



City of Tacoma Tacoma Public Library

REQUEST FOR BIDS LB21-0613F Library HVAC Replacement

Submittal Deadline: 11:00 a.m., Pacific Time, Tuesday, April 19, 2022

Submittals must be received by the City's Procurement and Payables Division prior to 11:00 a.m. Pacific Time. For electronic submittals, the City of Tacoma will designate the time of receipt recorded by our email, bids@cityoftacoma.org, as the official time of receipt. This clock will be used as the official time of receipt of all parts of electronic bid submittals.

Submittal Delivery: Sealed submittals will be received as follows:

By Email:

bids@cityoftacoma.org

Maximum file size: 35 MB. Multiple emails may be sent for each submittal

Bid Opening: Held virtually each Tuesday at 11AM. Attend <u>via this link</u> or call 1 (253) 215 8782. Submittals in response to a RFB will be recorded as received. As soon as possible on the day of submittal deadline, preliminary results will be posted to <u>www.TacomaPurchasing.org</u>.

Solicitation Documents: An electronic copy of the complete solicitation documents may be viewed and obtained at the City's plan distribution service provider, ARC, 632 Broadway, Tacoma, WA, or by going to http://www.e-arc.com/location/tacoma. Prospective bidders will be required to pay reproduction costs. A list of vendors registered for this solicitation is also available at their website.

Pre-Proposal Meeting: A pre-proposal meeting will be held on **Monday, April 11, 2022** at each of the locations involved, starting with **Fern Hill (765 S 84th St., Tacoma, WA 98444) at 8:30am.** Once all questions about Fern Hill have been answered, the meeting will move to Swasey (7001 6th Ave, Tacoma, WA 98406) and then to Wheelock (3722 N 26th St., Tacoma, WA 98407). Masks are recommended.

Project Scope: Replace HVAC systems at the Fern Hill, Swasey, and Wheelock library branches. Boiler replacement at Wheelock. Provide Mechanical, Electrical and Controls support work

Estimate: \$760,000

Paid Sick Leave: The City of Tacoma requires all employers to provide paid sick leave as set forth in Title 18 of the Tacoma Municipal Code. For more information, visit <u>our Minimum Employment Standards Paid Sick Leave</u> webpage.

Americans with Disabilities Act (ADA Information: The City of Tacoma, in accordance with Section 504 of the Rehabilitation Act (Section 504) and the Americans with Disabilities Act (ADA), commits to nondiscrimination on the basis of disability, in all of its programs and activities. Specification materials can be made available in an alternate format by emailing Gail Himes at ghimes@cityoftacoma.org, or by calling her collect at 253-591-5785.

Title VI Information: "The City of Tacoma" in accordance with provisions of Title VI of the Civil Rights Act of 1964, (78 Stat. 252, 42 U.S.C. sections 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin in consideration of award.

Additional Information: Requests for information regarding the specifications may be obtained by contacting Tina Eide, Senior Buyer by email to teide@cityoftacoma.org.

Protest Policy: City of Tacoma protest policy, located at www.tacomapurchasing.org, specifies procedures for protests submitted prior to and after submittal deadline.



Meeting sites are accessible to persons with disabilities. Reasonable accommodations for persons with disabilities can be arranged with 48 hours advance notice by calling 253-502-8468.

Table of Contents

Special Reminder to Bidders	4
Special Notice to Bidders	6
PART 1 - BID PROPOSAL AND CONTRACT FORMS	12
Pricing Sheet	13
Signature Page	15
Bid Bond	16
Certification of Compliance with Wage Payment Statutes	17
State Responsibility and Reciprocal Bid Preference Information	18
Sample Contract	19
Payment Bond	21
Performance Bond	23
General Release to the City of Tacoma	25
Record of Prior Contracts t	26
PART II – SPECIAL PROVISIONS	27
PART III – STATE PREVAILING WAGE RATES	286
PART IV – INSURANCE REQUIREMENTS	288
PART V – GENERAL PROVISIONS	293

SPECIAL REMINDER TO ALL BIDDERS

PLEASE NOTE: Be sure you have complied with all specifications and requirements and have signed all required documents.

