer, the Contractor shall submit a progress schedule, utilizing the critical path method scheduling technique, showing the order in which he proposes to carry out the work, the dates on which he will start each phase of the work, and the contemplated date for completion of each phase. The Contractor shall not be permitted to commence construction until the schedule complying with this paragraph has been submitted to the

City. The Contractor will not be granted any extension to the contract time or compensation for any damages as a result of the City's refusal to allow Contractor to commence construction until the critical path method progress schedule has been submitted and accepted by the Engineer.

The critical path method (CPM) scheduling technique requires a breakdown of the entire work into individual tasks and an analysis of the number of days required to perform each task. The schedule submitted to the City should highlight and identify the critical path for the project. After the work is in progress, the Contractor shall submit supplementary progress schedules, using the critical path method technique, of the progress to date and projection for completion. The supplementary progress schedules shall be submitted with each pay request in accordance with the paragraph, "Payments to Contractors," of these Supplemental General Conditions. The progress schedules shall be subject to the acceptance of the Engineer. In the event the Contractor fails to submit a supplementary progress schedule acceptable to the Engineer, the City may withhold further progress payments to the Contractor until the Contractor submits an acceptable supplementary progress schedule, which is accepted by the Engineer, to the City. Schedule changes requiring an increase in the City's engineering personnel on the project shall not be put into effect until the Engineer has approved such increase and made arrangements for the required additional personnel.

29. CHARACTER OF WORKMEN: None but skilled foremen and workmen shall be employed on work requiring special qualifications. When required by the Engineer, the Contractor shall discharge any person who is, in the opinion of the Engineer, disorderly, dangerous, insubordinate, incompetent, or otherwise objectionable. The Contractor shall keep the City harmless from damages or claims for compensation that may occur in the enforcement of this section of the specifications.

30. HINDRANCES AND DELAYS: Except as otherwise provided herein, no charge shall be made by the Contractor for hindrances or delays from any cause during the progress of the work embraced in this Contract; but such delays, if due to no fault or neglect of the Contractor, shall entitle the Contractor to an extension of time allowed for completing the work, sufficient to compensate for the delay, the amount of the delay to be determined by the Engineer, provided the Contractor shall give said Engineer immediate notice in writing of the cause of such delay.

30.1 Delay: In the event of a delay for which the City is solely responsible, which is unreasonable under the circumstances and which was not within the contemplation of City and Contractor at the time this Contract is executed, City and Contractor shall negotiate, in good faith, a payment by the City to Contractor for the expenses incurred by Contractor as a result of such delay, in accordance with the City of Glendale Engineering Department's POLICY STATEMENT FOR CALCULATING DELAYS AND DAMAGES. This provision shall not be construed to void any provision in the contract which requires notice of delay or provides for liquidated damages. However, if the delay is the result of any act or neglect of a third party, including the architect, engineer or other contractor employed by the City, or by labor disputes, fire, unusual delay in transportation, adverse weather conditions not reasonably foreseeable, unavoidable casualties, or any causes beyond the Contractor's control, the Contractor shall not be entitled to any payments or compensation for expenses incurred as a result of such delay, but the Contract Time shall be extended by Change Order for such reasonable time as the Engineer may determine. No extension or compensation will be granted for any delay which is the result, wholly or partially, of any act or neglect of Contractor or any Subcontractor hired by Contractor.

31. LIQUIDATED DAMAGES:

31.1 Should the contractor fail to substantially complete the work under this contract within the time for completion stated in the paragraph "Time of Completion," in the Information for Bidders, then the contractor shall pay the City of Glendale, Arizona, liquidated damages, pursuant to the provisions of Section 108.9, Standard Specifications for Public Works Construction, Maricopa Association of Governments, until the work is substantially complete.

31.2 Should the contractor fail to fully and finally complete the work under this contract within the time for completion set forth in the paragraph "Time of Completion," in the Information for Bidders, even though the contractor has achieved substantial completion of the work within such time, then the

contractor shall pay the City of Glendale, liquidated damages (pursuant to the provisions of Section 108.9, Standard Specifications for Public Works Construction, Maricopa Association of Governments), in an amount equal to 100% of the applicable liquidated damage rate set forth in MAG Section 108.9 for each and every calendar day of delay until the work is fully and finally complete and accepted.

31.3 The date of substantial completion shall be the date when the work is sufficiently complete, in accordance with the contract documents, so the owner can fully occupy and utilize the work or designated portion thereof for the use for which it is intended, with all the project's parts and systems operable as required by the contract documents and all the work is complete, accessible, operable, and usable by the owner for its intended purpose(s), and all parts, systems and sitework are 100% complete and cleaned for the owner's use. Only incidental corrective work and final cleaning (if required), beyond cleaning needed for the owner's full use, may remain for final completion.

31.4 Full and final completion shall be that date when all work under the project, including incidental corrective work under punch list and final cleaning, has been completed and the entire project is accepted by the owner.

32. PAYMENTS TO CONTRACTOR: The measurements of quantities and the payments to the Contractor shall be in accordance with MAG Uniform Standard Specifications for Public Works Construction, Part 100 - General Conditions, Section 109 - Measurements and Payments.

Payments will be made on the basis of itemized, monthly statements prepared by the City and signed by the Contractor. The Contractor shall submit an itemized, duly certified and approved estimate for work completed through the last day of the preceding month in accordance with MAG Specifications, as amended by these Supplemental General Conditions. Upon approval of the pay estimate, the City will mail the check directly to the Contractor.

The pay estimate shall be accompanied by an updated progress schedule as required by these Supplemental General Conditions and a cash flow report when required by the Special Provisions. Approval of progress payments shall be conditional upon submittal of progress schedules and cash flow reports, when required, which are acceptable to the Engineer.

Upon 100% completion and acceptance of the project, and with the request for final payment, the Contractor shall complete and submit the "Contractor's Affidavit Regarding Settlement of Claims" form which is included in these specifications. Before final payment and release of retention, Contractor must arrange for its Surety to provide the City with a fully executed AIA Consent of Surety form. To avoid delays in the final payment, the Surety may send the Consent of Surety directly to the City via fax at (623) 915-2861, and mail the original to the City of Glendale Engineering Department, 5850 West Glendale Avenue, Glendale, Arizona 85301. Should any ambiguity arise between the Contract and these Conditions, the provisions of the Contract shall prevail.

33. WARRANTY: This project shall have a 2 year warranty. The warranty period shall begin upon final acceptance of the work by the City of Glendale.

END OF SUPPLEMENTAL GENERAL CONDITIONS

SPECIAL PROVISIONS

1. SCOPE OF WORK: Furnish and install two (2) new air-cooled CRAC units to replace the two (2) existing air-cooled CRAC units that serve the second floor data room of the Public Safety Building as per design drawings and specifications. The new outdoor air cooled condensing unit shall be mounted on the roof above the data room.

2. DEFINITIONS:

A. Section: Reference to a Section on the plans or in these Specifications shall mean a Section of the Uniform Standard Specifications for Public Works Construction, sponsored and distributed by Maricopa Association of Governments (MAG), latest revision. The provisions of MAG Uniform Standard Specifications and Details for Public Works Construction, which are not altered or modified by the drawings or by these Special Provisions or by any subsequently issued Addendum, shall apply to the contract even though the Contractor's attention is not specifically drawn to such provisions.

B. Standard Detail: Reference to a MAG Standard Detail (MAG S.D.) on the plans or in these specifications shall mean a standard detail drawing in the latest revision of the Uniform Standard Specifications for Public Works Construction, sponsored and distributed by Maricopa Association of Governments. City of Glendale Standard Detail (C.O.G. S.D.) shall mean a standard detail drawing in the City of Glendale's Engineering Design and Construction Standards, latest revision. City of Phoenix Standard Detail (C.O.P. S.D.) shall mean a standard detail drawing in the Phoenix Supplemental Standard Details for Public Works Construction, latest revision.

3. SUSPENSION OF WORK: The Engineer reserves the right to suspend the work wholly or in part if deemed necessary for the best interest of the City. This suspension will be without compensation to the Contractor, other than to adjust the contract time in accordance with MAG Section 108.

4. COMPLIANCE WITH MANUFACTURER'S INSTRUCTIONS: In all instances wherein the item and/or specifications require installation or construction in accordance with either manufacturer's or supplier's recommendations and/or instructions, said recommendations and/or instructions shall be submitted with the applicable portions clearly marked for approval prior to the commencement of work on that item or portion of the contract.

5. ENERGIZED AERIAL ELECTRICAL POWER LINES: The utility company maintains energized aerial electrical power lines in the immediate vicinity of this project. Do not consider these lines to be insulated. Construction personnel working in proximity to these lines are exposed to an extreme hazard from electrical shock. Contractors, their employees, and all other construction personnel working on this project must be warned of the danger and instructed to take adequate protective measures, including maintaining a minimum ten (10) feet clearance between the lines and all construction equipment and personnel. (See: OSHA Standard 1926.550(a)15.) As an additional safety precaution, Contractors should also be instructed to call the utility company to arrange, if possible, to have these lines de-energized or relocated when the work reaches their immediate vicinity. The cost of such temporary arrangements would be borne by the Contractor. The utility company can often respond to such requests if two days advance notice is given, but some situations may require up to sixty (60) days lead time for relocation or other arrangements.

6. RECORD DRAWINGS: The Contractor shall maintain one set of contract drawings with all changes, deviations, additions and deletions clearly marked thereon. Upon completion of the work, this set of drawings, shall be marked "RECORD DRAWINGS," dated, and delivered to the Engineer prior to approval of the Contractor's final payment request.

7. CASH FLOW REPORT: The Contractor shall prepare a Cash Flow Report for projected monthly project cash flow on a City provided form and submit it for approval prior to issuance of the Notice to Proceed. The accumulation of monthly pay estimate costs shall be plotted versus time in accordance with the proposed construction schedule. After approval, the Contractor shall submit an updated Cash Flow Report prior to the receipt of each Progress Payment. Each updated Cash Flow Report shall reflect the Contractor's actual monthly payment versus the actual elapsed contract time.

At the City's request, if the projected quarterly project cash flow varies by more than ten percent of the total contract price, the Contractor shall prepare a revised Cash Flow Report. Each revised Cash Flow Report is subject to approval by the City prior to issuance of the progress payment.

Revisions to the report resulting from Contractor initiated delays or work schedule changes shall be at no cost to the City. Any revisions required by City initiated delays or changes to the work shall be paid as an integral part of the approved Change Order.

8. ALLOWANCE FOR CONSTRUCTION CONTINGENCIES: Bid schedule includes a lump sum contingency allowance. This allowance is at all times the property of the City and is for the sole purpose of reimbursing Contractor for any unforeseen work not apparent at the time of bidding or additional work requested by the CITY OF GLENDALE.

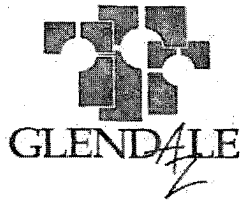
No work anticipated for reimbursement under this Bid Item shall be initiated by Contractor until Contractor, City of Glendale Representative and City of Glendale agree on the scope and cost to perform the additional work. The Contractor shall prepare and submit to City of Glendale Representative a cost itemization and summary for the additional work. City of Glendale Representative and City of Glendale shall review and approve prior to Contractor proceeding with any additional work. Any portion of the stated sum not expended remains the property of the City of Glendale.

Work under this section shall consist of any additional work identified by the owner and contractor due to construction activity. All work under this item shall be itemized as per MAG requirements and deducted from the set amount of $40,000.00. All work under this section shall include but is not limited to all necessary materials, tools, layout, survey and labor required to complete each task.

Measurement and payment for this item shall be made on an individual basis per task and as described above. Limit for this item is set at $40,000.00 on the bid form, under line item ALLOWANCE FOR CONSTRUCTION CONTINGENCY.

END OF SPECIAL PROVISIONS

Project Life Cycle
Cash Flow Schedule



Project No.: 0 Date:

Project Name: 0

Company Name: 0

Project Start Date: 0 Project Completion Date

Original ☐ Updated ☐ Revised ☐

		Estimated		Actual	
Qtr.	Fiscal Yr.	Amount	Accum.	Amount	Accum.
1st	07/13 - 09/13	$ -	$ -		
2nd	10/13 - 12/13	$ -			
3rd	01/14- 03-14	$ -			
4th	04/14 - 06/14				
1st	07/14 - 09/14				
2nd	10/14- 12/14				
3rd	01/15- 03/15				
4th	04/15- 06/15				
1st	07/15 - 09/15	$ -	$ -	$ -	$ -
2nd	10/15 - 12/15	$ -	$ -		
3rd	01/16 - 03/16	$ -	$ -		
4th	04/16 - 06/16	$ -	$ -		
1st	07/16 - 09/16	$ -	$ -	$ -	$ -
2nd	10/16 - 12/16				
3rd	01/17- 03/17				
4th	04/17 06/17				
1st	07/17 - 09/17				
2nd	10/17 - 12/17				
3rd	01/18- 03/18	$ -	$ -	$ -	$ -
4th	04/18- 06/18				
	Totals	$ -		$ -	$ -

* COG's fiscal year is July 1, (current year) through June 30, (following year)

For Engineering Use Only:

Account No: _____ PO No. _____

Construction

9. Special operating instructions and procedures. Including precautions against improper use.
10. Operating logs.

I. Wiring Diagrams: Diagram of factory installed wiring including any options as well as any field modifications.

J. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

K. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

L. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

M. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

N. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

O. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

P. Licenses: Include copies of any licenses with requirements including inspection and renewal dates.

Q. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1.12 WORK AND MATERIALS

A. Unless otherwise specified, all materials must be new and of the quality specified. The workmanship shall be of a quality that is acceptable to the Engineer, and Owner, and is equal to the standards of the trades. Contractor must staff the project with sufficient skilled workmen, including a fully qualified construction superintendent, to complete the work in the time allotted. The superintendent must be qualified to supervise all of the work in his work category.

B. Uniformity: Unless otherwise specified, provide all equipment and products of same type or classification by the same manufacturer.

1.13 APPROVALS OF MATERIALS AND EQUIPMENT

A. Refer to Division 01 for description of material and equipment for prior approvals and substitutions.

1.14 COOPERATIVE WORK

A. Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration. See Division 01 for additional requirements.

B. Cooperative Work Includes:

1. General supervision and responsibility for proper location, rough-in, and size of work related to Division 26 but provided under other divisions of these specifications.
2. Installation of sleeves, inserts and anchors bolts for work under sections in Division 26.

1.15 EXISTING MATERIALS AND EQUIPMENT

A. Disposition: With the exception of items that are to be reused or retained by the Owner, all other materials indicated to be removed shall be removed and disposed of by the Contractor. Items that are indicated to be retained or returned to the Owner and shall be delivered to a storage area designated by the Owner.

B. Unused Materials: All unused raceways, conductors, boxes, equipment, and miscellaneous materials shall be removed by the Contractor except where located within walls, below or above existing construction which is not being altered and would require removal and replacement of this existing construction. All visible raceways, conductors, boxes, equipment, and miscellaneous materials shall be removed and sealed or capped within wall, below floor unless noted otherwise.

C. Exterior Services: The Contractor shall be responsible for maintaining electrical and control service to the existing building during the construction period. Existing services are to be retained until such a time that the new services, if any, are completely installed and ready for use. Scheduling of service interruptions is to be coordinated with the Engineer and Owner.

D. Disconnect, demolish, and remove electrical systems, equipment, and components that are indicated to be removed.

1. Conduit to be Removed: Remove portion of conduit indicated to be removed and cap or plug remaining conduit with same or compatible conduit material. Patch insulation, as required, to match adjacent areas.
2. Conduit to be Abandoned In Place: Cap or plug conduit with same or compatible conduit material.
3. Equipment to be Removed: Disconnect services and remove equipment.
4. Equipment to be Removed and Reinstalled: Disconnect and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to be Removed and Salvaged: Disconnect and remove equipment and deliver to Owner.

E. Continuity of Services in Existing Building: Contractor shall permanently reroute existing electrical and control services or provide temporary connection as required to maintain service to existing fixtures in building which are to remain in service.

F. Rerouting and Relocation of Existing Electrical Equipment and Services in Existing Building:

1. General: Contractor shall reroute, relocate all existing materials which are in conflict with the building alterations and which are required to be maintained in use.
2. Existing Raceways and Conductors: Where applicable, existing material may be reused in their original location unless otherwise indicated.

G. Testing: All existing services affected by the new construction and which are to remain in operation shall be returned to their original condition. The existing services shall be tested as new, as described in other sections of these specifications. If for any reason these requirements cannot be met, the Contractor shall immediately notify the Owner or Engineer.

1.16 CONSTRUCTION FACILITIES

A. General: Under this division of the specifications, execute all work in a manner to provide safe and lawful ingress and egress to the Owner's establishment and such facilities shall be kept clear of materials or equipment. Refer to Division 01 for additional requirements.

B. Furnish and maintain from the beginning to the completion of all work all lawful and necessary guards, railings, fences, canopies, lights, and warning signs. Take all necessary precautions required by city and state laws to avoid injury or damage to any and all persons and property.

1.17 GUARANTEE

A. Guarantee all material, equipment, installation and workmanship for all sections under Division 26 in writing to be free from defects of material and workmanship for two years from date of final acceptance as outlined in Division 01. Equipment warranties shall be a minimum of two years from date of substantial completion or as specified elsewhere. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of the equipment under all conditions of load, installing any additional items of control and/or protective devices as required.

1.18 ELECTRICAL WIRING

A. Provide all line voltage power wiring, line voltage interlock wiring, and line voltage control wiring for the equipment that is to be provided under Divisions 21, 22 & 23 unless wiring is specifically shown on electrical drawings.

B. The following schedule is intended to summarize the division of work material responsibilities between the Mechanical Contractor, Controls Contractor and the Electrical Contractor.

Item	Furn. By	Set By	Power Wiring	Control Wiring
Equipment Motors	MC	MC	EC	--
Motor Control Center	EC	EC	EC	CC
Motor Starters, Controllers, Contactors and Overload Heaters	MC*	EC**	EC	CC
Fused and Non-Fused Disconnect Switches	EC	EC	EC	--
Manual Operating Switches, Multispeed Switches, Pushbutton Stations and Pilot Lights	CC	CC	CC	CC
Control Relays and Transformers	CC	CC	CC	CC
Line Voltage Thermostats and Time Switches***	MC	MC	EC	EC
Low Voltage Thermostats	MC	MC	-	MC
Temperature Control Panels	MC	MC	EC	CC
Smoke Detectors (Duct Mounted)	EC	MC	EC	MC or CC
Motor and Solenoid Valves, Damper Motors, PE and EP Switches	CC	MC	CC	CC
Water Treatment Equipment	MC	MC	EC	CC

Item	Furn. By	Set By	Power Wiring	Control Wiring

MC = Mechanical Contractor
CC = Controls Contractor
EC = Electrical Contractor

*Except where such devices are located in MCC's.