YOUR ATTENTION IS PARTICULARLY CALLED to the following forms, which must be executed in full before the bid is submitted:

- 1. <u>BID PROPOSAL</u>: The unit prices bid must be shown in the space provided. Check your computations for omissions and errors.
- 2. <u>SIGNATURE PAGE</u>: To be filled in and executed by a duly authorized officer or representative of the bidding entity. If the bidder is a subsidiary or doing business on behalf of another entity, so state, and provide the firm name under which business is hereby transacted.
- 3. <u>BID BOND</u>: The Bid Bond must be executed by the person legally authorized to sign the bid, and must be properly signed by the representatives of the surety company unless the bid is accompanied by a certified check. If Bid Bond is furnished, the form furnished by the City must be followed; no variations from the language thereof will be accepted. The amount of the Bid Bond must be not less than 5% of the total amount bid. If submitting your bid electronically, a scanned version of the original bid bond must accompany your electronic bid submittal. The original bid bond shall be sent to the Contracting Agency and postmarked no later than the day of bid opening. Original bid bonds will be delivered to: City of Tacoma Procurement & Payables Division, Tacoma Public Utilities, P.O. Box 11007, Tacoma WA 98411-0007.
- 4. <u>CERTIFICATION OF COMPLIANCE WITH WAGE PAYMENT STATUTES</u>: Bidder shall complete this form in its entirety to ensure compliance with state legislation (SHB 2017).
- 5. <u>STATE RESPONSIBILITY AND RECIPROCAL BID PREFERENCE</u> <u>INFORMATION</u>: Bidder shall complete this form in its entirety to ensure compliance with state legislation (SHB 2010).

POST AWARD FORMS EXECUTED UPON AWARD:

- A. CONTRACT: Must be executed by the successful bidder.
- B. PAYMENT BOND TO THE CITY OF TACOMA: Must be executed by the successful bidder and his/her surety company.
- C. PERFORMANCE BOND TO THE CITY OF TACOMA: Must be executed by the successful bidder and his/her surety company.
- D. CERTIFICATE OF INSURANCE: Shall be submitted with all required endorsements.
- E. LEAP UTILIZATION PLAN: Shall be submitted at the Pre-Construction Meeting. DOES NOT APPLY
- F. GENERAL RELEASE.

<u>CODE OF ETHICS</u>: The successful bidder agrees that its violation of the City's Code of Ethics contained in TMC Chapter 1.46 shall constitute a breach of the contract subjecting the contract to termination.

CITY OF TACOMA FINANCE/PURCHASING DIVISION SPECIAL NOTICE TO BIDDERS

Public works and improvement projects for the City of Tacoma are subject to Washington state law and Tacoma Municipal Code, including, but not limited to the following:

I. STATE OF WASHINGTON

A. RESPONSIBILITY CRITERIA - STATE OF WASHINGTON

In order to be considered a responsible bidder the bidder must meet the following mandatory state responsibility criteria contained in RCW 39.04.350:

- 1. Have a current certificate of registration as a contractor in compliance with chapter 18.27 RCW, which must have been in effect at the time of bid submittal;
- 2. Have a current Washington Unified Business Identifier (UBI) number;
- 3. If applicable:
 - a. Have Industrial Insurance (workers' compensation) coverage for the bidder's employees working in Washington, as required in Title 51 RCW;
 - b. Have a Washington Employment Security Department number, as required in Title 50 RCW;
 - c. Have a Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW and;
- 4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 (unlicensed or unregistered contractors) or 39.12.065(3) (prevailing wage).
- 5. Have received training on the requirements related to public works and prevailing wage under this chapter and chapter 39.12 RCW and must designate a person or persons to be trained on these requirements. The training must be provided by the department of labor and industries or by a training provider whose curriculum is approved by the department. Bidders that have completed three or more public works projects and have had a valid business license in Washington for three or more years are exempt from this subsection.

B. RECIPROCAL PREFERENCE FOR RESIDENT CONTRACTORS:

Effective March 30, 2012, RCW 39.04.380 imposes a reciprocal preference for resident contractors. Any bid received from a non-resident contractor from a state that provides an instate percentage bidding preference is subject application of a comparable percentage disadvantage.

A non-resident contractor from a state that provides an in-state percentage bidding preference means a contractor that:

- 1. Is from a state that provides a percentage bid preference to its resident contractors bidding on public works projects, and
- 2. Does not have a physical office located in Washington at the time of bidding on the City of Tacoma public works project.

The state of residence for a non-resident contractor is the state in which the contractor was incorporated, or if not a corporation, the state in which the contractor's business entity was formed.

The City of Tacoma will evaluate all non-resident contractors for an out of state bidder preference. If the state of the non-resident contractor provides an in state contractor preference, a comparable percentage disadvantage will be applied to the non-resident contractor's bid prior to contract award. The responsive and lowest and best responsible bidder after application of any non-resident disadvantage will be awarded the contract.