**Unless required by these specifications to be provided as part of a factory furnished assembly (i.e., fan coils, air handlers, chillers, etc.).

***Motor-drive units which are controlled from line voltage automatic controls such as line voltage thermostats, float switches or time switches which conduct full load current of the motor shall be wired for both power and control circuit under the electrical contract.

PART 2 PRODUCTS

2.1 CONCRETE

A. Where used for structures to be provided under the contract such as bases, etc., concrete work and associated reinforcing shall be as specified under that Division.

B. See other sections for additional requirements for underground vaults, cable ducts, etc.

2.2 FRAMING CHANNEL

A. The framing channel shall be a cold-rolled, high-quality, carbon steel channel with factory-applied, hot-dipped-after-fabrication finish. Utilize factory-built interconnecting components, mounting straps, connectors, etc., designed for use with the framing channel supplied. Channel nuts shall be spring type and shall utilize standard US threads. Provide heavy zinc paint for field touch-up. B-Line "B" series, Unistrut "P" series, or as accepted by the Owner or Engineer.

2.3 ANCHORS

A. Anchors shall be expandable lead type, as manufactured by Ackerman-Johnson, Pierce, Diamond, Hilti, or as accepted by the Owner or Engineer.

B. Adjustable concrete hanger inserts shall be as manufactured by Grinnell or as accepted by the Owner or Engineer.

PART 3 EXECUTION

3.1 SUBMITTALS

A. Prepare submittals as directed for review by the Contractor, Owner, and Engineer.

B. Adjust quantities below to suit project. Quantities indicated are sufficient for most projects.

C. Submit six copies of paper submittals unless directed otherwise.

D. Submit one copy of PDF submittals via email, project website or other electronic media.

3.2 RECORD DRAWINGS

A. Recording: Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

3.3 OPERATION AND MAINTENANCE MANUALS

A. Prepare Operation and Maintenance Manuals as directed for review by the Contractor, Owner, and Engineer.

B. Make corrections and resubmit as required.

3.4 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are diagrammatic and many offsets, bends, special fittings and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact locations, routes, building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

3.5 CUTTING AND PATCHING

A. Cut work and patch per Division 01 as necessary to properly install the new work. As the work progresses, coordinate necessary openings, holes, chases, etc., in their correct location. If the required openings, holes and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Owner or Engineer. Include as a part of the work all structural framing required

by penetrations through the roof and necessary steel to support ducts and pipes between structural steel unless shown on the structural drawings.

3.6 CLOSING-IN OF UNFINISHED WORK

A. Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

3.7 ACCESSIBILITY

A. Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement conveniently and accessibly throughout the finished building. Where any of these devices are shown on the contract drawings to be installed above any inaccessible ceiling or behind any inaccessible wall, the Electrical Contractor shall furnish access doors or panels as required.

B. All access doors or panels in walls and ceilings required for access to control devices, traps, valves and similar devices are to be furnished and installed as part of the work under this section. Provide type as specified under Division 08.

C. Coordinate work of various sections to locate valves, traps, and dampers with others to avoid unnecessary duplication of access doors.

D. The Contractor, along with the Owner's representative, shall complete the Electrical Accessibility/Clearance Checklist at the end of this section for all electrical equipment. The chart shall be submitted to the Owner or Engineer for approval prior to substantial completion. All conflicts shall be resolved to the Engineer's and Owner's satisfaction prior to submission.

E. Provide doors that pierce a fire separation with the same fire rating as the separation.

3.8 ROOF FLASHINGS

A. Flash and counterflash all conduit penetrating roofing membrane with flashing per roofing manufacturer's recommendations.

3.9 PRODUCT AND EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. All equipment, detectors, etc., shall be installed in strict conformance with the manufacturer's recommendations and all codes.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install electrical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

E. Do not install any equipment in an application not recommended by the manufacturer.

3.10 EQUIPMENT ROUGH-IN

A. Rough in all equipment and fixtures as designated on the drawings and in the specifications. The drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large-scale certified drawings. The Contractor shall obtain all certified rough-in information before progressing with any work for rough-in final connections.

B. Be responsible for providing all outlets and services of proper size at the required locations.

C. Minor changes in the contract drawings shall be anticipated and provided for under this Division.

1. Rough-in only (unless otherwise designated on the drawings) shall include providing all services as indicated and required, including all conduit and conductors. Cap all conduit stub-outs. Cap all conduits stub-outs in a manner suitable for future extension.

3.11 EQUIPMENT FINAL CONNECTIONS

A. Provide all final connections for the following:

1. All equipment furnished under this Division.
2. Electrical equipment furnished under other sections of the specifications (except as otherwise designated).
3. Owner-furnished equipment as shown on the drawings.

3.12 OWNER-FURNISHED AND OTHER EQUIPMENT

A. Rough-in only for all Owner-furnished equipment reference Division 01 and all equipment furnished under other sections of the specifications, except as otherwise specified and/or noted on the drawings.

3.13 WIRING OF EQUIPMENT FURNISHED UNDER OTHER SECTIONS

A. All electrical wiring including power wiring and control wiring (except as specified in Divisions 21, 22 & 23), including all raceways, wiring, outlet and junction boxes, and labor for installation of the wiring and equipment, shall be included in this section of the specifications.

B. Wiring diagrams, complete with all connection details, shall be furnished under each respective section.

C. Provide all connections as described per Divisions 21, 22 & 23.

3.14 EQUIPMENT SUPPORTS

A. Erection of Metal Supports and Anchorages:

1. Refer to Division 05 for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment. Neatly fabricate and erect steel work with burrs and welding spatter ground off. Paint after fabrication with a rust-inhibitive primer.
3. Field Welding: Comply with AWS D1.1.

B. Erection of Wood Supports and Anchorages:

1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support and anchor electrical materials and equipment.
2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

C. Concrete Inserts: Furnish and install all concrete inserts required for all materials and equipment specified and/or shown on the drawings for Division 26.

3.15 CLEANUP

A. In addition to cleanup specified under Division 01, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any splattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

B. During the progress of the work, keep the premises clean and free of debris.

3.16 PAINTING

A. Except as otherwise specified or indicated, paint all exposed unfinished metal with one coat of rust-inhibiting primer. Galvanized ductwork and factory painted equipment shall be considered as having primed surface.

B. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Finished painting is specified under Division 09.

3.17 OBJECTIONABLE NOISE AND VIBRATION

A. Construct and brace the metal partitions, ducts and sheet metal housings to prevent vibration or rattling when systems are in operation. Install connections to

equipment so noise and vibration will not reach the conditioned area through ducts, conduit, sheet metal work, or the building structure.

3.18 TESTING

A. Upon completion of the electrical work, the entire installation shall be tested and demonstrated to be operating satisfactorily. Tests and documentation shall be in accordance with NETA Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems.

B. Tests, calibrations, and settings shall include the following:

1. Wiring shall be tested for continuity, short circuits and/or accidental grounds. All systems shall be entirely free from grounds, short circuits, and any or all defects.
2. Motors shall be operating in proper rotation and control devices shall be functioning properly. Check all motor controllers to determine that properly sized overload devices are installed. Check all electrical equipment for proper operation.
3. Insulation resistance test for all switchboard buses, bus ducts, motor and feeder conductors, including neutrals, using a megohmeter. Apply to each conductor and maintain for 15 seconds or until reading stabilizes. Minimum value for each conductor shall be 20 megohms at 30 deg C. This test shall be performed by an independent testing company.
4. Test, calibrate, and set all relays, circuit breaker trip devices, and ground fault protection trip units after receipt of engineered settings. Circuit breaker setups shall be performed or witnessed by a qualified representative of the circuit breaker manufacturer. This representative shall be identified by name and initial related test report(s).
5. Additional equipment-specific testing is described in the equipment's respective section of this Division.

C. Furnish a written report of testing to the Owner or Engineer. At a minimum, the report shall include:

1. Testing Contractor's letterhead.
2. Testing technician's name and signature.
3. Date and time that test was performed.
4. Ambient temperature and weather conditions.
5. Test equipment manufacturer, model number, and last calibration date.
6. The manufacturer, model number, and, as applicable, trip unit model number and available adjustments of tested equipment.
7. Statement of "As Left" conditions.
8. Pass/Fail statement relative to NETA Chapter 10 recommendations.
9. Recommendations if any.

D. The Contractor shall submit the testing schedule to the Owner or Engineertwo weeks prior to initiation of testing activity.

E. Upon placing an order for equipment, but in no case less than two weeks prior to energization, provide the following to the Owner or Engineer:

1. List of circuit breakers supplied on the project. The list shall include manufacturer and model number, trip unit model number, frame rating, trip plug rating, available adjustments, and proposed circuit breaker trip settings. Categorize the submission by plan electrical equipment name (switchboard, panelboard, MCC, etc.), then by frame ampere rating. The Contractor shall implement settings.
2. List of ground fault protection trip units supplied on the project. The list shall include manufacturer and model number, trip unit model number, and available adjustments. Categorize the submission by plan electrical equipment name (switchboard, panelboard, MCC), then by frame ampere rating.

F. Ground fault protection (GFP) trip units shall be calibrated and tested prior to energizing any equipment served by GFP devices.

G. The Contractor shall furnish the necessary instruments and labor required for testing, calibration, and implementation of engineered settings.

H. Tests and adjustments shall be made prior to acceptance of the electrical installation by the Owner or Engineer, and a certificate of inspection and acceptance of the electrical installation shall be provided by local inspection authorities.

I. Any equipment or wiring provided, which through testing proves to be defective or operating improperly, shall be corrected or replaced promptly, at no additional cost to the Owner.

END OF SECTION

ELECTRICAL ACCESSIBILITY / CLEARANCE CHECKLIST
(See Paragraph 3.8.E)

Bldg. Name	Equipment Name	Room No.	Acceptable Access		Conflict	Date	Action	Observer	
			Yes	No				Owner	Contractor

SECTION 26 05 01

SCOPE OF WORK

PART 1 GENERAL

1.1 SUMMARY

A. The work under this Division includes furnishing all labor, material and equipment necessary for the installation and placing into operation of the electrical systems as indicated on the drawings.

B. The work shall also include the completion of such minor details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems described on the drawings or required by these specifications.

1.2 SCOPE

A. The work includes, but is not necessarily limited to, furnishing and installing the following:

1. Complete power and lighting systems, branch circuit panelboards, switches, feeders, branch circuits, controls and accessories.
2. Motor and power wiring for all motors and/or equipment furnished under the contract. Except as otherwise specified to be furnished by or under other Divisions of these specifications, all wiring devices, starter wiring, conduit, feeders, control wiring, accessories and final connections to all equipment shall be furnished under this section.
3. Install controls for all equipment except as specified under automatic temperature control system.
4. All equipment and materials specified in this Division.
5. Empty conduit systems as indicated on the drawings.
6. All other items and/or work indicated on the drawings.
7. Equipment lists and maintenance manuals.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 26 05 02

TEMPORARY & REMODELING WORK

PART 1 GENERAL

1.1 SUMMARY

A. Perform all temporary and remodeling work as shown on the drawings and described in the specifications including minor items of material or equipment necessary to meet the requirements and intent of the project.

B. All temporary and remodeling work shall be considered a part of this contract and no extra charges will be allowed.

C. Examine architectural, structural and mechanical drawings and specifications to determine the sequence of construction throughout the project, including existing, temporary, remodeled and new areas.

D. Where drawings indicate existing conditions, an attempt has been made to show electrical equipment, buildings, site details, etc., but accuracy cannot be guaranteed. Verify exact location of all conduits, outlets, etc. and all building and site details.

E. Branch circuits shall be reused where practical and shall, in addition, be revised as required. Conceal all work where possible. Where exposed work is required in finished areas, use Wiremold or similar raceway system components as approved by the Engineer.

F. Existing electrical wiring intended to remain in use but which will be disturbed due to construction changes required by this contract shall be restored to operating condition, as required and/or directed. Where required, shown and/or directed, outlets and conduit runs shall be relocated. In some cases it may be necessary to extend conduits and pull in new wiring or install junction boxes and splice in new wiring, or replace old wiring with new.

G. Outlets from which switches, receptacles, and/or other electrical devices are removed and are not intended to be reused shall be removed or, if it is not possible to remove, place a blank cover on the outlet box. Where outlets, boxes, etc., are completely removed, the Contractor shall cut off conduits and remove wiring.

H. Where conduits extending through floors are to be abandoned, the Contractor shall cut and cap or plug conduit, so that it will not protrude above the floor.

I. Where existing conduit is to be abandoned, the conduit shall be removed if it is exposed, in a crawl space or in an accessible ceiling. Where it is impossible to remove the conduit, it shall be cut off and capped or plugged.

J. The Contractor shall be held fully responsible for the proper restoration of all existing surfaces requiring patching, plastering, painting and/or other repair due to the installation of electrical work under the terms of this specification. Close all openings, repair all surfaces, etc., as required.

K. The Contractor shall employ qualified and experienced workmen for this work. All restoration work shall be subject to the approval of the Architect and/or the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install wire and cable for branch circuits and feeders as specified herein and as shown on the drawings.

PART 2 PRODUCTS

2.1 WIRE AND CABLE

A. All wire and cable shall be new, 600-volt insulated copper, of types specified below for different applications. All wire and cable shall bear the UL label and shall be brought to the project in unbroken packages. Wire and cable #4 AWG size and smaller shall be type THHN or THWN. Wire and cable larger than #4 AWG size and air conditioning feeders shall be type XHHW-2.

B. Wire Pulling Lubricant: Richards "Gel Lube 7/5"; American Polywater A, C, G&J; Quelcor "Quelube"; American Colloid "Slip X-300"; Thomas/Jet Line "Slipry Loob"; Ideal "Wire Lube"; Mac "Wirepull"; Minerallac "Wire-Wax"; or Electro "Y-er Eas."

C. Mineral insulated cable shall be AmerCable, M.I. Cable Company (MICC), or as accepted.

D. Armor-clad (AC) cable shall not be permitted to be used in this project.

E. Fire Rated Cable Assemblies shall be Draka Cableteq "Lifeline RHW" 600-volt copper, or as accepted.

2.2 TERMINATIONS, SPLICES, AND JOINTS

A. Terminations at Circuit Breakers and Switches:

1. #10 and #8 AWG wire, locking tongue lug, Buchanan "Termend," or as accepted.
2. #6 AWG and larger wire, round flange solderless lug, Burndy "Quick-Lug" type QDA, or as accepted.

B. Fixture Connections: Pressure-type solderless connectors, Buchanan, Scotchlok, Wing Nut, or accepted equal.

C. Motor Connections: Solderless lug with RayChem GelCap, or as accepted.

D. Wire Splices:

1. Joints in Wire:

   a. #8 AWG and smaller wire, pressure-type solderless connectors, Buchanan, Scotchlok, Wing Nut, or as accepted.
   b. #6 AWG and larger wire, irreversible compression type, Burndy, Ilsco, or as accepted.

2. Wire Taps: Solderless lug, solderless compression lug, each with Raychem Gtap, Ilsco GTA, or GTT with insulating cover, or as accepted.
3. Exterior Below Grade Joints in Wire (Specific, case by case approval by the Engineer is required): Solderless lug, solderless compression lug, each with Raychem GelCap or as accepted.

2.3 APPLIED INSULATION

A. Insulating materials shall be listed for the application. Voltage rating shall be equal to or greater than the factory-applied wire insulation. Raychem, 3M, Ilsco, or as accepted.

2.4 MARKERS AND TAGS

A. Plastic Wire Markers: T&B or Brady.

PART 3 EXECUTION

3.1 INSTALLATION

A. Conductors for branch circuit lighting, receptacle, power and miscellaneous systems must be a minimum of #12 AWG. Wire indicated to be larger than #12 AWG shall be increased the entire length of the circuit.

B. Provide dedicated neutral conductors for all multiwire branch circuits except where the branch circuit supplies only one piece of utilization equipment.

C. Wire and cable shall be pulled into conduits without strain, using an approved lubricant.

D. In no case shall wire be re-pulled if same has been pulled out of a conduit run for any purpose.

E. No conductors shall be pulled into conduit until conduit system is complete, including junction boxes, pull boxes, etc. Wire sized #14 through #10 AWG shall be solid; wire sized #8 AWG and larger shall be stranded.

F. All connections to circuit breakers, switches, fixtures, motors, and all joints in wires shall be made as noted below:

1. Terminations at Circuit Breakers and Switches:

   a. #12 AWG wire formed around binding post or screw.

b. #10 and #8 AWG wire, locking tongue lug.
c. #6 AWG and larger wire, round flange, solderless lug.

2. Fixture Connections: Circuit wiring connections to fixture wire shall be made with pressure-type solderless connectors.
3. Motor Connections: Solderless lug.
4. Joints in Wire:

   a. #8 AWG and smaller wire, pressure-type solderless connectors.
   b. #6 AWG and larger wire, irreversible compression type.

5. Wire Taps: Solderless lug, solderless compression lug.
6. Exterior Below Grade Joints in Wire (Specific, case by case approval by the Engineer is required): Solderless lug, solderless compression lug.
7. Solderless connectors not used for grounding shall be insulated. Applied wire insulation voltage rating shall be equal to or greater than the factory-applied wire insulation. Insulate by [one of] the following methods:

   a. One or more layers of rubber tape, equal in thickness to the conductor insulation, followed by two layers of electrical vinyl tape.
   b. Pre-manufactured insulating caps.
   c. Heat shrink insulating sleeve or tape. Shrink in accordance with the manufacturer's recommendations.

G. Wire compression type sleeves or lugs shall be installed with the manufacturer's recommended tool, in accordance with their published instructions.

3.2 COLOR CODING AND MARKING

A. All wiring throughout shall be color-coded as follows:

	480 Volt System	208 Volt System
A Phase	Brown	Black
B Phase	Orange	Red
C Phase	Yellow	Blue
Neutral*	Grey	White
Ground	Green	Green

*Where multiple neutrals are installed within the same raceway, each individual neutral shall be distinctly identified by one or more color stripes.

B. All control wiring in a circuit shall be color-coded, each phase leg having a separate color, and with all segments of the control circuit, whether in apparatus or conduit, utilizing the same color-coding.

C. Wiring must be color-coded throughout its entire length, except that feeders may have color-coded plastic tape at both ends and all accessible points.

D. At all terminations of control wiring, the wiring shall have a numbered wire marker.

3.3 FIRE RATED CABLE ASSEMBLIES

A. Fire rated cable assemblies shall be permitted where fire rated cable assemblies are specifically allowed by the NEC. Coordinate use with project Fire/Life Safety Analysis Documents. Provide copy of listing requirements to local AHJ for inspection during construction. Install according to the listing requirements.

3.4 GENERAL WIRING

A. Drawings, in general, indicate location of items of equipment. Exact locations of motors and other devices are to be determined in the field by the Contractor. Provide an electrical feed for all equipment, not smaller than shown or NEC size where size is omitted from drawings, together with a suitable circuit protective device. Verify panel schedules and layout, maintaining number of spare branches indicated.

B. Feeder conductors to distribution equipment shall be adjusted to limit voltage drop. Contractor shall review the anticipated installed length and confirm the selected feeder provides not more than 2% voltage reduction. Base calculations on 80% of the supplied equipment bus rating or the actual load whichever is greater.

C. Conductors for branch circuit receptacle, power, and miscellaneous systems shall be as stated in this section. Wire indicated specifically to be larger than the specified minimum shall be increased for the entire length of the circuit.

D. Conductor sizes for lighting, receptacles, and small motor branch circuits with less than a 20-ampere connected load are not shown. Conductors for such circuits are sized as follows:

1. For Branch Circuits (120V) 65 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 12. (16 amps)
2. For Branch Circuits (120V) up to 110 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 10. (16 amps)
3. For Branch Circuits (120V) up to 165 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 8. (16 amps)
4. For Branch Circuits (120V) up to 255 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 6. (16 amps)
5. For Branch Circuits (208V) 110 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 12. (16 amps)
6. For Branch Circuits (208V) up to 185 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 10. (16 amps)
7. For Branch Circuits (208V) up to 280 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 8. (16 amps)
8. For Branch Circuits (208V) up to 440 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 6. (16 amps)
9. For Branch Circuits (277V) 150 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 12. (16 amps)
10. For Branch Circuits (277V) up to 250 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 10. (16 amps)

11. For Branch Circuits (277V) up to 380 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 8. (16 amps)
12. For Branch Circuits (277V) up to 590 Feet in Length from Branch Circuit Panel to Center of Load: Not smaller than No. 6. (16 amps)

END OF SECTION

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SECTION 26 05 26

GROUNDING & BONDING OF ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install grounding and grounding conductors as specified herein and as shown on the drawings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GROUNDING

A. All panelboard cabinets, equipment, enclosures, and conduit systems shall be grounded securely in accordance with pertinent sections of the NEC, as amended by any local codes. Conductors shall be copper. All electrically operated equipment shall be bonded to the grounded conduit system. All non-current carrying conductive surfaces that are likely to become energized and subject to personal contact shall be grounded by one or more of the methods detailed in the NEC. All ground connections shall have clean contact surfaces. Install all grounding conductors in conduit and make connections readily accessible for inspection. Furnish and install grounding electrodes as described on the drawings.

B. Grounding of metal raceways shall be assured by means of grounding bushings on feeder conduit terminations at the service entrance, distribution switchboards and panelboards, and by means of a continuous, stranded, copper grounding wire extended from the ground bus in the enclosure to the conduit grounding bushings.

C. A separate insulated grounding conductor, sized per the NEC, shall be installed in all electrical metallic tubing (EMT).

END OF SECTION

SECTION 26 05 33

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install conduit and fittings as shown on the drawings and as specified herein.

1.2 COORDINATION

A. It shall be the responsibility of the Contractor to consult the other trades before installing conduit and boxes. Any conflict between the location of conduit and boxes, piping, ductwork, or structural steel supports shall be adjusted before installation. In general, large pipe mains, waste, drain, and steam lines which pitch, large air ducts, and all structural steel shall be given priority.

B. Conduit size shall be such that the required number and sizes of wires can be easily pulled in and the Contractor shall be responsible for the selection of the conduit sizes. Conduit sizes shown on the drawings are minimum sizes in accordance with appropriate tables in the NEC. If, because of bends or elbows, a larger conduit size is required, the Contractor shall so furnish without further cost to the Owner.

C. The Contractor shall be entirely responsible for the proper protection of this work from the other trades on the project. When conduit becomes bent, holes are punched through same, or outlets are moved after being roughed-in, the Contractor shall replace same, without additional cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. Conduit sizes for various numbers and sizes of wire shall be as required by the NEC Chapter 9, but shall not be smaller than 1/2" size except as otherwise noted.

B. Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the UL label.

C. All concrete inserts and pipe clamps shall be galvanized. All steel bolts, nuts, washers, and screw shall be galvanized or cadmium plated. Individual hangers, trapeze hangers, and rods shall be prime-coated.

D. Calibrated pull string/measuring tape shall be Greenlee Part No. 435, or as accepted.

2.2 CONDUIT

A. Rigid galvanized steel (RGS), intermediate metallic conduit (IMC), and electrical metallic tubing (EMT) shall be Allied Tube & Conduit, Republic Conduit, Western Tube & Conduit Corp., or as accepted.

B. PVC coated RGS or IMC shall be Robroy Industries Inc., or as accepted.

C. Polyvinyl chloride (PVC) conduit shall be Carlon, Cantex, or as accepted.

D. Liquid-tight flexible metallic conduit shall be Anaconda Sealtite Type UA, or as accepted.

E. Conduit systems shall be color coded. Reference Section 26 05 53 Identification for Electrical Systems for additional requirements.

2.3 FITTINGS

A. Couplings and connectors for RGS or IMC conduit shall be steel or malleable iron, threaded, and rain- and concrete-tight. Couplings and connectors that are exposed, installed in hollow construction, or above ceilings shall be threaded, unicouple or compression type. Steel set-screw type or compression-type, steel, watertight fittings shall be used for EMT. Die-cast or pressure-cast EMT fittings shall not be allowed.

B. Bushings and locknuts shall be malleable iron with sharp, clean-cut threads.

C. Fittings shall be Appleton, Crouse-Hinds, Steel City, T & B, or as accepted.

D. Expansion joint fittings on RGS or IMC conduit shall be Crouse-Hinds type XJ, or as accepted. Expansion joint fittings on PVC conduit shall be Carlon type E945, or as accepted.

E. Entrance seals shall be O.Z. type FSK, or as accepted.

F. Explosion-proof seals shall be listed for 40% fill application, vertical and horizontal, and shall be Appleton type EY, or as accepted.

G. Couplings and connectors for PVC conduit shall be of the same manufacturer as the conduit to be coupled or connected. Fittings shall be provided in accordance with the manufacturer's recommendations.

2.4 BOXES

A. All boxes must conform to the provisions of Article 314 of the NEC. All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Boxes shall not be less than 4" square and 1-1/2" deep unless otherwise noted.

B. Generally, boxes shall be hot-dipped galvanized steel with knockouts. Where recessed, boxes shall have square cut corners. Outlet, switch, and gang size junction boxes on exterior surfaces or in damp locations shall be corrosion-resistant, cast malleable iron. Boxes shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Boxes shall be Appleton type FS or FD, Crouse-Hinds, or as accepted. Conduit bodies shall be corrosion-resistant, cast malleable iron and shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Bodies shall be Appleton Unilets, Crouse-Hinds, or as accepted.

C. Deep boxes shall be used in walls covered by wainscot acoustical wall panels or paneling and in walls of glazed tile, brick, or other masonry which will not be covered with plaster. The bottom of the box shall be located on the horizontal joint. Through-the-wall type boxes shall not be used unless specifically called for. All boxes shall be non-gangable. Boxes in concrete shall be of a type to allow the placing of conduit without displacing the reinforcing bars. All lighting fixture outlet boxes shall be equipped with the proper fittings to support and attach a light fixture.

D. All light switch, receptacle, and similar outlets shall be provided with approved boxes, suitable for their function. Back boxes shall be furnished and installed as required for the equipment and/or systems under this contract.

E. Pull and junction boxes shall be substantially-made code-gauge boxes with screw covers. Boxes shall be rigid under torsional and deflecting forces and shall be provided with angle-iron framing where required. Boxes shall be 4" square with a blank cover in unfinished areas and with a plaster ring and blank cover in finished areas, and shall be installed where required to pull cable or wire, but only in finished areas by approval of the Architect. Boxes shall be rigidly attached to the structure, independent of any conduit support. Boxes shall have their covers accessible. Covers shall be fastened to boxes with machine screws to ensure continuous contact all around. Covers for surface-mounted boxes shall line up evenly with the edges of boxes. Covers for flush-mounted oversize boxes shall extend 3/4" past the box all around. Covers for 4" square and 4" ganged boxes shall extend 1/4" past the box all around.

F. Outlets are only approximately located on the plans and great care must be used in the actual location of outlets by consulting the various detailed drawings. Outlets shall be flush with finished wall or ceiling. Trim, cases, or other fixtures shall have their boxes installed symmetrically on such trim or fixture. Refer to drawings for location and orientation of all outlet boxes.

G. Furnish and install all plaster rings as may be required. Plaster rings shall be installed on all boxes where the boxes are recessed. Plaster rings shall be of a depth to reach the finished surface. Extension rings, where required, shall be installed so that the plaster ring is flush with the finished surface.

H. Exterior gang type boxes shall be cast type. Where any box occurs within 12" of the earth, provide cast iron type.

I. Boxes with unused punched-out openings shall have the openings filled with factory-made knockout seals.

J. Construct pull boxes and rack space for future conduits equal to 25% of present runs. Provide required barriers. Attach a plastic label to each pull box cover listing the feeder numbers enclosed within and the source of current. Identify each conduit at pull box termination with voltage and feeder number in red. Provide sufficient cable slack at terminations and in junction and pull boxes to allow for cable contraction and for future splicing. Fireproof cable in pull boxes where more than one feeder is enclosed.

K. Boxes shall be as manufactured by Steel City, Appleton, Raco, or as accepted.

PART 3 EXECUTION

3.1 CONDUIT

A. Applications:

1. PVC conduit may be used for all exterior underground systems, in slab, below slab on grade, and in concrete or masonry walls. All plastic conduit shall be rigid, Schedule 40, heavy wall PVC. All PVC conduit shall be UL listed. Install bell ends at all conduit terminations in manholes and pull boxes. All bends over 30 degrees shall be made with wrapped intermediate metallic conduit. All plastic conduit, except that used for telephone, shall contain a code-sized bond wire.
2. Intermediate metallic conduit (IMC) shall be used for all conduit larger than 2", and for all underground or in-slab conduit, except where PVC is permitted or where rigid galvanized steel is specified. IMC conduit shall be used in explosion-proof areas.
3. Rigid galvanized steel (RGS) conduit shall be used in place of IMC or where it is specified on plans.
4. PVC-coated rigid galvanized steel (PVC-RGS) conduit shall be used in corrosive areas where exposed to physical damage, or where specified on the plans.
5. Liquid-tight flexible metallic conduit, in lengths not exceeding 4 feet, shall be used to connect motors and transformers. Installation shall be such that considerable slack is realized. The conduit shall contain a separate grounding conductor. Connectors shall be steel or malleable iron.
6. Galvanized steel, flexible metallic conduit, in lengths not exceeding 6 feet, shall be used to connect fire alarm and wiring devices mounted in movable panels such as acoustical ceiling tiles, etc. Installation shall be such that considerable slack is realized. The conduit shall contain a separate grounding conductor. Connectors shall be steel or malleable iron.
7. All other conduit shall be electrical metallic tubing (EMT). A separate insulated grounding conductor, sized per the NEC, shall be installed in EMT.

B. Conduit shall be continuous from outlet to outlet, cabinet or junction box, and shall be so arranged that wire may be pulled in with the minimum practical number of junction boxes.

C. All conduit shall be concealed wherever possible. All conduit runs may be exposed in mechanical equipment rooms, electrical equipment rooms, and electrical closets, and where indicated on the drawings. No conduit shall be run exposed in finished areas without specific acceptance by the Architect.

D. Exposed conduit shall be run in straight lines at right angles to or parallel with walls, beams, or columns. In no case shall conduit be supported or fastened to other pipes or installed to prevent the ready removal of other pipe.

E. Where possible, all conduit for wiring within stud or moveable partitions shall enter the partition from above.

F. Provide sleeves and chases where conduit passes through floors or walls as part of the work of this section. Core drilling will only be permitted where accepted by the Architect.

G. Conduit stubbed up/down or through floor slabs shall be wrapped RGS or wrapped IMC with a minimum of 6" of conduit exposed out of slab for connection of threaded or compression fitting. Where conduit bends extend out of slab, the conduit shall be placed at the maximum allowable distance from the exit surface and shall have a bend radius as allowed by code to provide as true and square a conduit exit as possible. Conduit deck flanges will be used where conditions allow and where the flange can be tightly secured flush to the face of a concrete form.

H. Openings through fire-rated floors and fire walls through which conduit passes shall be sealed by fire stop material to seal off cold smoke and toxic fumes. Fire-seal material shall have an hourly fire rating equal to or higher than the fire rating of the floor or wall through which the cable or conduit passes. Material used shall conform to the Authority Having Jurisdiction requirements. Openings through smoke walls through which cable or conduit passes shall be sealed with non-shrink, non-combustible material approved by the Authority Having Jurisdiction to seal off cold smoke and toxic fumes.

I. Conduit above lay-in grid-type ceilings shall be installed in such a manner that it does not interfere with the "lift-out" feature of the ceiling system.

J. Conduit runs shall be installed to maintain the following minimum spacing wherever practical:

1. Water and Waste Piping: Not less than 3".
2. Steam and Condensate Lines: Not less than 12".
3. Radiation and Reheat Lines: Not less than 6".

K. Provide corrosion protection for metallic conduit under concrete or in earth. Provide half-lap wrap of polyethylene 20-mil tape, factory PVC coating, or as

accepted. Where PVC coating is provided, joints must be sealed in accordance with the coating manufacturer's published instructions.

L. PVC-coated rigid galvanized steel (PVC-RGS) joints must be sealed in accordance with the coating manufacturer's published instructions.

M. Empty conduit shall be provided with a nylon pull string installed in each.

N. Bending: Changes in direction shall be made by bends in the conduit wherever possible, and these bends shall be made smooth and even without flattening the pipe or flaking the finish. Bends shall be of as long a radius as possible, but in no case less than shown in the NEC.

O. Not more than four 90 degree bends will be allowed in one raceway run. Where more bends are necessary, a pull box shall be installed. All bends in 1" and smaller conduit shall be made with a conduit bender, and all larger conduit sizes shall have machine bends.

P. Plastic conduit joints shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling selected. Conduit joint couplings shall be made watertight. Plastic conduit joints shall be made up by brushing a plastic solvent cement on the inside of a plastic coupling fitting and on the outside of the conduit ends. The conduit and fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Transition from plastic to steel conduit shall be with PVC female threaded adaptors.

Q. Plastic conduit shall be stored on a flat surface and protected from the direct rays of the sun.

R. The ends of all conduit shall be securely plugged, and all boxes temporarily covered to prevent foreign material from entering the conduit. All conduit shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place.

3.2 FITTINGS

A. Bushings and Locknuts: Where conduit enters boxes, panels, cabinets, etc., it shall be rigidly clamped to the box by locknuts on the outside and inside, and a bushing on the inside of the box. All conduit shall enter the box squarely.

B. Provide insulated bushings per the NEC on all conduit. The use of insulated bushings does not exclude the use of double locknuts to fasten conduit to the box.

C. Provide expansion fittings for all conduit where it crosses building expansion joints, or not to exceed 100 feet apart. Fittings shall be complete with bonding jumpers and clamps and shall be suitably bonded to conduit.

D. Provide weatherproof fittings in exterior installations or as noted on the plans.

3.3 SUPPORTS

A. All raceways that are not buried or embedded in concrete shall be supported by straps, clamps, or hangers to provide a rigid installation.

B. Conduit shall be supported at intervals no greater than 8 feet, within 3 feet of any bend, and within 3 feet of every outlet, junction box, panel, etc. This shall apply to vertical runs as well as horizontal runs. Where conduit is run individually, it shall be supported by approved conduit straps or beam clamps. Straps shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. No perforated straps or wire hangers of any kind will be permitted. Where individual conduits are suspended from the ceiling, or above ceiling, they shall be supported by hanger rods and hangers. Conduit installed exposed in damp locations shall be provided with clamp backs under each conduit clamp, to prevent accumulation of moisture around the conduit. Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers. Hanger rods shall be fastened to structural steel members with suitable beam clamps or to concrete inserts set through the opening provided in the concrete inserts. Beams clamps shall be suitable for structural members and conditions. Rods shall be galvanized steel, 3/8" diameter minimum. Each conduit shall be clamped to the trapeze hanger with conduit clamps.

3.4 GENERAL

A. Install all boxes parallel and perpendicular to the finished floor. Adjust all flush mounting positions so as to compensate for wall material thickness. Where devices occur in the same horizontal viewing plane, align devices.

B. Where outlet boxes occur on opposite sides of a common wall, do not place back-to-back or use through-the-wall boxes, so as to limit sound transmission between rooms.

C. Where fire-rated walls occur, all membrane penetrations shall comply with the International Building Code (IBC) for walls/partitions, and for floor-ceilings/roof-ceilings. Outlet boxes in rated walls shall be steel. Outlet boxes on opposite sides of a rated wall shall be separated by a minimum of 24 inches horizontally.

D. Support all boxes independently of conduit, except cast type which may be supported by rigid steel conduit only. Secure flush-mount boxes to wall and interior partition studs using stamped steel bridges as required to accurately position boxes. Secure ceiling-hung boxes to adjustable steel channel fasteners.

E. All cabinets and boxes shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard precast inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. All wall- and ceiling-mounted outlet boxes shall be supported by bar supports extending from the studs or channels on either side of

the box. Boxes mounted on drywall or plaster shall be secured to wall studs or adequate internal structure.

F. Boxes with unused punched-out openings shall have the openings filled with factory-made knockout seals.

G. Where emergency power and normal power are located in the same outlet box or a potential of 480 volts is present in a switch box, install partition barriers to separate the various systems.

3.5 SEPARATE CONDUIT SYSTEMS

A. Each system shall be contained in a separate conduit system. This includes each power system, lighting system, signal system of whatever nature, telephone, emergency system, emergency subsystems, sound system, control system, fire alarm system, etc.

B. Each item of building equipment shall have its own run of power wiring. Control wiring may be included in properly sized conduit for equipment feeders of #6 AWG and smaller, but separate conduits shall be used for larger size feeders.

END OF SECTION

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 use by label printers, shall comply with UL 969.

PART 2 PRODUCTS

2.1 FACTORY RACEWAY SYSTEM 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 of Raceways Carrying Circuits at 600 V or Less:

1. Conduit shall be factory anodized in color as stated below. Where conduit system is painted, all junction boxes shall be required to be painted to match system color. On junction boxes that are larger than 16" square, only the cover of the box need be painted.

System	Conduit Color
General Power	No color (galvanized)
Emergency Power System	Orange
Fire Alarm System	Red
HVAC Controls	Blue

2. Conduits for future use shall be "No color" except where the future system is identified.

C. Write-On Tags for Empty Conduit Stubs: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black or white (as appropriate based on background color), by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for 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.

C. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Snap-Around Labels: Slit, pre-tensioned, flexible, pre-printed, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid colored acrylic sleeve 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

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: Pre-printed, flexible label laminated with a clear, weather and chemical resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 FLOOR MARKING TAPE

A. 2 inch (50 mm) wide, 5 mil (0.125 mm) pressure sensitive vinyl tape, with black and yellow stripes and clear vinyl overlay.