The reciprocal preference evaluation does not apply to public works procured pursuant to RCW 39.04.155, RCW 39.04.280, federally funded competitive solicitations where such agencies prohibit the application of bid preferences, or any other procurement exempt from competitive bidding.

Bidders must provide the City of Tacoma with their state of incorporation or the state in which the business entity was formed and include whether the bidder has a physical office located in Washington.

The bidder shall submit documentation demonstrating compliance with above criteria on the enclosed State Responsibility and Reciprocal Bidder Information form.

C. SUBCONTRACTOR RESPONSIBILITY

- The Contractor shall include the language of this subcontractor responsibility section in each of its first tier subcontracts, and shall require each of its subcontractors to include the same language of this section in each of their subcontracts, adjusting only as necessary the terms used for the contracting parties. The requirements of this section apply to all subcontractors regardless of tier.
- 2. At the time of subcontract execution, the Contractor shall verify that each of its first tier subcontractors meets the following bidder responsibility criteria:
 - Have a current certificate of registration as a contractor in compliance with chapter
 18.27 RCW, which must have been in effect at the time of subcontract bid submittal;
 - b. Have a current Washington Unified Business Identifier (UBI) number;
 - c. If applicable, have:
 - a. Have Industrial Insurance (workers' compensation) coverage for the bidder's employees working in Washington, as required in Title 51 RCW;
 - b. A Washington Employment Security Department number, as required in Title 50 RCW:
 - c. A Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;
 - d. An electrical contractor license, if required by Chapter 19.28 RCW;
 - e. An elevator contractor license, if required by Chapter 70.87 RCW and;
- 3. Not be disqualified from bidding on any public works contract under RCW 39.06.010 (unlicensed or unregistered contractors) or 39.12.065(3) (prevailing wage).

II. CITY OF TACOMA

A. SUPPLEMENTAL RESPONSIBILITY CRITERIA - CITY OF TACOMA:

In order to be considered a responsible bidder, the prospective bidder shall have all of the following qualifications set forth in Tacoma Municipal Code 1.06.262:

- 1. Adequate financial resources or the ability to secure such resources;
- 2. The necessary experience, stability, organization and technical qualifications to perform the proposed contract;
- 3. The ability to comply with the required performance schedule, taking into consideration all existing business commitments;
- 4. A satisfactory record of performance, integrity, judgment and skills; and
- 5. Be otherwise qualified and eligible to receive an award under applicable laws and regulations.
 - a. Bidder Responsibility. Bidders shall not be in violation of 39.04.350 RCW Bidder Responsibility Criteria Supplemental Criteria.

In addition to the mandatory bidder responsibility criteria listed immediately above, the City may, in addition to price, consider any or all of the following criteria contained in Tacoma Municipal Code Chapter 1.06.262 in determining bidder responsibility:

- 1. The ability, capacity, experience, stability, technical qualifications and skill of the respondent to perform the contract;
- 2. Whether the respondent can perform the contract within the time specified, without delay or interference:
- 3. Integrity, reputation, character, judgment, experience, and efficiency of the respondents, including past compliance with the City's Ethics Code;
- 4. Quality of performance of previous contracts;
- 5. Previous and existing compliance with laws and ordinances relating to contracts or services:
- 6. Sufficiency of the respondent's financial resources;
- 7. Quality, availability, and adaptability of the supplies, purchased services or public works to the particular use required;
- 8. Ability of the respondent to provide future maintenance and service on a timely basis;
- 9. Payment terms and prompt pay discounts;
- 10. The number and scope of conditions attached to the submittal;
- 11. Compliance with all applicable City requirements, including but not limited to the City's Ethics Code and its Small Business Enterprise and Local Employment and Apprenticeship programs:
- 12. Other qualification criteria set forth in the specification or advertisement that the appropriate department or division head determines to be in the best interests of the City.

The City may require bidders to furnish information, sworn or certified to be true, to demonstrate compliance with the City responsibility criteria set forth above. If the city manager or director of utilities is not satisfied with the sufficiency of the information provided, or if the prospective respondent does not substantially meet all responsibility requirements, any submittal from such respondent must be disregarded.

B. ADDITIONAL SUPPLEMENTAL CRITERIA - NOT APPLICABLE

C. MODIFICATIONS TO SUPPLEMENTAL CRITERIA

Potential bidders may request modifications to the City's **supplemental criteria** by submitting a written request to the Purchasing Division via email to bids@cityoftacoma.org no later than 5:00 p.m. Pacific Time, three days prior to the submittal deadline. Please include the Specification No. and Title when submitting such requests. Requests must include justification for why certain criteria should be modified. Requests received after this date and time will not be considered.