2.5 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.
2. Punched or drilled for mechanical fasteners, minimum one per corner.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Minimum letter height shall be 3/8 inch (10 mm). Punched or drilled for mechanical fasteners, two minimum.

B. First line of text shall include the equipment name assigned on the floor plans. Second line of text is equipment specific.

1. Switchboards, panelboards, motor control centers, and disconnects shall include ampere rating, voltage, phase, 3 or 4 wire, and upstream source "fed from (name as appropriate)".
2. Wireways shall include ampere upstream source "fed from (name as appropriate)".
3. Fire alarm panels and relay panels, fire alarm terminal cabinets shall include name of general area served; Classroom Bldg. B, 1st Floor, 2nd Floor West, etc.

4. Special system control cabinets shall include name of general area served; Classroom Bldg. B, 1st Floor, 2nd Floor West, etc.
5. Special system racks do not require a second line.

C. Colors:

1.	Normal Power:	White letters on black background
2.	Life Safety Power:	White letters on red face
3.	Critical:	White letters on orange face
4.	Equipment Power:	White letters on yellow face
5.	Fire Alarm:	Red letters on white face

2.7 DEVICE CIRCUIT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed by thermal transfer or equivalent process. Minimum letter height shall be 1/4 inch (6 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Text Colors:

1. Black text for normal power systems.
2. Red for emergency or essential power systems.

2.8 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, stainless-steel machine screws with nuts and flat and lock washers, or stainless steel rivets.

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. For instance, vertically mounted boxes or equipment, labels shall read horizontally.

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 shall be attached with mechanical fasteners appropriate to the location and substrate.

E. Write-On tags shall be used for temporary identification of conductor and cable only. Each tag shall be changed to a permanent solution prior to project close out.

F. 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.

G. 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 or concrete envelope exceeds 16 inches (400 mm) overall.

H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

I. 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.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with design plans wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to switchboards panelboards, motor control centers, lighting controls panels, relay panels, transformers, disconnects, wireways, generators, transfer switches, UPS's, fire alarm panels, fire alarm power booster panels, fire alarm terminal cabinets, special system control cabinets and racks.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 3/8-inch (10-mm) high letters on 1-inch (25-mm) high label; where two lines of text are required, use labels 1-1/2 inches (38 mm) high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 3/8-inch (10-mm) high letters on 1-inch (25-mm) high label; where two lines of text are required, use labels 1-1/2 inches (38 mm) high.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

3.2 IDENTIFICATION SCHEDULE

A. Equipment Identification: Identify each piece of electrical equipment as described in this section.

B. Accessible raceways shall be continuously color coded per the Schedule in Part 2 of this specification.

C. Junction boxes recessed in walls or ceilings shall be color coded on the interior to match the raceway system color code.

D. 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 match the raceway color-coding descriptions and shall have dark text over light box color, light text over dark box color.

E. 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 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.

F. Device Circuit Identification: Circuits supplying devices shall be identified on the device trim plate.

G. Conductors to be Extended in the Future: Attach marker tape to conductors and list source.

H. 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 & Maintenance Manual.

I. 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. Outline NEC horizontal workspace requirements per NEC 110.26 Table for the applicable condition. Workspace width shall be the length of electrical equipment or 30" centered on equipment, whichever is greater.

END OF SECTION

ON

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install all wiring devices as shown on the drawings and as herein specified.

B. Manufacturer:

1. Unless otherwise noted, device and plate numbers shown are Hubbell and shall be considered the minimum standard acceptable.
2. Other acceptable manufacturers are Bryant, Leviton, and P&S.

PART 2 PRODUCTS

2.1 MATERIALS

A. Receptacles:

1. All convenience receptacles and special outlets throughout shall be grounding type.
2. Generally, convenience receptacles shall be specification grade, back- or side-wired, parallel slot, two-pole, three-wire, 20-amp as follows:

Single	5361
Duplex	5362
Ground Fault Circuit Interrupters	GFR5362

3. If receptacles of higher ampere ratings are required, they shall be of similar type and quality to those shown above.
4. Receptacle color shall be selected by the Architect.
5. Receptacles shall be located at 18" centerline above finish floor, except where otherwise indicated.
6. Receptacles on emergency power shall be red; receptacles on normal power shall be selected by the Architect. Nylon plates shall match.
7. Special receptacles shall be as noted on the drawings. Furnish caps for all special outlets.
8. SNAPConnect type device connections are acceptable.

B. Spring-Wound Timers:

1. Spring-wound time switches shall be of the quiet mechanical type, specification grade, 20 amperes, 250 volt AC, DPDT, 12-hour duration (unless noted otherwise on the drawings), without Hold feature. Intermatic FF Series, or Paragon SWPD Series.
2. Where noted as weatherproof (WP), provide "weatherproof while in use" cover consisting of cast aluminum material, NEMA 3R rated. Intermatic #WP1010MC or as accepted.

C. Cover Plates:

1. Provide wall plates for all wiring devices and outlet boxes, including special outlets, etc., as required. All cover plates shall be appropriate for type of device.
2. All plates throughout shall be specification grade nylon, color to match wiring devices.
3. Where weatherproof covers are required by the Authority Having Jurisdiction, provide Taymac MX Series, deep metal enclosure and cover appropriate for the device indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Verify location and mounting height of all receptacles and other equipment before roughing in. See drawings for pertinent information. Refer questionable cases to the Owner.

END OF SECTION

SECTION 26 28 13

OVERCURRENT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install fuses and circuit breakers as specified herein and as indicated on the drawings.

B. Acceptable fuse manufacturers are Bussmann, LittelFuse, and Ferraz.

C. Circuit breakers shall be manufactured by the same manufacturer as the equipment within which they are installed.

D. Submittals: Submit short circuit interrupting data for all overcurrent devices. Include UL series combination rating data, where applicable, with equipment submittals. Clearly indicate each rating and/or combination being utilized.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Provide termination lug quantities to accommodate conductor sizes and quantities shown on the drawings. Increase circuit breaker frame sizes as required.

B. Fuses:

1. Fuses protecting motor branch circuits shall be UL Class RK-5, time-delay, 600- or 250-volt, 200,000 amperes RMS symmetrical interrupting rating, sized at 125% of motor nameplate full load amperes (Bussmann FRS-R or FRN-R).
2. Fuses shall be applied considering upstream devices, in accordance with their UL series combination ratings. All applications of fuses shall be on a single fuse per phase leg basis.
3. Furnish and deliver spare fuses to the Owner as follows:
    a. Three spares for each type and size, in excess of 60 amperes, used for initial fusing.
    b. Ten percent or minimum of three spares for each type and size, up to and including 60 amperes, used for initial fusing.
4. Provide a NEMA -12 spare fuse cabinet with appropriate shelving, and size as required to accommodate spare fuses supplied. Hoffman, Hammond, or as accepted. Provide 1" x 4", laminated, black text on white micarta nameplate with script "SPARE FUSES."

PART 3 EXECUTION

3.1 INSTALLATION

A. Fuses:

1. Install fuses in such a manner as to expose manufacturer's label indicating model number and ratings.
2. Legibly write the design fuse type on the inside of the switch cover with an indelible ink marker.
3. Coordinate installation location of the spare fuse cabinet with the Owner, and install prior to Project Closeout.

3.2 OVERCURRENT SIZE VERIFICATION

A. Confirm maximum overcurrent protective device (MOCP) ratings with mechanical accepted shop drawings for equipment supplied PRIOR TO ORDERING. The Contractor shall adjust the supply circuit breaker and/or fuse ratings to match accepted shop drawing MOCP data per the NEC.

B. Where equipment includes an adjustable speed drive, upstream overcurrent device and feeder size shall be adjusted to match the rated input current to the accepted drive furnished. In no case shall the overcurrent setting be less than 125% of the nameplate load. Refer to the NEC and Division 23 for requirements. Confirm accepted adjustable speed drives to be supplied PRIOR TO ORDERING related overcurrent device(s) and installing underground conduit.

C. Prior to project completion, the Contractor shall verify that MOCP ratings match nameplate data for installed equipment. Correct MOCP device sizes as required by the NEC.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES & CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install all safety switches and enclosed circuit breakers as shown on the drawings and as required by the NEC.

PART 2 PRODUCTS

2.1 GENERAL

A. Basis of Design: Drawings are based on Square D. Subject to compliance with requirements, provide the basis of design product or comparable product acceptable to the Owner by one of the following:

1. Eaton
2. General Electric
3. Siemens
4. Square D

B. Switches and circuit breakers shall be mounted in a sheet metal enclosure with externally operable pad-lockable handles. Device mounting shall include an interlocking cover and suitable internal supporting members in the rear of the cabinet. Provide enclosure with an ANSI 61 finish, surface mount, except where shown recessed on the drawings. NEMA-1 for indoor applications, unless noted otherwise. All enclosures outside the building shall have a minimum of NEMA-3R ratings, unless noted otherwise

2.2 SAFETY SWITCHES

A. All switches shall be heavy-duty type, externally operated with interlocking cover, quick-make, quick-break, rated 240 or 600 volts, as applicable, with the number of poles and ampacity as noted. All switches for motors shall be horsepower rated. All switches outside the building shall have NEMA-3R enclosures. Generally, switches shall be fused, except where noted to be non-fused (NF) on the drawings. Fusible switches shall be capable of accepting Class R rejection fuses, but shall be set up for the fuse class indicated on the drawings.

B. Disconnect Switches for Fractional Horsepower, 120 Volt, Single-Phase Motors:

1. With Built-In Thermal Overload Protection: Single-pole, manual motor starter with pilot light unless noted otherwise. Starter ampere rating shall match branch circuit breaker.
2. Without Built-In Thermal Overload Protection: Single-pole, manual motor starter with thermal overload protection and pilot light, unless noted

otherwise. Starter ampere rating shall match branch circuit breaker. Overload elements shall be sized per motor manufacturer's recommendations and NEC Article 430.32. Maximum ambient temperatures shall be considered when sizing overload elements.

C. Disconnect switches for fractional horsepower motors larger than 1/2 horsepower, for integral horsepower motors, and for equipment of similar capacity shall be provided per Paragraph 2.1.A.

D. Disconnect switches for small 120V equipment 12 amps or less, shall be specification grade, single-pole, 15-amp toggle switch with pilot light.

E. Where a local disconnect switch for an item of equipment is remotely located on the load side of a variable frequency drive (VFD), provide the disconnect switch with a factory-installed electrical interlock kit. The interlock kit contact shall be wired into the VFD shutdown control to prevent damage to the VFD in the event of operation of the switch while equipment is under load. The interlock kit shall be field adjusted to insure the interlock contact operates before switch blades open.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Provisions of Specification Section 26 28 13 shall apply.

B. Circuit Breakers: Circuit breakers shall be molded-case, trip-free, quick-make, quick-break, thermal-magnetic type, with handles clearly indicating rating and position - ON, OFF or TRIPPED. Where series combinations are noted to be applied on the plans, UL series combination ratings shall be maintained with upstream overcurrent device(s).

PART 3 EXECUTION

3.1 EQUIPMENT SIZE VERIFICATION

A. Confirm disconnect ratings with mechanical shop drawings for equipment supplied PRIOR TO ORDERING. The Contractor shall adjust minimum sizes provided based on nameplate data per NEC 430 and 440.

3.2 INSTALLATION

A. Install switches at locations indicated on the drawings, using approved fastening methods, and maintaining proper working clearances working clearances per NEC 110.26 and mounting parameters per NEC 404.

B. Where it is not possible to install switches on a wall, structure or item of equipment, provide rigid, freestanding supports of galvanized angle or channel. Supports shall be primed and painted.

C. Circuit Breakers: Set adjustable circuit breakers per the engineered coordination settings. Reference Section 26 05 00.

3.3 OVERCURRENT SIZE VERIFICATION

A. Confirm maximum overcurrent protective device (MOCP) ratings with accepted mechanical shop drawings for equipment supplied PRIOR TO ORDERING. The Contractor shall adjust the supply circuit breaker and/or fuse ratings to match accepted shop drawing MOCP data per NEC 430, 440, and 695.

B. Where equipment includes an adjustable speed drive, upstream overcurrent device and feeder size shall be adjusted to match the rated input current to the accepted drive furnished. In no case shall the overcurrent setting be less than 125% of the nameplate load. Refer to the NEC and Division 23 for requirements. Confirm accepted adjustable speed drives to be supplied PRIOR TO ORDERING related overcurrent device(s) and installing underground conduit.

C. Prior to project completion, the Contractor shall verify that MOCP ratings match nameplate data for installed equipment. Correct MOCP device sizes as required by NEC 430, 440, and 695.

END OF SECTION

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2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer will return three copies.

D. Provide operating and maintenance manuals for all systems, subsystems, and equipment that requires operation and regular maintenance, or has replaceable parts.

E. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, product data, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below. In addition to requirements in this Section, include operation and maintenance data required in individual Specification Sections.

F. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

G. Product Data: Include the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Approved submittals.
3. Include the following if not shown on approved submittals:

    a. Product name and model number. Use designations for products indicated on Contract Documents.
    b. Manufacturer's name.
    c. Equipment identification with serial number of each component.
    d. Equipment function.
    e. Operating characteristics.
    f. Limiting conditions.
    g. Performance curves.
    h. Engineering data and tests.

H. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.

2. Mark the Contract Drawings, Submittals and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:

   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Engineer.
   e. Name of Contractor.

3. Remove or obscure Engineer's seal from Record Drawings.

1.11 OPERATION AND MAINTENANCE MANUAL

A. Prior to completion of the project, compile a complete equipment, operation and maintenance manual for all equipment supplied under Division 26.

B. Schedule:

1. Submit a preliminary copy of the manual not less than 30 days prior to substantial completion for review and comment.
2. Submit the final version the manual not more than four weeks after substantial completion of the project.

C. Format: Submit manuals in both of the following formats:

1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Engineer.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.
   c. Provide one final copy to Engineer and two copies to Owner.

2. Maintain a second complete set at the project location, readily accessible by both the Owner's personnel and the contractor's personnel.

1.9 REQUEST FOR INFORMATION

A. Request for Information:

1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as RFI.
2. A properly prepared request for information shall include a detailed written statement of the clarification, apparent conflict, or information requested that indicates the specific drawings or specification in need of clarification and the nature of the clarification requested.

    a. Drawings shall be identified by drawing number and location on the drawing sheet.
    b. Specifications shall be identified by section number, page, and paragraph.

3. Include a proposed solution, where appropriate, based upon the field conditions and best knowledge of the Contractor.

B. Improper or Frivolous RFIs: RFIs which are not properly prepared or that request information which is clearly shown in the contract documents will be returned unanswered. Processing time for multiple submissions of improper or frivolous RFIs will be billed at the Engineer's standard hourly rate to the Owner who may deduct an equal amount from the monies due the Contractor.

1.10 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings, Submittals and Shop Drawings.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Include underground and overhead conduit. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Include dimensions both horizontally and vertically to permanent points of reference accurate within 6 inches. Include descriptors such as "below slab", "above ceiling", etc.
    c. Record data daily or as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.

2. Assemble PDF submittals in one PDF file for each Division. Separate and order sections within each file by corresponding specification number. Provide bookmarks at the first page of each section and label each bookmark with the specification number and name to allow for easy navigation of the submittal.
3. Partial submittals will be returned without review.

E. Identification and Information:

1. Place a permanent label or insert on the cover and spine of each binder indicating the Division and binder number along with the sequential submittal number. (i.e., the first submittal shall be No. 1; the second submittal shall be No. 2.)
2. Name the PDF file with the Project name, Division number and sequential submittal number. (i.e., the first submittal shall be No. 1; the second submittal shall be No. 2.)
3. Provide a cover sheet at the front of each submittal with the following information:

    a. Project name.
    b. Date.
    c. Name of Engineer.
    d. Name of Contractor.
    e. Name of subcontractor.

4. Provide a cover sheet at the front of each submittal section with the following information:

    a. Name of supplier.
    b. Name of manufacturer.
    c. Number and title of appropriate Specification Section.
    d. Drawing number and detail references, as appropriate.
    e. Other necessary identification.

F. Options:

1. Identify options requiring selection by the Engineer.
2. Identify options included with submittal item.

G. Deviations: Identify deviations from the Contract Documents on submittals

1.8 MATERIAL SAFETY DATA SHEETS

A. Provide current, Material Safety Data Sheets (MSDS), for all hazardous chemicals that are proposed for use at the project site.

1. Provide one complete set to the Owner for review and approval a minimum of one week prior to the delivery of any hazardous chemicals to the site.

1.4 ELECTRICAL CONTRACTOR

A. The Electrical Contractor shall be licensed and hold a current contracting license that has been valid for a minimum of two years in the State of Arizona as an electrical contractor.

1.5 REGULATIONS, PERMITS, FEES, CHARGES, INSPECTIONS

A. Regulations: Comply with all applicable codes, rules and regulations.

B. Fees and Permits: Pay all connection, installation, use, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 01.

C. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Owner or Engineer with certificates of inspections and approvals by the local authorities in accordance with Division 01.

1.6 DRAWINGS AND SPECIFICATIONS

A. If a conflict exists on the drawings or between the drawings and specifications, promptly notify the Owner or Engineer.

1.7 SUBMITTALS

A. Select paper and/or PDF formats for submittals. You may also allow contractor to choose format.

B. Submittals are for information and coordination only. The Engineer will diligently review the submittals and attempt to verify compliance with the project requirements. Such review, however, does not constitute approval or disapproval of obligation to comply with all project requirements. The submittals are not to be construed to be contract documents. Any failure by the Engineer to note a point of non-compliance shall not be construed to be acceptance or approval of the discrepancy.

C. Product Information Sheets: Provide manufacturer's literature which includes the information required by the Product Data paragraph of the applicable Specification Section. Where Product Information Sheets show multiple models or options, clearly mark the model and options to be provided.

D. Assembly: Assemble all required submittal information for each specification section and submit in paper or PDF formats.

1. Assemble paper submittals in 3-ring binders, providing separate binders for each Division. Separate and order sections within each binder by corresponding specification number. Provide labeled tabs at each section with a table of contents at the front of the binder. The table of contents shall indicate the tab number and the information contained at that tab.

SECTION 26 05 00

GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

A. Provisions of this section apply to all work specified in all sections under Division 26.

B. In addition, work in Division 26 is governed by the provisions of the Bidding Requirements, Contract Forms, General Conditions, and all sections under Division 01.

1.2 DEFINITIONS

A. Exposed, not concealed.

B. Finished Spaces: Spaces other than mechanical, electrical, and communication equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and utility tunnels.

C. Exposed, Interior Installations: Exposed to view indoors. Examples include unfinished spaces, mechanical, electrical, and communication equipment rooms.

D. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations and equipment yards.

E. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. 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.

G. Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the "Finish Schedule" with exposed and unpainted construction for walls, floor or ceilings, or specifically mentioned as "unfinished."

1.3 EXAMINATION OF PREMISES

A. Visit the site, verify all measurements and job conditions, and pay all costs necessary to perform the work.

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DIVISION 26

ELECTRICAL

26 05 00 Common Work Results for Electrical
- 26 05 00 General Provisions
- 26 05 01 Scope of Work
- 26 05 02 Temporary & Remodeling Work
- 26 05 19 Low-Voltage Electrical Power Conductors & Cables
- 26 05 26 Grounding & Bonding of Electrical Equipment
- 26 05 33 Raceway & Boxes for Electrical Systems
- 26 05 53 Identification for Electrical Systems

26 27 00 Low-Voltage Distribution Equipment
- 26 27 26 Wiring Devices

26 28 00 Low-Voltage Circuit Protective Devices
- 26 28 13 Overcurrent Protection
- 26 28 16 Enclosed Switches & Circuit Breakers

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C. Computer-room air conditioners will be considered defective if they do not pass tests and inspections.

D. After startup service and performance test, change filters and flush humidifier.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain computer-room air conditioners.

END OF SECTION

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Examine walls, floors, and roofs for suitable conditions where computer-room air conditioners will be installed.

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

3.2 INSTALLATION

A. Install computer-room air conditioners level and plumb, maintaining manufacturer's recommended clearances.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Condensate Drainage Connections: Comply with applicable requirements in Division 23 Section "HVAC Drain Piping."

D. Water Connections: Comply with applicable requirements in Division 22 Section "Domestic Water Piping." Provide adequate connections for humidifier flushing system.

E. Refrigerant Piping: Comply with applicable requirements in Division 23 Section "Refrigerant Piping." Provide shutoff valves and piping.

3.4 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.

B. Tests and Inspections:

1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
2. After installing computer-room air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

m. Compressor No. 1 - High Pressure.
n. Compressor No. 2 - Overload.
o. Compressor No. 2 - Low Pressure.
p. Compressor No. 2 - High Pressure.

2. Digital Display:

a. Control power on.
b. Humidifying.
c. Dehumidifying.
d. Compressor No. 1 - Operating.
e. Compressor No. 2 - Operating.
f. Heat operating.
g. Economy cooling.

3. Push buttons shall stop and start process cooling system, silence audible alarm, test indicators, and display room's relative humidity.
4. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor and display unit status and alarms.

a. Hardwired Points:

1) Monitoring: On-off status, common trouble alarm space temperature space relative humidity.
2) Control: On-off operation, space temperature set-point adjustment space relative humidity set-point adjustment.

b. Modbus communication interface with the BAS shall enable the BAS operator to remotely monitor the unit from an operator workstation. Monitoring points displayed locally at unit control panel shall be available through the BAS.

2.3 FAN MOTORS

A. 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."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

5. Remote Air-Cooled Refrigerant Condenser: Corrosion-resistant cabinet, copper-tube aluminum-fin coils arranged for two circuits, multiple direct-drive propeller fans with permanently lubricated ball bearings, and single-phase motors with internal overload protection and integral electric control panel and disconnect switch. Control capacity by modulating fan speeds.

E. Extended-Surface, Disposable, Panel Filter: Pleated, lofted, nonwoven, reinforced cotton fabric; supported and bonded to welded-wire grid; enclosed in cardboard frame.

1. Thickness: 2 inches.
2. Arrestance (ASHRAE 52.1): 90 percent.
3. MERV (ASHRAE 52.2): 7.

F. Infrared Humidifier: High-intensity quartz lamps mounted above stainless-steel evaporator pan, serviceable without disconnecting water, drain, or electrical connections; prepiped and using condensate water from cooling coils with stainless-steel or brass float-valve mechanism; located in bypass airstream; with flush-cycle timer and solenoid drain valve. Water supply shall have a factory provided air gap.

G. Integral Electrical Controls: Unit-mounted electrical enclosure with piano-hinged door, grounding lug, combination magnetic starters with overload relays, circuit breakers and cover interlock, and fusible control-circuit transformer.

H. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.

I. Microprocessor-Control System: Continuously monitors operation of process cooling system; continuously displays room temperature and room relative humidity; sounds alarm on system malfunction and simultaneously displays problem. If more than one malfunction occurs, system displays fault in sequence with room temperature and continues to display fault when malfunction is cleared until system is reset.

1. Malfunctions:

a. Power loss.
b. Loss of airflow.
c. Clogged air filter.
d. High room temperature.
e. Low room temperature.
f. High humidity.
g. Low humidity.
h. Smoke/fire.
i. Water under floor.
j. Supply fan overload.
k. Compressor No. 1 - Overload.
l. Compressor No. 1 - Low Pressure.

PART 2 PRODUCTS

2.1 BASIS-OF-DESIGN PRODUCT

A. Subject to compliance with requirements, provide product indicated on Drawings.

2.2 FLOOR-MOUNTED UNITS 6 TONS AND LARGER

A. Description: Packaged, factory assembled, prewired, and prepiped; consisting of cabinet, fans, filters, humidifier, and controls.

B. Cabinet and Frame: Welded steel, braced for rigidity, and supporting compressors and other mechanical equipment and fittings.

1. Doors and Access Panels: Galvanized steel with polyurethane gaskets, and concealed fastening devices.
2. Insulation: Thermally and acoustically insulate cabinet interior with 1-inch-thick duct liner.
3. Finish of Exterior Surfaces: Baked-on, textured vinyl enamel; color as selected from manufacturer's standard colors.
4. Floor Stand: Welded tubular steel, high, with adjustable legs and vibration isolation pads.
5. Configuration: Downflow.

C. Supply-Air Fan(s):

1. Single-inlet, plenum type fan; statically and dynamically balanced.
2. Drive: Fan shall be direct driven by an electronically commutated, variable speed motor.

D. Refrigeration System:

1. Compressors: Semihermetic reciprocating type; with suction-gas-cooled, 1750-rpm motors; thermal overloads; oil sight glass; suction-line strainer; and reversible oil pumps; with resilient suspension system, crankcase heater, manual-reset high-pressure switch, and pump-down low-pressure switch. Provide un-loaders on each compressor.
2. Refrigeration Circuits: Two; each with hot-gas mufflers, thermal-expansion valve with external equalizer, liquid-line solenoid valve, liquid-line filter-dryer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.
3. Refrigerant: R-407C or R-410A.
4. Refrigerant Evaporator Coil: Alternate-row or split-face-circuit, direct-expansion coil of seamless copper tubes expanded into aluminum fins.
    a. Mount coil assembly over stainless-steel drain pan complying with the latest addition of ASHRAE 62.1.
    b. Provide condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir where scheduled.

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. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

1.6 COORDINATION

A. Coordinate layout and installation of computer-room air conditioners and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate installation of computer-room air conditioners with computer-room access flooring Installer.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of computer-room air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Humidifiers: Manufacturer's standard, but not less than three years from date of Substantial Completion.
3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set(s) for each belt-driven fan.
2. Filters: One set(s) of filters for each unit.

SECTION 23 81 23

COMPUTER ROOM AIR CONDITIONERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Floor-mounted computer-room air conditioners, 6 tons and larger.

1.3 DEFINITION

A. BAS: Building automation system.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's product data for each unit indicated on the drawings. Data to be specific to the equipment proposed for the project with all options and accessories indicated. Include the following as a minimum:

1. Manufacturer and model number.
2. Rated capacity based on scheduled conditions and project elevation.
3. Equipment dimensions.
4. Required clearances.
5. Electrical data.
    a. Motor horsepower
    b. Voltage/Phase/Hz
    c. Full load ampacity, minimum circuit ampacity and maximum overcurrent protection device requirements.
    d. Electrical service point(s) of connection.
    e. AIC rating of the equipment.
6. Materials of construction.
7. Accessories and options.
8. Controls.

B. Operation and Maintenance Data: For computer-room air conditioners to include in emergency, operation, and maintenance manuals.

C. Warranty: Sample of special warranty.

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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

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, 10 feet; minimum rod size, 1/2 inch.

D. 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 or as required by the Authorities Having Jurisdiction.

    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.

L. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install traps and double risers to entrain oil in vertical runs.
3. Liquid lines may be installed level.

M. When brazing, 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.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Construct joints according to AWS Brazing Handbook, Chapter 35, Pipe and Tubing.

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.

B. Flow an inert gas (nitrogen or carbon dioxide) through pipe and fittings during brazing to prevent scale formation.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Provide trapeze hangers for multiple, parallel runs.
2. Secure pipe to strut supports with pipe clamps or single-piece pipe straps
3. Provide pipe and tube isolation device at each clamp and support.

C. 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.

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.

C. 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.

D. 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.

E. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 PIPING INSTALLATION

A. Drawing plans indicate general location and arrangement of piping systems. Install piping as indicated on approved 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. Do not use 45 degree ells.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.

3. Working Pressure Rating: 400 psig.
4. Maximum Operating Temperature: 275 deg F.

2.5 HANGERS AND SUPPORTS

A. Pipe and Tubing Isolation Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. B-Line Systems.
b. Elgen.
c. Grinnell.
d. Hydra-Zorb
e. Kin-Line.
f. Michigan Hanger Co.
g. National Pipe Hanger Corp.
h. Pipe Technology and Products.
i. PHD manufacturing.
j. PHS Industries.
k. Unistrut.

2. Material: Oil, fuel, solvent, resistant thermoplastic elastomer. UL Listed for installation in return air plenums with a flame spread rating of 25 or less and a smoke development rating of 50 or less.
3. Design: Slit insert, designed for use with strut clamps to prevent metal to metal contact, reduce vibration transmission, and to securely hold pipe or tubing in position.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS

A. Above Ground Refrigerant Lines:

1. NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
2. NPS 4: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, K, or L (B) drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Except as otherwise indicated, install diaphragm packless, packed-angle, or packed ball valves on inlet and outlet side of filter dryers.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.

2.3 REFRIGERANT PIPING SPECIALTIES

A. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

B. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

C. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

2.4 ACCUMULATORS

A. Liquid Accumulators 6 Inch Diameter and Smaller: Comply with ARI 495; listed and labeled by an NRTL.

1. Body: Brazed steel with corrosion-resistant coating.
2. Connections: Socket or threaded for inlet, outlet and pressure relief valve.

5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Packed Ball Valves:

1. Body: Two-piece, forged brass.
2. Extensions: Copper tubing.
3. Bonnet: Brass.
4. Stem Seals: Neoprene.
5. Ball: Chrome-plated brass.
6. Seals: Teflon.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 300 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

E. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 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 or ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

1. Elbows shall be long radius type.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals:

1. Copper-to Copper Joints: BCuP-5 or BCuP-6 without flux.
2. Copper-to-Steel or Brass Joints: BAg-28 with non-acid flux.

E. 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 VALVES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

B. Refrigerant type shall be consistent with refrigeration equipment specified in other Sections.

C. Refrigerant piping indicated on Drawings is schematic and intended to show the routing of the piping only.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-407c:

1. Suction Lines for Air-Conditioning Applications: 185 psig.
2. Suction Lines for Heat-Pump Applications: 325 psig.
3. Hot-Gas and Liquid Lines: 325 psig.

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.

B. Pipe Sizing Guidelines: Equipment manufacturer's guidelines for layout and sizing of refrigerant piping.

C. Shop Drawings: The Contractor is required to submit an isometric piping layout with each condensing unit submittal showing the detailed refrigerant piping layout. This refrigerant pipe layout is to include the following:

1. System identification.
2. All components, accessories, specialties, lengths and elevation difference between compressor and evaporator.
3. Total equivalent length of the piping system.
4. Pipe sizing, oil traps, double risers, etc. required to ensure proper operation and compliance with warranties of the connected equipment.
5. Refrigerant pipe layout, sizing and components must conform to standard engineering practice as recognized by ARI, the ASHRAE Refrigeration Handbook and the equipment manufacturer's written recommendations.

D. Field quality-control test reports.

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3.6 FIELD QUALITY CONTROL

A. Prepare drain piping according to ASME B31.9 and as follows:

1. Leave joints uninsulated and exposed for examination during test.
2. Flush drain piping systems with clean water.
3. Isolate equipment from piping.

B. Perform the following tests on drain piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. Subject piping system to hydrostatic test pressure that is equal to 10 feet of water column or maximum that can be obtained based on installed conditions.
3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
4. Prepare written report of testing.

END OF SECTION

electrolytic protection where hangers or supports are in direct contact with copper piping.

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 6 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
8. NPS 4: Maximum span, 10 feet; minimum rod size, 1/2 inch.

D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.4 PIPE 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.

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. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. 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.

3.5 TERMINAL EQUIPMENT CONNECTIONS

A. Install vented traps at cooling coil condensate pan connections. Size trap and connected piping the same as or larger than equipment connections.

B. Size trap to provide seal against fan static pressure.

H. Install fittings for changes in direction and branch connections.

I. Install cleanouts fabricated with a tee fitting with a threaded plug at each change of direction to facilitate cleaning of pipe. Cleanout shall allow for cleaning in direction of flow.

J. Install piping to allow application of insulation.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Reduce pipe sizes using concentric reducer fitting or eccentric reducer fitting installed with level side up.

M. Make branch connections to mains using flow tees.

N. Unless otherwise indicated, install branch connections to mains with the branch connected to the top or side of the main pipe.

O. Install unions in piping, NPS 2 and smaller at final connections of equipment, and elsewhere as indicated.

P. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.3 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Wrap copper piping with not less than two layers of 10 mil. thick black plastic tape extending a minimum of 1 inch on each side of clamp for

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 Couplings: Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS

A. Drain Piping: Type DWV or Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated piping locations and arrangements if such were used to size pipe. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise. Avoid routing piping on floor across walkways. Provide steel ramps over piping where floor mounted piping crosses walkways.

D. Do not install drain piping within electrical rooms, elevator equipment rooms, MDF or IDF rooms, or stairwells. Exception: Pipe serving equipment serving the room. Maintain all required clearances to other equipment.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping at a uniform grade of 1.0 percent downward towards drain outlet unless otherwise indicated.

G. Install piping free of sags and bends.

SECTION 23 21 15

HVAC DRAIN PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, and joining methods for HVAC drain piping including coil condensate drains.

1.2 PERFORMANCE REQUIREMENTS

A. Drain piping components and installation shall be capable of withstanding 5 psig at 150 deg F.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's product literature indicating materials of construction, ratings, options and accessories for each type of the following:

1. Pipe and fittings.

B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. DWV Copper Tubing: ASTM B 306, Type DWV.

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

2.2 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

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D. Piping, Exposed:

1. PVC: 30 mils thick.

END OF SECTION

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

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.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on pre-insulated underground piping.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Liquid and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.

B. Air Conditioning Condensate Drain Piping: Flexible elastomeric, 3/4 inch thick.

3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option or as directed on the drawings.

C. Piping, Concealed: None.

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 and where required for maintenance. 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 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 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

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, 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. Shape insulation at these connections by

N. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

O. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

P. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

Q. 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 below roof surface. 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 Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 for firestopping and fire-resistive joint sealers.

D. Installation of Pipe Hangers and Rollers:

1. Install thermal-hanger shield inserts complying with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" at all hangers and rollers.

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. 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 piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, 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. Install insulation continuously through hangers and around anchor attachments.

K. 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.

L. 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.

M. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. 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.

2.5 SEALANTS

A. Joint Sealants:

1. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, traps, and mechanical joints.

2.7 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

PART 3 EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following manufacturers:

a. Armacell LLC.
b. Halstead-Nomalco.
c. Imcoa.
d. Nomaco.
e. Rubatex

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Refrigerant piping.
2. Condensate drain piping.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer's technical data with proposed thickness and R-value indicated, and application.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to 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 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. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. All insulating materials shall conform to NFPA 90A and NFPA 90b, ASHRAE 90.1 and the International Energy Construction Code (IECC).

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.

15. Notes to explain why certain final data in the body of reports vary from indicated values.
16. 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. Variable frequency drive settings including maximum and minimum setpoints.
    g. Inlet vane settings for variable-air-volume systems.
    h. Settings for supply-air, static-pressure controller.
    i. Other system operating conditions that affect performance.

17. Include a list of instruments used for procedures, along with proof of calibration.

END OF SECTION

3.13 FINAL REPORT

A. General: Prepare certified reports in both paper and PDF format; tabulate and divide the report into separate sections for tested systems and balanced systems. Submit three (3) copies of paper reports and one (1) copy of report in PDF format.

1. Assemble paper reports in 3-ring binders. Separate and order sections within each binder. Provide labeled tabs at each section with a table of contents at the front of the binder. The table of contents shall indicate the tab number and the information contained at that tab.
2. Assemble PDF report in one PDF file. Separate and order sections within the file to match the paper copy. Provide bookmarks at the first page of each section and label each bookmark with the information contained in that section.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. 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. Certification sheet signed and sealed by the certified testing and balancing engineer.
11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
12. 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.

13. Nomenclature sheets for each item of equipment.
14. Data for terminal units, including manufacturer's name, type, size, and fittings.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. 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.

3.9 PROCEDURES FOR TESTING FIRE AND SMOKE CONTROL DEVICES

A. Record manufacturer and model number for each fire damper, smoke detector, smoke damper, combination fire/smoke damper, and damper actuator.

B. Confirm access door has been installed at each damper location and is properly labeled.

C. Air-Moving Device Shut-down: Verify air-moving device(s) that are to be de-energized by a Total Coverage Smoke Detection System de-energize on a signal from the system.

D. After all smoke control devices have been successfully tested, the TAB firm shall engage the services of a Professional Mechanical Engineer, registered in the State of Arizona, to submit a signed and sealed report attesting to the proper operation of the smoke control devices and air-moving device shut-downs.

3.10 TOLERANCES

A. Set HVAC system's air 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.

3.11 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.12 SPECIAL INSPECTIONS

A. Prepare special inspection reports, signed and sealed by a professional engineer, as required by the Authority Having Jurisdiction or as required above.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment. Exception: Individual component measurement is not required for unitary equipment 5-tons and less in capacity. Provide external static pressure measurement across unit only.

   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. 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.
7. Instruct Mechanical Contractor to replace fan and motor sheaves and belts as required to achieve design airflow or pressurization.

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. Set minimum motor speed to 20 percent. 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.

required outlet volumes with required fan volumes. Correct variations that exceed plus or minus 10 percent.

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.

I. Check for proper sealing of air-handling-unit components.

J. Verify that joints and seams in air duct systems are sealed as specified in Division 23 Sections.

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.

H. Report deficiencies discovered before and during performance of TAB procedures directly to Engineer and Mechanical Contractor. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

I. The General or Mechanical Contractor shall not in any way prohibit the TAB Contractor from communicating directly and freely with the Engineer. The TAB Contractor is required to copy the Engineer on all communications to the Contractor.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. 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. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. 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" or NEBB's "Procedural Standards for Testing Adjusting and Balancing of Environmental Systems," and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2, "Air Balancing."

B. Cut insulation and ducts for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts airtight.
2. Coordinate with mechanical contractor to restore insulation, coverings, vapor barrier, and finish according to Division 23 Sections.

C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

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

1.5 QUALITY ASSURANCE

A. 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 TAB plan and the procedures specified and referenced in this Specification.

B. TAB Report Forms: Use standard TAB contractor's forms.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

D. Perform special inspections as required herein and by Authorities Having Jurisdiction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents and approved submittals for the HVAC systems and equipment to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment or inefficient operation. Report findings and recommendations directly to the Engineer within thirty days of document review.

B. Examine ceiling plenums used for return or relief air to verify that there is a proper path for return and relief air from all areas of the building. Verify that penetrations through walls between plenum and non-plenum areas are sealed.

C. Examine underfloor air plenums used for supply air to verify that the plenums are properly separated from adjacent areas and that penetrations in plenum walls are sealed.

D. Examine equipment performance data including fan curves. 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.

E. 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.

F. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

G. Examine operating safety interlocks and controls on HVAC equipment.

SECTION 23 05 93

TESTING, ADJUSTING & BALANCING FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems.
2. Balancing HVAC Equipment.
3. Testing and Certifying the Proper Operation of Fire and Smoke Control Devices.

1.2 APPROVED CONTRACTORS

A. Approved Contractors: Engage the services of one of the following:

1. ABM Building Services, LLC., Phoenix, Arizona Balance Division
2. Arizona Air Balance Co.
3. Phoenix Test & Balance, LLC.
4. Precision Air.
5. Southwest Testing and Balancing, LLC.
6. TAB Technologies, Inc.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Contractor Qualifications: Include AABC or NEBB certificates for proposed personnel, test instrument certifications.

B. Certified TAB reports.

C. Sealed special inspection reports.

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3.3 PIPE LABEL INSTALLATION

A. 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 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment. Reduce spacing to 5 feet when required by code.
7. Spaced at maximum 10 feet on piping above removable acoustical ceilings. Reduce spacing to 5 feet when required by code.

B. Pipe Label Color Schedule:

1. Condensate Drain Piping:

   a. Background Color: Green.
   b. Letter Color: White.

2. Refrigerant Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3.4 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

B. Clean faces of mechanical identification devices.

END OF SECTION

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: 1/2 inch. Include secondary lettering 3/8 inch.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: As indicated on drawings or required by local authority.

2.3 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. Strap-On Pipe Labels: Semirigid plastic formed to fit circumference of pipe and to attach to pipe with stainless steel worm-drive clamps.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. 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.

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.

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING & EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.1 EQUIPMENT LABELS

A. 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: 1/2 inch. Include secondary lettering 3/8 inch.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number. Coordinate with Owner.

2.2 WARNING SIGNS AND 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: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

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M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape. Include retaining clip.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes. Include retaining clip.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Roof Bases: Unless otherwise indicated install roof bases for roof mounted piping, conduit, ductwork and equipment as follows:

1. Select roof base size based on expected load to prevent crushing of the roofing membrane and underlying insulation.
2. Space roof bases as required to properly support conduit, pipes, or ducts or more frequently to distribute the weight of the supported systems to prevent damage to the roofing membrane, underlying insulation, or roofing system.
3. Provide protective pads between each roof base and the roofing membrane. Size pads to extend a minimum of 2" beyond each roof base.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 1-1/2 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
5. Single-Pipe Rolls (MSS Type 43): For suspension of pipes NPS 1 to NPS 30, with one rod if longitudinal movement caused by expansion and contraction might occur.
6. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
7. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Conduit Support Applications:

1. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical conduit.
2. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where it's Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
3. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

    a. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

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 a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

D. Use hangers and supports with galvanized metallic coatings for piping and equipment that is exposed to weather and that will not have field-applied finish.

E. Use stainless-steel pipe hangers and stainless-steel attachments for corrosive atmospheres.

F. Wrap copper piping with not less than two layers of 10 mil. thick black plastic tape extending a minimum of 1 inch on each side of clamp for electrolytic protection where hangers or supports are in direct contact with copper piping.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

L. Insulated Piping: Thermal-hanger shield inserts shall be used. Install with insulation same thickness as piping insulation. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

M. Conduit Support Installation:

1. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
2. 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.
3. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead, or to support equipment above floor or roof.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation: Install fasteners in strict accordance with manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

2.6 NON-PENETRATING ROOFTOP BASES

A. Subject to compliance with requirements, manufacturers shall be one of the following:

1. Dymotek.
2. Miro Industries, Inc.

B. Description: Stainless-steel or polycarbonate bases designed for direct placement on roofing membrane.

1. General:

a. All edges and corners in contact with the roof surface shall be rounded to prevent damage to the roof membrane.
b. Drainage ports shall be provided to prevent ponding of water within the base.
c. The bottom of the base shall be sold and flat, free of voids and deformities to prevent concentrated loading of the roofing membrane.
d. Polycarbonate bases shall be UV stabilized with carbon black.

2. Supports: Pipe, conduit, duct, and equipment supports mounted to roof bases shall be constructed as outlined above. Integral supports for small diameter piping and conduit may be integral with polycarbonate bases.
3. Protective Pads: 1/8 inch thick, flexible, PVC with carbon black additive for UV stabilization, protective pad for placement beneath roof bases to protect roofing membrane.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

C. Tape for Plenum Use:

1. Polypropylene backing with acrylic adhesive, Hart & Cooley part number 011371.
2. Polyethylene coated cloth backing with rubber adhesive, Uline Black Nashua 398 Duct Tape, model number S-17236BL.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. 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.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, pipe clamps, and U-bolts.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Hot or Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

E. Shield: Shields shall be a minimum of 18 gauge galvanized steel, 12 inches long for piping 6 inches and smaller. Shields shall be a minimum of 16 gauge galvanized steel, 18 inches long for pipe over 6 inches.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Surface-Burning Characteristics: For tapes, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label tapes with appropriate markings of applicable testing agency.

1. Tape Installed in Return Plenums: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Tape Installed Elsewhere: No testing requirement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers shall be one of the following unless noted otherwise:

1. Anvil International.
2. B-Line Systems.
3. Elgen.
4. Grinnell.
5. Kin-Line.
6. Michigan Hanger Co.
7. National Pipe Hanger Corp.
8. Pipe Technology and Products.
9. PHD manufacturing.
10. PHS Industries.
11. Unistrut.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

SECTION 23 05 29

HANGERS & SUPPORTS FOR HVAC PIPING & EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.
6. Non-penetrating rooftop bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

3.11 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 paint finishes with matching touchup coating recommended by manufacturer.

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections: Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

B. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

3.7 IDENTIFICATION SCHEDULE

A. 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 branch-circuit conductors.

a. Color shall be factory applied.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral: White.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral: Gray.

B. Control Systems Conductor Identification: Identify field-installed 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.

3.8 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables.

3.9 GROUNDING

A. For low-voltage wiring and cabling, comply with requirements in Division 26.

3.10 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Comply with requirements in Division 07.

G. Class 1 and 2 Control Circuits: Type THHN-THWN or XHHW, in raceway unless noted otherwise.

1. Final raceway connections for low-voltage control wiring to equipment, actuators and similar devices may be omitted where the devices are located above lay-in ceilings. Length of exposed wire is to be less than 24 inches.

H. Class 3 Control Circuits: Type TW or TF in raceway unless noted otherwise.

1. Final raceway connections for low-voltage control wiring to equipment, actuators and similar devices may be omitted where the devices are located above lay-in ceilings. Length of exposed wire is to be less than 24 inches.

3.5 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 Division 23 Sections "Hangers and Supports for HVAC Piping and Equipment."

F. Identify and color-code conductors and cables.

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.

3.6 IDENTIFICATION INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Branch Circuit Sizing: Size conductors for circuits with less than a 20 ampere connected load, maximum of 16 amperes actual load, as follows:

1. For 120V circuits up to 65 feet in length from panel to center of load: Not smaller than No. 12.
2. For 120V circuits up to 110 feet in length from panel to center of load: Not smaller than No. 10.
3. For 120V circuits up to 165 feet in length from panel to center of load: Not smaller than No. 8.
4. For 120V circuits up to 255 feet in length from panel to center of load: Not smaller than No. 6.
5. For 208V circuits up to 110 feet in length from panel to center of load: Not smaller than No. 12.
6. For 208V circuits up to 185 feet in length from panel to center of load: Not smaller than No. 10.
7. For 208V circuits up to 280 feet in length from panel to center of load: Not smaller than No. 8.
8. For 208V circuits up to 440 feet in length from panel to center of load: Not smaller than No. 6.
9. For 277V circuits up to 150 feet in length from panel to center of load: Not smaller than No. 12.
10. For 277V circuits up to 250 feet in length from panel to center of load: Not smaller than No. 10.
11. For 277V circuits up to 380 feet in length from panel to center of load: Not smaller than No. 8.
12. For 277V circuits up to 590 feet in length from panel to center of load: Not smaller than No. 6.

3.4 CONDUCTOR INSULATION APPLICATIONS AND WIRING METHODS

A. Comply with NECA 1.

B. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN or XHHW, single conductors in raceway.

C. Branch Circuits Concealed in Walls, and Partitions: Type THHN-THWN or XHHW, single conductors in raceway.

D. Branch Circuits Concealed above or in Ceilings: Type THHN-THWN or XHHW, single conductors in raceway.

E. Branch Circuits Concealed above Lay-in Ceilings: Type THHN-THWN or XHHW, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN or XHHW, single conductors in raceway.

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 expansion fittings at all locations where conduits cross building or structure expansion joints.
2. 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 48 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for motors.

1. Use FMC in indoor, dry locations.
2. Use LFMC in all other locations.

R. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

S. Locate boxes so that cover or plate will not span different building finishes.

T. 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.

U. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 CONDUCTOR MATERIAL APPLICATIONS

A. Control Circuit Sizing: Minimum sizes are listed below:

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.

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 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 of enclosures to which attached.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or GRC 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. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

M. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following but not limited to:

   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Gymnasiums.

4. Concealed in Interior Walls and Partitions: EMT.
5. Concealed Above or In Ceilings: EMT.
6. Connection to Vibrating Equipment (Including Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
7. Damp or Wet Locations: GRC or IMC.
8. 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: 3/4-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 conduit, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only in retrofit applications where indicated.

3.2 RACEWAY 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 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 Division 23 Section "Hangers and Supports for HVAC Piping and Equipment" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.8 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 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.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.9 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches 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.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

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. Connection to Vibrating Equipment (Including Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. 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.

G. Cabinets:

1. NEMA 250; Type 1, Type 3R or Type 12, as required by location; 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.

2.5 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 or 18 AWG, stranded (19x29) 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 or 18 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.6 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with the following:

1. NEMA WC 70 for Types THHN-THWN and XHHW.
2. UL 83 for Types TW and TF.

2.7 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250; Type 1, Type 3R, Type 4 or Type 12, as required by location; 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.

2.3 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Where installed in finished spaces, match color of adjacent surfaces.

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. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

D. Device Box Dimensions: 4 inches square by 2-1/8 inches deep or 4 inches by 2-1/8 inches by 2-1/8 inches deep.

E. Gangable boxes are prohibited.

F. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250; Type 1, Type 3R, Type 4 or Type 12, as required by location; 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.

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, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Comply with ANSI A13.1 for identification devices.

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.

1. Color: Factory applied color per schedule below.

   a. HVAC Control Wiring: White
   b. Power – Normal: Natural
   c. Power – Standby: Orange

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. 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 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

H. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for

SECTION 23 05 20

ELECTRICAL & CONTROL WIRING FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This Section is to be used for all low- and line- voltage wiring for mechanical controls. All line-voltage work shall be performed by a licensed contractor qualified to perform the work and shall comply with the requirements contained in this section or in Division 26.

B. This Section does not apply to plenum rated cables used for electrically activated remote damper operators.

C. This Section includes the following:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Surface raceways.
4. Boxes, enclosures, and cabinets.
5. Low-voltage control cabling.
6. Conductors and cables rated 600 V and less.
7. Connectors, splices, and terminations rated 600 V and less.
8. Identification products.
9. Identification of power and control cables.
10. Identification for conductors.

1.2 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer's technical data, materials of construction and listings.

B. Field quality-control test reports.

C. Maintenance data.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons using new materials.

END OF SECTION

SECTION 23 05 18

ESCUTCHEONS FOR HVAC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-casting, Cast-brass Type: With concealed hinge and set screw and polished chrome-plated finish.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Insulated Piping: One-piece, stamped-steel type.
c. Bare Piping: One-piece, cast-brass type.

2. Escutcheons for existing piping shall be split-casting, cast-brass type.

C. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07.

END OF SECTION

SECTION 23 05 17

SLEEVES & SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

PART 3 EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07.

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B. Motors Used with Variable Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 EXECUTION

3.1 INSTALLATION

A. Arrange and set motors.

B. Line up motors on direct drive equipment using dial type gauges.

C. Connections and testing of motor for proper rotation/phasing shall be under Division 26.

END OF SECTION

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Motors 3/4 HP and larger, except as otherwise noted shall be designed for 3 phase, 60 hertz power supply.

D. Motors 1/2 HP and smaller, except as otherwise noted, shall be designed for 120 volt, single phase, 60 hertz power supply.

E. Motors not directly exposed to weather and located in nonhazardous spaces shall be in drip-proof enclosures or as indicated on drawings.

F. Motors shall be totally enclosed, fan cooled where directly exposed to weather or as indicated on drawings.

G. High-starting torque, totally enclosed or explosion-proof motors to be used in all hazardous areas or as indicated on drawings.

3.2 DEMONSTRATION

A. Inspect and operate satisfactorily, in presence of Engineer and Owner, each system and item of equipment, including accessories.

3.3 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

C. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral or a demonstration performance-based test.

END OF SECTION

m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.1 PREPARATION

A. Inspect and test each system, subsystem and piece of equipment prior to demonstration. Confirm proper operation prior to scheduling demonstrations.

1. Replace defective work or material.
2. Repeat inspection and testing until defects are eliminated.

B. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements for "Operations and Maintenance Data."

expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Operating standards.
    c. Regulatory requirements.
    d. Equipment function.
    e. Operating characteristics.
    f. Limiting conditions.
    g. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations and Maintenance manuals.
    c. Project record documents.
    d. Identification systems.
    e. Warranties and bonds.
    f. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.

SECTION 23 05 01

DEMONSTRATION & TRAINING FOR HVAC SYSTEMS & COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for demonstration of proper operation of equipment and instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 CLOSEOUT SUBMITTALS

A. At completion of training, submit complete training manual(s) for Owner's use.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.

1.4 COORDINATION

A. Complete demonstrations prior to Substantial Completion.

B. Complete instruction prior to Final Completion.

C. Coordinate demonstration and instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

D. Coordinate content of training modules with content of approved operation and maintenance manuals.

PART 2 PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system. Include training for all HVAC systems and equipment such as heat pumps, air-conditioners, heating and ventilating units, evaporative coolers, make-up air units, chillers, cooling towers, pumps, fans, air handlers, etc. and as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is

MECHANICAL ACCESSIBILITY / CLEARANCE CHECKLIST
(See Paragraph 3.8.E)

Bldg.	Location	Unit #	Acceptable Access		Conflict	Date	Action	Observer	
			Yes	No				Owner	Contractor

3.20 WELDING

A. Procedures:

1. All procedures and welders must be qualified in accordance with the requirements of Section IX, ASME Boiler and Pressure Vessel Code and ANSI code for power piping B31.1. Procedure qualification test records and acceptance shall be submitted with the welding procedure prior to the start of fabrication.
2. Architect's inspector or authorized representative will review performance qualification records of individual welders.

END OF SECTION

F. Grouting:

1. Grout under all equipment after leveling, filling completely the space between machinery bed plate and foundation surface as specified in Division 03.
2. Mix and install grout for mechanical equipment base bearing surfaces, pumps and other equipment base plates, and anchors.
3. Clean surfaces that will come into contact with grout.
4. Provide forms as required for placement of grout.
5. Avoid air entrapment during placement of grout.
6. Place grout, completely filling equipment bases.
7. Place grout on concrete bases and provide smooth bearing surface for equipment.
8. Place grout around anchors.
9. Cure placed grout.
10. Finish exposed surface of grout for a neat appearance.

3.16 CLEANUP

A. In addition to cleanup specified under Division 01, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any splattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

B. During the progress of the work, keep the premises clean and free of debris.

3.17 PAINTING

A. Except as otherwise specified or indicated in the architectural drawings and/or specifications, paint all exposed unfinished metal with one coat of rust-inhibiting primer. Galvanized ductwork and factory painted equipment shall be considered as having primed surface.

B. Damage and Touch-Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Finished painting is specified under Division 09.

3.18 FIRESTOPPING

A. Coordinate with the firestopping installer for sealing of all penetrations of fire and smoke barriers and other rated assemblies created during the installation of the Division 23 work.

3.19 OBJECTIONABLE NOISE AND VIBRATION

A. Construct and brace the metal partitions, ducts and sheet metal housings to prevent vibration or rattling when systems are in operation. Install connections to equipment so noise and vibration will not reach the conditioned area through ducts, piping, conduit, sheet metal work, or the building structure.

equipment. Neatly fabricate and erect steel work with burrs and welding spatter ground off. Paint after fabrication with a rust-inhibitive primer.

3. Field Welding: Comply with AWS D1.1.

B. Erection of Wood Supports and Anchorages:

1. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support and anchor mechanical materials and equipment.
2. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

C. Where supports, foundations, stands, suspended platforms for machinery, tanks, or other equipment are indicated or specified, perform the following:

1. Locate support members to avoid equipment strains and interference with piping connections, tube pulling or other maintenance operations.
2. Where saddles are required, use cast iron or welded steel saddles with curvature to fit the tank shell.
3. Mount power-driven equipment on common base with driver.

D. Concrete Inserts: Furnish and install all concrete inserts required for all materials and equipment specified and/or shown on the drawings for Division 23.

E. Concrete Bases: Work under this section includes coordination of construction of all concrete foundations indicated or required for equipment specified under Division 23. Materials and workmanship shall be described under Division 03. 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 (100 mm) 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 (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extends 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.

F. Do not install any equipment in an application not recommended by the manufacturer.

3.11 EQUIPMENT ROUGH-IN

A. Rough in all equipment and fixtures as designated on the drawings and in the specifications. The drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large-scale certified drawings. The Contractor shall obtain all certified rough-in information before progressing with any work for rough-in final connections.

B. Be responsible for providing all outlets and services of proper size at the required locations.

C. Minor changes in the contract drawings shall be anticipated and provided for under this contract.

1. Rough-in only (unless otherwise designated on the drawings) shall include providing all services as indicated and required, including all ductwork, piping and valves. Valve and cap all piping stub-outs. Cap all ductwork stub-outs in a manner suitable for future extension.

3.12 OWNER-FURNISHED AND OTHER EQUIPMENT

A. Rough-in only for all Owner-furnished equipment see Division 01 and all equipment furnished under other sections of the specifications, except as otherwise specified and/or noted on the drawings.

B. Provide all services designated, valve and cap all piping, cap all ductwork and leave in a clean and orderly manner.

3.13 EQUIPMENT FINAL CONNECTIONS

A. Provide all piping and duct final connections for all equipment under Division 23 and as indicated on the drawings.

3.14 MACHINERY DRIVES

A. After tests have been performed on the air conditioning and air handling systems, make without cost, not more than one change in the size of non-adjustable sheaves to obtain the required air quantities.

3.15 EQUIPMENT SUPPORTS

A. Erection of Metal Supports and Anchorages:

1. Refer to Division 05 for structural steel.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and

3.8 ACCESSIBILITY

A. Install valves, dampers, thermometers, gauges, traps, cleanouts, control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement conveniently and accessibly throughout the finished building. Where any of these devices are shown on the contract drawings to be installed above any inaccessible ceiling or behind any inaccessible wall, the Mechanical Contractor shall furnish access doors or panels as required.

B. All access doors or panels in walls and ceilings required for access to control devices, traps, valves and similar devices are to be furnished and installed as part of the work under this section. Provide type as specified under Division 08.

C. Refer to architectural drawings for type of wall and ceiling in each area and for rated construction.

D. Coordinate work of various sections to locate valves, traps, and dampers with others to avoid unnecessary duplication of access doors.

E. The Contractor, along with the Owner's representative, shall complete the Mechanical Accessibility/Clearance Checklist at the end of this section for all mechanical equipment. The chart shall be submitted to the Architect for approval prior to substantial completion. All conflicts shall be resolved to the Architect's and Owner's satisfaction prior to submission.

3.9 ROOF FLASHINGS

A. Flash and counterflash all piping, conduits and ductwork penetrating roofing membrane with flashing per roofing manufacturer's recommendations. Refer to architectural drawings for detailing of duct and pipe penetrations through roof.

3.10 PRODUCT AND EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. All equipment, valves, sensors, dampers, detectors, etc., shall be installed in strict conformance with the manufacturer's recommendations and all codes.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

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 to allow right-of-way for piping installed at required slope.

3.3 RECORD DRAWINGS

A. Recording: Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

3.4 OPERATION AND MAINTENANCE MANUALS

A. Prepare Operation and Maintenance Manuals as directed for review by the Contractor, Owner, Architect, and Engineer.

B. Make corrections and resubmit as required.

3.5 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are diagrammatic and many offsets, bends, special fittings and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact locations, routes, building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

3.6 CUTTING AND PATCHING

A. Cut work and patch per Division 01 as necessary to properly install the new work. As the work progresses, coordinate necessary openings, holes, chases, etc., in their correct location. If the required openings, holes and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Architect. Include as a part of the work all structural framing required by penetrations through the roof and necessary steel to support ducts and pipes between structural steel unless shown on the structural drawings.

3.7 CLOSING-IN OF UNFINISHED WORK

A. Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

PART 2 PRODUCTS

2.1 MACHINERY DRIVES

A. Unless otherwise specified in Division 23 equipment sections, use V-belts designed for 150% of capacity for all belt drives. For multiple belt drives, use matched sets, so marked at the factory.

B. On drives with not more than two belts, provide adjustable pitch motor sheaves with the midpoint of the adjustment range equal to that required to achieve the specified fan capacity.

C. On motors with drives with more than two belts, furnish non-adjustable sheaves, providing the specified fan capacity.

2.2 MACHINERY ACCESSORIES

A. Guards: Provide totally-enclosed OSHA type belt guards for all rotating equipment. Design guards to be readily removable for access to belt drives.

2.3 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.

B. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.1 SUBMITTALS

A. Prepare submittals as directed for review by the Contractor, Owner, Architect, and Engineer.

B. Submit one copy of PDF submittals via email, project website or other electronic media.

3.2 REFRIGERANT HANDLING AND DOCUMENTATION

A. Refrigerant Handling: Handle, contain and dispose of refrigerant in compliance with local, federal, and EPA regulations and requirements.

B. Documentation: Maintain documentation for all refrigerant brought onto or removed from project location in compliance with local, federal, and EPA regulations and requirements. Submit documentation to Owner and Architect.

warranties shall be a minimum of two years from date of substantial completion or as specified elsewhere. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of the equipment under all conditions of load, installing any additional items of control and/or protective devices as required and the replacing of any refrigerant lost.

1.18 MECHANICAL WIRING

A. Provide all temperature control wiring, interlock wiring, and equipment control wiring for the equipment that is to be provided under Division 23 unless wiring is specifically shown on electrical drawings.

B. The following schedule is intended to summarize the division of work material responsibilities between the Mechanical Contractor, Controls Contractor and the Electrical Contractor.

Item	Furn. By	Set By	Power Wiring	Control Wiring
Equipment Motors	MC	MC	EC	--
Motor Control Center	EC	EC	EC	CC
Motor Starters, Controllers, Contactors and Overload Heaters	MC*	EC**	EC	CC
Fused and Non-Fused Disconnect Switches	EC	EC	EC	--
Manual Operating Switches, Multispeed Switches, Pushbutton Stations and Pilot Lights	CC	CC	CC	CC
Control Relays and Transformers	CC	CC	CC	CC
Line Voltage Thermostats and Time Switches***	MC	MC	EC	EC
Low Voltage Thermostats	MC	MC	-	MC
Temperature Control Panels	MC	MC	EC	CC
Smoke Detectors (Duct Mounted)	EC	MC	EC	MC or CC
Motor and Solenoid Valves, Damper Motors, PE and EP Switches	CC	MC	CC	CC
Water Treatment Equipment	MC	MC	EC	CC

MC = Mechanical Contractor
CC = Controls Contractor
EC = Electrical Contractor

*Except where such devices are located in MCC's.

**Unless required by these specifications to be provided as part of a factory furnished assembly (i.e. fan coils, air handlers, chillers, etc.).

***Motor-drive units which are controlled from line voltage automatic controls such as line voltage thermostats, float switches or time switches which conduct full load current of the motor shall be wired for both power and control circuit under the electrical contract.

3. Ducts to be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material. Patch insulation, as required, to match adjacent areas.
4. Ducts to be Abandoned In Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to be Removed: Disconnect and cap services and remove equipment.
6. Equipment to be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

E. Continuity of Services in Existing Building: Contractor shall permanently reroute existing mechanical and control services or provide temporary connection as required to maintain service to existing fixtures in building which are to remain in service.

F. Rerouting and Relocation of Existing Mechanical Equipment and Services in Existing Building:

1. General: Contractor shall reroute, relocate all existing materials which are in conflict with the building alterations and which are required to be maintained in use.
2. Existing Piping and Ductwork: Where applicable, existing material may be reused in their original location unless otherwise indicated.

G. Testing: All existing services affected by the new construction and which are to remain in operation shall be returned to their original condition. The existing services shall be tested as new, as described in other sections of these specifications. If for any reason these requirements cannot be met, the Contractor shall immediately notify the Architect.

1.16 CONSTRUCTION FACILITIES

A. General: Under this division of the specifications, execute all work in a manner to provide safe and lawful ingress and egress to the Owner's establishment and such facilities shall be kept clear of materials or equipment. Refer to Division 01 for additional requirements.

B. Furnish and maintain from the beginning to the completion of all work all lawful and necessary guards, railings, fences, canopies, lights, and warning signs. Take all necessary precautions required by city and state laws to avoid injury or damage to any and all persons and property.

1.17 GUARANTEE

A. Guarantee all material, equipment, installation and workmanship for all sections under Division 23 in writing to be free from defects of material and workmanship for one year from date of final acceptance as outlined in Division 01. Equipment

1.13 APPROVALS OF MATERIALS AND EQUIPMENT

A. Refer to Division 01 for description of material and equipment for prior approvals and substitutions.

1.14 COOPERATIVE WORK

A. Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration. See Division 01 for additional requirements.

B. Cooperative Work Includes:

1. General supervision and responsibility for proper location, rough-in and size of work related to Division 23 but provided under other divisions of these specifications.
2. Installation of sleeves, inserts and anchors bolts for work under sections in Division 23.
3. Sealing of penetrations through fire and smoke barriers caused by work installed as part of Division 23.

1.15 EXISTING MATERIALS AND EQUIPMENT

A. Disposition: With the exception of items that are to be reused or retained by the Owner, all other materials indicated to be removed shall be removed and disposed of by the Contractor. Items that are indicated to be retained or returned to the Owner shall be delivered to a storage area designated by the Owner.

B. Unused Materials: All unused piping, ductwork, controls and miscellaneous materials shall be removed by the Contractor except where located within walls, below or above existing construction which is not being altered and would require removal and replacement of this existing construction. All visible piping, ductwork, etc., shall be removed and sealed or capped within wall, below floor, or above ceiling unless noted otherwise.

C. Exterior Services: The Contractor shall be responsible for maintaining mechanical and control service to the existing building during the construction period. Existing services are to be retained until such a time that the new services, if any, are completely installed and ready for use. Scheduling of service interruptions is to be coordinated with the Architect and Owner.

D. Disconnect, demolish, and remove mechanical systems, equipment, and components that are indicated to be removed.

1. Piping to be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material. Patch insulation, as required, to match adjacent areas.
2. Piping to be Abandoned In Place: Drain piping and cap or plug piping with same or compatible piping material.

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

M. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

N. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

O. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

P. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

Q. Licenses: Include copies of any licenses with requirements including inspection and renewal dates.

R. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

S. Test and Balance Report: Include a final, approved copy of the Test and Balance Report.

1.12 WORK AND MATERIALS

A. Unless otherwise specified, all materials must be new and of the quality specified. The workmanship shall be of a quality that is acceptable to the Architect, Engineer, and Owner, and is equal to the standards of the trades. Contractor must staff the project with sufficient skilled workmen, including a fully qualified construction superintendent, to complete the work in the time allotted. The superintendent must be qualified to supervise all of the work in his work category.

B. Uniformity: Unless otherwise specified, provide all equipment and products of same type or classification by the same manufacturer.

F. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

G. Product Data: Include the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Approved submittals.
3. Include the following if not shown on approved submittals:

    a. Product name and model number. Use designations for products indicated on Contract Documents.
    b. Manufacturer's name.
    c. Equipment identification with serial number of each component.
    d. Equipment function.
    e. Operating characteristics.
    f. Limiting conditions.
    g. Performance curves.
    h. Engineering data and tests.

H. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures. Including precautions against improper use.
10. Operating logs.

I. Wiring Diagrams: Diagram of factory installed wiring including any options as well as any field modifications.

J. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

K. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification. Include valve locations and designations.

L. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

2. Identification: As follows:

   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Engineer.
   e. Name of Contractor.

3. Remove or obscure Engineer's seal from Record Drawings.

1.11 OPERATION AND MAINTENANCE MANUAL

A. Prior to completion of the project, compile a complete equipment, operation and maintenance manual for all equipment supplied under Division 23.

B. Schedule:

1. Submit a preliminary copy of the manual not less than 30 days prior to substantial completion for review and comment.
2. Submit the final version the manual not more than four weeks after substantial completion of the project.

C. Format: Submit manuals in both of the following formats:

1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Engineer.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.
   c. Provide one final copy to Engineer and two copies to Owner.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer will return three copies.

D. Provide operating and maintenance manuals for all systems, subsystems, and equipment that requires operation and regular maintenance, or has replaceable parts.

E. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, product data, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below. In addition to requirements in this Section, include operation and maintenance data required in individual Specification Sections.

b. Specifications shall be identified by section number, page, and paragraph.

3. Include a proposed solution, where appropriate, based upon the field conditions and best knowledge of the Contractor.

B. Improper or Frivolous RFIs: RFIs which are not properly prepared or that request information which is clearly shown in the contract documents will be returned unanswered. Processing time for multiple submissions of improper or frivolous RFIs will be billed at the Engineer's standard hourly rate to the Owner who may deduct an equal amount from the monies due the Contractor.

1.10 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings, Submittals and Shop Drawings.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Include underground and overhead piping. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Include dimensions both horizontally and vertically to permanent points of reference accurate within 6 inches. Include descriptors such as "below slab", "above ceiling", etc.
c. Record data daily or as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings, Submittals and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Provide a cover sheet at the front of each submittal with the following information:

   a. Project name.
   b. Date.
   c. Name of Engineer.
   d. Name of Contractor.
   e. Name of subcontractor.

3. Provide a cover sheet at the front of each submittal section with the following information:

   a. Name of supplier.
   b. Name of manufacturer.
   c. Number and title of appropriate Specification Section.
   d. Drawing number and detail references, as appropriate.
   e. Other necessary identification.

E. Options:

1. Identify options requiring selection by the Engineer.
2. Identify options included with submittal item.

F. Deviations: Identify deviations from the Contract Documents on submittals.

1.8 MATERIAL SAFETY DATA SHEETS

A. Provide current, Material Safety Data Sheets (MSDS), for all hazardous chemicals that are proposed for use at the project site.

1. Provide one complete set to the Owner for review and approval a minimum of one week prior to the delivery of any hazardous chemicals to the site.
2. Maintain a second complete set at the project location, readily accessible by both the Owner's personnel and the contractor's personnel.

1.9 REQUEST FOR INFORMATION

A. Request for Information:

1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as RFI.
2. A properly prepared request for information shall include a detailed written statement of the clarification, apparent conflict, or information requested that indicates the specific drawings or specification in need of clarification and the nature of the clarification requested.

   a. Drawings shall be identified by drawing number and location on the drawing sheet.

1.5 REGULATIONS, PERMITS, FEES, CHARGES, INSPECTIONS

A. Regulations: Comply with all applicable codes, rules and regulations.

B. Fees and Permits: Pay all connection, installation, use, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 01.

C. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Architect with certificates of inspections and approvals by the local authorities in accordance with Division 01.

1.6 DRAWINGS AND SPECIFICATIONS

A. If a conflict exists on the drawings or between the drawings and specifications, promptly notify the Architect.

1.7 SUBMITTALS

A. Submittals are for information and coordination only. The Engineer will diligently review the submittals and attempt to verify compliance with the project requirements. Such review, however, does not constitute approval or disapproval of obligation to comply with all project requirements. The submittals are not to be construed to be contract documents. Any failure by the Engineer to note a point of non-compliance shall not be construed to be acceptance or approval of the discrepancy.

B. Product Information Sheets: Provide manufacturer's literature which includes the information required by the Product Data paragraph of the applicable Specification Section. Where Product Information Sheets show multiple models or options, clearly mark the model and options to be provided.

C. Assembly: Assemble all required submittal information for each specification section and submit in PDF format.

1. Assemble PDF submittals in one PDF file for each Division. Separate and order sections within each file by corresponding specification number. Provide bookmarks at the first page of each section and label each bookmark with the specification number and name to allow for easy navigation of the submittal.
2. Partial submittals will be returned without review. Submittals for Building Automation System may be submitted separately.

D. Identification and Information:

1. Name the PDF file with the Project name, Division number and sequential submittal number. (I.E. The first submittal shall be No. 1; the second submittal shall be No. 2.)

SECTION 23 05 00

GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

A. Provisions of this section apply to all work specified in all sections under Division 23.

B. In addition, work in Division 23 is governed by the provisions of the Bidding Requirements, Contract Forms, General Conditions, and all sections under Division 01.

1.2 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, crawlspaces, and utility tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished 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 and mechanical yards.

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.

1.3 EXAMINATION OF PREMISES

A. Visit the site, verify all measurements and job conditions, and pay all costs necessary to perform the work.

1.4 MECHANICAL CONTRACTOR

A. The Mechanical Contractor shall be licensed and hold a current contracting license that has been valid for a minimum of two years in the State of Arizona as a mechanical contractor.

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DIVISION 23

HEATING, VENTILATING & AIR CONDITIONING

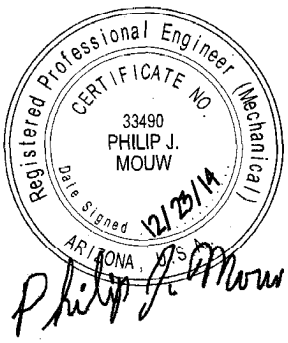
23 05 00 Common Work Results for HVAC
- 23 05 00 General Provisions
- 23 05 01 Demonstration & Training for HVAC Systems & Components
- 23 05 13 Common Motor Requirements for HVAC Equipment
- 23 05 17 Sleeves & Sleeve Seals for HVAC Piping
- 23 05 18 Escutcheons for HVAC Piping
- 23 05 20 Electrical & Control Wiring for Mechanical Systems
- 23 05 29 Hangers & Supports for HVAC Piping & Equipment
- 23 05 53 Identification for HVAC Piping & Equipment
- 23 05 93 Testing, Adjusting & Balancing for HVAC

23 07 00 HVAC Insulation
- 23 07 19 HVAC Piping Insulation

23 21 00 Hydronic Piping & Pumps
- 23 21 15 HVAC Drain Piping

23 23 00 Refrigerant Piping
- 23 23 00 Refrigerant Piping

23 81 00 Decentralized Unitary HVAC Equipment
- 23 81 23 Computer Room Air Conditioners



EXPIRES 3/31/17

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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 for testing of piping cleanliness. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities to Architect/Engineer. Include a copy of final report in Operation and Maintenance Manual.

3.11 PIPING SCHEDULE

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 and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 2 and smaller shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 4 and smaller.

END OF SECTION

C. Piping Tests:

1. Fill domestic water piping using clean, potable water. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. 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 hours. Leaks and loss in test pressure constitute defects that must be repaired.
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 for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 CLEANING

A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

B. Clean and disinfect potable domestic water piping prior to putting into service as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before use with clean, potable water.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. 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.

E. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

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 final inspection for 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 tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 4 and smaller. Use gate valves for piping NPS 5 and larger.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: MSS Type 1, adjustable, steel clevis hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved.

B. Install domestic water piping level and plumb.

C. Install piping concealed from view and protected from physical contact by building occupants 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. Do not install piping within electrical rooms, elevator equipment rooms, MDF or IDF rooms, or stairwells. Exception: Pipe supplying equipment serving the room. Maintain all required clearances to other equipment.

F. Do not install piping above electrical equipment such as transformers, panels, motor control centers, etc. in other rooms

G. Install piping adjacent to equipment and specialties to allow service and maintenance.

H. Install piping to permit valve servicing.

I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded

4. 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.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Description:

a. Pressure Rating: 150 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:

a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 150 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.

1.2 DEFINITIONS

A. Domestic Water: Includes softened and un-softened domestic hot and cold water.

1.3 SUBMITTALS

A. Product Data: For each type of pipe and joining material, and for method for joining piping intended for the project.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures. 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 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment. Reduce spacing to 5 feet when required by code.

B. Pipe Label Color Schedule:

1. Domestic Water Piping:

a. Background Color: Green.
b. Letter Color: White.

3.3 ADJUSTING AND CLEANING

A. Relocate plumbing identification materials and devices that have become visually blocked by other work.

B. Clean faces of plumbing identification devices.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING & EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.1 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. Strap-On Pipe Labels: Semirigid plastic formed to fit circumference of pipe and to attach to pipe with stainless steel worm-drive clamps.

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.

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 PIPE LABEL INSTALLATION

A. 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:

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3.2 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.3 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Wrap copper piping with not less than two layers of 10 mil. thick black plastic tape extending a minimum of 1 inch on each side of clamp for electrolytic protection where hangers or supports are in direct contact with copper piping.

D. Use carbon-steel pipe hangers and supports and attachments for general service applications. Provide galvanized coating on all hangers and supports outside the insulated building envelope.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

END OF SECTION

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

C. 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.

D. Install lateral bracing with pipe hangers and supports to prevent swaying.

E. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

SECTION 22 05 29

HANGERS & SUPPORTS FOR PLUMBING PIPING & EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Fastener systems.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For tapes, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label tapes with appropriate markings of applicable testing agency.

1. Tape Installed in Return Plenums: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Tape Installed Elsewhere: No testing requirement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers shall be one of the following unless noted otherwise:

1. Anvil International.
2. B-Line.
3. Elcen.
4. Grinnell.
5. Kin-Ling.
6. Michigan Hanger Co.
7. National Pipe Hanger Corp.
8. Pipe Technology Products.
9. PHD Manufacturing.
10. PHS Industries.
11. Unistrut.

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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. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 4 and Smaller:

1. Brass and Bronze Valves: NPS 2-1/2 and smaller may be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port.

END OF SECTION

4. Hammond Valve.
5. Milwaukee Valve Company.
6. NIBCO INC.
7. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2.2 BALL VALVES

A. Two-Piece, Full-Port Ball Valves with Bronze Trim:

1. Description:

a. Standard: MSS SP-110.
b. Compliance: ANSI/NSF 372 lead free.
c. SWP Rating: 150 psig.
d. CWP Rating: 600 psig.
e. Body Design: Two piece.
f. Body Material:

1) Valves 2 inches and smaller: Forged bronze.
2) Valves 2-1/2 inches and larger: Forged bronze or brass.

g. Ends: Soldered or threaded as indicated below.
h. Seats: PTFE or TFE.
i. Stem: Bronze or brass to match valve body.
j. Ball: Chrome-plated brass.
k. Port: Full.

PART 3 EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem and handle movement.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not otherwise indicated, use the following:

1. Shutoff Service: Ball valves.

SECTION 22 05 23

GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handlever: For quarter-turn valves NPS 4 and smaller except plug valves.

E. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

F. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Valve.
2. Conbraco Industries, Inc.; Apollo Valves.
3. FNW

PLUMBING ACCESSIBILITY / CLEARANCE CHECKLIST (See Paragraph 3.8.E)									
Bldg.	Location	Unit #	Acceptable Access		Conflict	Date	Action	Observer	
			Yes	No				Owner	Contractor

3.14 OBJECTIONABLE NOISE AND VIBRATION

A. Construct and brace piping systems to prevent vibration or rattling when systems are in operation. Install connections to equipment so noise and vibration will not reach the conditioned area through piping, conduit, or the building structure.

3.15 WELDING

A. Procedures:

1. All procedures and welders must be qualified in accordance with the requirements of Section IX, ASME Boiler and Pressure Vessel Code and ANSI code for power piping B31.1. Procedure qualification test records and acceptance shall be submitted with the welding procedure prior to the start of fabrication.
2. Architect's inspector or authorized representative will review performance qualification records of individual welders.

END OF SECTION

drawings. The Contractor shall obtain all certified rough-in information before progressing with any work for rough-in final connections.

B. Be responsible for providing all outlets and services of proper size at the required locations.

C. Minor changes in the contract drawings shall be anticipated and provided for under this contract.

1. Rough-in only (unless otherwise designated on the drawings) shall include providing all services as indicated and required, including all piping and valves. Valve and cap all piping stub-outs.

3.10 OWNER-FURNISHED AND OTHER EQUIPMENT

A. Rough-in only for all Owner-furnished equipment see Division 01 and all equipment furnished under other sections of the specifications, except as otherwise specified and/or noted on the drawings.

B. Provide all services designated, valve and cap all piping, and leave in a clean and orderly manner.

3.11 EQUIPMENT FINAL CONNECTIONS

A. Provide all piping final connections for all equipment under Division 22 and as indicated on the drawings.

3.12 CLEANUP

A. In addition to cleanup specified under Division 01, thoroughly clean all parts of the equipment and fixtures. Where exposed parts are to be painted, thoroughly clean off any splattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

B. Thoroughly flush and clean all water systems.

C. During the progress of the work, keep the premises clean and free of debris.

3.13 CONNECTIONS TO SERVICES

A. Provide all connections to sanitary sewer lines, storm water lines, gas lines, and water lines, except as otherwise specifically designated. Provide all necessary tees, taps and connections required to properly connect to all building services. Verify all requirements with civil drawings before making any piping connections to sanitary sewer, storm sewer, water or gas piping and conform to them during installation.

3.7 ACCESSIBILITY

A. Install valves, thermometers, gauges, traps, cleanouts, control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement conveniently and accessibly throughout the finished building. Where any of these devices are shown on the contract drawings to be installed above any inaccessible ceiling or behind any inaccessible wall, the Plumbing Contractor shall furnish access doors or panels as required.

B. All access doors or panels in walls and ceilings required for access to control devices, traps, valves and similar devices are to be furnished and installed as part of the work under this section. Provide type as specified under Division 08.

C. Refer to architectural drawings for type of wall and ceiling in each area and for rated construction.

D. Coordinate work of various sections to locate valves, traps, etc. with others to avoid unnecessary duplication of access doors.

E. The Contractor, along with the Owner's representative, shall complete the Plumbing Accessibility/Clearance Checklist at the end of this section for all plumbing equipment. The chart shall be submitted to the Architect for approval prior to substantial completion. All conflicts shall be resolved to the Architect's and Owner's satisfaction prior to submission.

3.8 PRODUCT AND EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. All equipment, valves, sensors, etc., shall be installed in strict conformance with the manufacturer's recommendations and all codes.

B. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

E. Install equipment to allow right-of-way for piping installed at required slope.

F. Do not install any equipment in an application not recommended by the manufacturer.

3.9 EQUIPMENT ROUGH-IN

A. Rough in all equipment and fixtures as designated on the drawings and in the specifications. The drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large-scale certified

3.2 RECORD DRAWINGS

A. Recording: Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

3.3 OPERATION AND MAINTENANCE MANUALS

A. Prepare Operation and Maintenance Manuals as directed for review by the Contractor, Owner, Architect, and Engineer.

B. Make corrections and resubmit as required.

3.4 VERIFICATION OF DIMENSIONS

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are essentially diagrammatic and many offsets, bends, special fittings and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact locations, routes, building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

3.5 CUTTING AND PATCHING

A. Cut work and patch per Division 01 as necessary to properly install the new work. As the work progresses, coordinate necessary openings, holes, chases, etc., in their correct location. If the required openings, holes and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Architect. Include as a part of the work all structural framing required by penetrations through the roof and necessary steel to support ducts and pipes between structural steel unless shown on the structural drawings.

3.6 CLOSING-IN OF UNFINISHED WORK

A. Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

2. Existing Piping: Where applicable, existing material may be reused in their original location unless otherwise indicated.

G. Testing: All existing services affected by the new construction and which are to remain in operation shall be returned to their original condition. The existing services shall be tested as new, as described in other sections of these specifications. If for any reason these requirements cannot be met, the Contractor shall immediately notify the Architect.

1.16 CONSTRUCTION FACILITIES

A. General: Under this division of the specifications, execute all work in a manner to provide safe and lawful ingress and egress to the Owner's establishment and such facilities shall be kept clear of materials or equipment. Refer to Division 01 for additional requirements.

B. Furnish and maintain from the beginning to the completion of all work all lawful and necessary guards, railings, fences, canopies, lights, and warning signs. Take all necessary precautions required by city and state laws to avoid injury or damage to any and all persons and property.

1.17 GUARANTEE

A. Guarantee all material, equipment, installation and workmanship for all sections under Division 22 in writing to be free from defects of material and workmanship for one year from date of final acceptance as outlined in Division 01. Equipment warranties shall be a minimum of two years from date of substantial completion or as specified elsewhere. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of the equipment under all conditions.

PART 2 PRODUCTS

2.1 EQUIPMENT DESIGN AND INSTALLATION

A. Design: Design all equipment in accordance with latest edition of ASME, AGA, UL and other applicable technical standards as follows:

1. Pressure Vessels: ASME Code constructed and stamped.
2. Electric Appliances: UL labeled.

PART 3 EXECUTION

3.1 SUBMITTALS

A. Prepare submittals as directed for review by the Contractor, Owner, Architect, and Engineer.

B. Submit one copy of PDF submittals via email, project website or other electronic media.

2. Installation of sleeves, inserts and anchors bolts for work under sections in Division 22.

1.15 EXISTING MATERIALS AND EQUIPMENT

A. Disposition: With the exception of items that are to be reused or retained by the Owner, all other materials indicated to be removed shall be removed and disposed of by the Contractor. Items that are indicated to be retained or returned to the Owner shall be delivered to a storage area designated by the Owner.

B. Unused Materials: All unused piping, controls and miscellaneous materials shall be removed by the Contractor except where located within walls, below or above existing construction which is not being altered and would require removal and replacement of this existing construction. All visible piping, etc., shall be removed and sealed or capped within wall, below floor, or above ceiling unless noted otherwise.

C. Exterior Services: The Contractor shall be responsible for maintaining plumbing services to the existing building during the construction period. Existing services are to be retained until such a time that the new services, if any, are completely installed and ready for use. Scheduling of service interruptions is to be coordinated with the Architect and Owner.

D. Disconnect, demolish, and remove plumbing systems, equipment, and components that are indicated to be removed.

1. Piping to be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material. Patch insulation, as required, to match adjacent areas.
2. Piping to be Abandoned In Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment and Fixtures to be Removed: Disconnect and cap services and remove equipment and fixtures.
4. Equipment and Fixtures to be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and fixtures; when appropriate, reinstall, reconnect, and make equipment fixtures operational.
5. Equipment and Fixtures to be Removed and Salvaged: Disconnect and cap services and remove equipment and fixtures, and deliver to Owner.

E. Continuity of Services in Existing Building: Contractor shall permanently reroute existing plumbing services or provide temporary connection as required to maintain service to existing fixtures in building which are to remain in service.

F. Rerouting and Relocation of Existing Plumbing Equipment and Services in Existing Building:

1. General: Contractor shall reroute, relocate all existing materials which are in conflict with the building alterations and which are required to be maintained in use.

6. Demonstration and training video recording, if available.

N. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

O. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

P. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

Q. Licenses: Include copies of any licenses with requirements including inspection and renewal dates.

R. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1.12 WORK AND MATERIALS

A. Unless otherwise specified, all materials must be new and of the quality specified. The workmanship shall be of a quality that is acceptable to the Architect, Engineer, and Owner, and is equal to the standards of the trades. Contractor must staff the project with sufficient skilled workmen, including a fully qualified construction superintendent, to complete the work in the time allotted. The superintendent must be qualified to supervise all of the work in his work category.

B. Uniformity: Unless otherwise specified, provide all equipment and products of same type or classification by the same manufacturer.

1.13 APPROVALS OF MATERIALS AND EQUIPMENT

A. Refer to Division 01 for description of material and equipment for prior approvals and substitutions.

1.14 COOPERATIVE WORK

A. Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration. See Division 01 for additional requirements.

B. Cooperative Work Includes:

1. General supervision and responsibility for proper location, rough-in and size of work related to Division 22 but provided under other divisions of these specifications.

b. Manufacturer's name.
c. Equipment identification with serial number of each component.
d. Equipment function.
e. Operating characteristics.
f. Limiting conditions.
g. Performance curves.
h. Engineering data and tests.

H. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures. Including precautions against improper use.
10. Operating logs.

I. Wiring Diagrams: Diagram of factory installed wiring including any options as well as any field modifications.

J. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

K. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification. Include valve locations and designations.

L. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

M. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.

B. Schedule:

1. Submit a preliminary copy of the manual not less than 30 days prior to substantial completion for review and comment.
2. Submit the final version the manual not more than four weeks after substantial completion of the project.

C. Format: Submit manuals in both of the following formats:

1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Engineer.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.
   c. Provide one final copy to Engineer and two copies to Owner.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer will return three copies.

D. Provide operating and maintenance manuals for all systems, subsystems, and equipment that requires operation and regular maintenance, or has replaceable parts.

E. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, product data, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below. In addition to requirements in this Section, include operation and maintenance data required in individual Specification Sections.

F. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

G. Product Data: Include the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Approved submittals.
3. Include the following if not shown on approved submittals:

   a. Product name and model number. Use designations for products indicated on Contract Documents.

1.10 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings, Submittals and Shop Drawings.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Include underground and overhead piping. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Include dimensions both horizontally and vertically to permanent points of reference accurate within 6 inches. Include descriptors such as "below slab", "above ceiling", etc.
   c. Record data daily or as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings, Submittals and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:

   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Engineer.
   e. Name of Contractor.

3. Remove or obscure Engineer's seal from Record Drawings.

1.11 OPERATION AND MAINTENANCE MANUAL

A. Prior to completion of the project, compile a complete equipment, operation and maintenance manual for all equipment supplied under Division 22.

b. Name of manufacturer.
c. Number and title of appropriate Specification Section.
d. Drawing number and detail references, as appropriate.
e. Other necessary identification.

E. Options:

1. Identify options requiring selection by the Engineer.
2. Identify options included with submittal item.

F. Deviations: Identify deviations from the Contract Documents on submittals.

1.8 MATERIAL SAFETY DATA SHEETS

A. Provide current, Material Safety Data Sheets (MSDS), for all hazardous chemicals that are proposed for use at the project site.

1. Provide one complete set to the Owner for review and approval a minimum of one week prior to the delivery of any hazardous chemicals to the site.
2. Maintain a second complete set at the project location, readily accessible by both the Owner's personnel and the contractor's personnel.

1.9 REQUEST FOR INFORMATION

A. Request for Information:

1. A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as RFI.
2. A properly prepared request for information shall include a detailed written statement of the clarification, apparent conflict, or information requested that indicates the specific drawings or specification in need of clarification and the nature of the clarification requested.

a. Drawings shall be identified by drawing number and location on the drawing sheet.
b. Specifications shall be identified by section number, page, and paragraph.

3. Include a proposed solution, where appropriate, based upon the field conditions and best knowledge of the Contractor.

B. Improper or Frivolous RFIs: RFIs which are not properly prepared or that request information which is clearly shown in the contract documents will be returned unanswered. Processing time for multiple submissions of improper or frivolous RFIs will be billed at the Engineer's standard hourly rate to the Owner who may deduct an equal amount from the monies due the Contractor.

1.6 DRAWINGS AND SPECIFICATIONS

A. Refer to Division 01 for additional information on submittals and shop drawings.

B. If a conflict exists on the drawings or between the drawings and specifications, promptly notify the Architect.

1.7 SUBMITTALS

A. Submittals are for information and coordination only. The Engineer will diligently review the submittals and attempt to verify compliance with the project requirements. Such review, however, does not constitute approval or disapproval of obligation to comply with all project requirements. The submittals are not to be construed to be contract documents. Any failure by the Engineer to note a point of non-compliance shall not be construed to be acceptance or approval of the discrepancy.

B. Product Information Sheets: Provide manufacturer's literature which includes the information required by the Product Data paragraph of the applicable Specification Section. Where Product Information Sheets show multiple models or options, clearly mark the model and options to be provided.

C. Assembly: Assemble all required submittal information for each specification section and submit in PDF format.

1. Assemble PDF submittals in one PDF file for each Division. Separate and order sections within each file by corresponding specification number. Provide bookmarks at the first page of each section and label each bookmark with the specification number and name to allow for easy navigation of the submittal.
2. Partial submittals will be returned without review.

D. Identification and Information:

1. Name the PDF file with the Project name, Division number and sequential submittal number. (I.E. The first submittal shall be No. 1; the second submittal shall be No. 2.)
2. Provide a cover sheet at the front of each submittal with the following information:

    a. Project name.
    b. Date.
    c. Name of Engineer.
    d. Name of Contractor.
    e. Name of subcontractor.

3. Provide a cover sheet at the front of each submittal section with the following information:

    a. Name of supplier.

SECTION 22 05 00

GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

A. Provisions of this section apply to all work specified in all sections under Division 22.

B. In addition, work in Division 22 is governed by the provisions of the Bidding Requirements, Contract Forms, General Conditions, and all sections under Division 01, General Requirements.

1.2 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, crawlspaces, and tunnels.

B. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

1.3 EXAMINATION OF PREMISES

A. Visit the site, verify all measurements and job conditions, and pay all costs necessary to perform the work.

1.4 PLUMBING CONTRACTOR

A. The Plumbing Contractor shall be licensed and hold a current contracting license that has been valid for a minimum of two years in the State of Arizona as a plumbing contractor.

1.5 REGULATIONS, PERMITS, FEES, CHARGES, INSPECTIONS

A. Regulations: Comply with all applicable codes, rules and regulations.

B. Fees and Permits: Pay all connection, installation, use, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 01.

C. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Architect with certificates of inspections and approvals by the local authorities in accordance with Division 01.

DIVISION 22 INDEX
LSW Project No. 2014-006.001

DIVISION 22

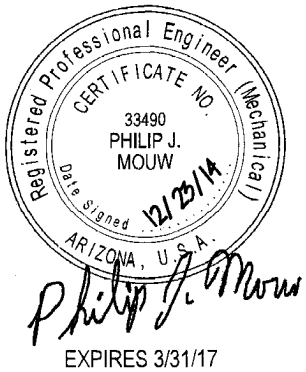
PLUMBING

22 05 00 Common Work Results for Plumbing

22 05 00 General Provisions
22 05 23 General Duty Valves for Plumbing Piping
22 05 29 Hangers & Supports for Plumbing Piping & Equipment
22 05 53 Identification for Plumbing Piping & Equipment

22 11 00 Facility Water Distribution

22 11 16 Domestic Water Piping



EXPIRES 3/31/17

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3.4 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Epoxy System MPI EXT 5.1F:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Topcoat: Epoxy, gloss, MPI #77.

END OF SECTION

C. Colors: Selected from Manufacturer's standard range to match the adjacent, painted screen walls.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

SECTION 09 96 00

HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

a. Steel.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Behr Process Corporation.
2. Benjamin Moore & Co.
3. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
4. Sherwin-Williams Company (The).

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

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DIVISION 09

FINISHES

09 96 00 High-Performance Coatings

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EXPIRES 3/31/17