The City will respond to a timely submitted request prior to the bid opening date. Changes to the supplemental criteria, if warranted, will be issued by addendum to the solicitation documents and posted to the City's website for the attention of all prospective bidders.

D. DETERMINATION OF BIDDER RESPONSIBILITY

If the City determines the bidder does not meet the criteria above and is therefore not a responsible bidder, the City shall notify the bidder in writing with the reasons for its determination. If the bidder disagrees, the bidder may appeal the determination in a manner consistent with the City's Protest Policy. Appeals are coordinated by the Purchasing Division heard by the Procurement and Payables Division manager for contracts less than or equal to \$500,000 and by Contracts and Awards Board for contracts greater than \$500,000.

1. INQUIRIES

Questions and request for clarifications of the scope of work may be submitted in writing by **3:00 PM**, **Pacific Time**, **Tuesday**, **April 11**, **2022**, to Tina Eide, Purchasing Division, via email to teide@cityoftacoma.org. No further questions will be accepted after this date and time. The City will not be responsible for unsuccessful submittal of questions.

Written answers to all questions submitted will be posted on the Purchasing website at www.TacomaPurchasing.org on or about **April 12, 2022**. The City reserves the discretion to group similar questions to provide a single answer or not to respond when the requested information is confidential. The answers are not typically considered an addendum.

2. DISCLAIMER

The City is not liable for any costs incurred by the Respondent for the preparation of materials or a proposal submitted in response to this RFB, for conducting any presentations to the City, or any other activities related to responding to this RFB, or to any subsequent requirements of the contract negotiation process.

3. RESPONSIVENESS

Bid submittals must provide ninety (90) days for acceptance by City from the due date for receipt of submittals. All submittals will be reviewed by the City to determine compliance with the requirements and instructions specified in this RFB. The Respondent is specifically notified that failure to comply with any part of this RFB may result in rejection of the submittal as non-responsive. The City reserves the right, in its sole discretion, to waive irregularities deemed immaterial. The City also reserves the right to not award a contract or to issue subsequent RFB's

4. AWARD

Award will be made to the lowest responsive, responsible bidder. All bidders shall provide unit or lump sum pricing for each line item. Each line item will be added up for a subtotal price. The subtotal price will be compared amongst each bidder, including any payment discount terms offered twenty (20) days or more. The City may also take into consideration all other criteria for determining award, including evaluation factors set forth in Municipal Code Section 1.06.262.

5. PAYMENT AND PERFORMANCE BOND

If a payment and performance bond is stated herein, the required bond will **be** including power of attorney, will be in 100 percent of the Contract total and is subject to the following requirements.

- 1. The City's payment and performance bond forms must be used.
- 2. The payment and performance bonds must be executed by a surety company licensed to do business in the state of Washington.
- 3. The cost of a payment and performance bonds must be included in submittal prices. Bonds will not be paid as a separate line item.
- 4. For a supply-type contract, a certified cashier's check or cash may be substituted for the bonds; however, this cash or check must remain with the City through the guarantee period and any interest on said amount shall accrue to the City.

6. WARRANTY

Labor: Minimum three (3) year warranty.

Parts: Manufacturer's warranty or minimum one-year warranty whichever is greater.

Contractor shall arrive on-site within 48 hours of notification for all warranty repairs during normal work hours of 8:00 a.m. to 5:00 p.m. Monday through Friday, or outside these hours by appointment.

Contractor agrees to allow TPL to make minor warranty repairs where that is most cost effective and, if requested, contractor will credit TPL for cost of parts, but not labor.

Vendor will warrant goods according to the manufacturer's warranty guidelines. The start of the warranty commences once the goods are delivered and accepted by the City.

7. INSPECTION

All goods are subject to final inspection and acceptance by the City. If any inspection fails, the vendor shall be required to make arrangements to exchange the goods at their own expense and replace it in a timely manner acceptable to the City.

Material failing to meet the requirements of this contract will be held at Vendor's risk and may be returned to Vendor. If so returned, the cost of transportation, unpacking, inspection, repackaging, reshipping, or other like expenses are the responsibility of the Vendor.

8. COMPLIANCE WITH SPECIFICATIONS

All products shall be new and unused. Any product that does not comply with any part of these technical specifications shall be rejected and the vendor shall, at its own expense, including shipping, replace the item.

9. MATERIALS AND WORKMANSHIP

The successful bidder shall be required to furnish all materials necessary to perform contractual requirements. Materials and workmanship for this contract shall conform to all codes, regulations and requirements for such specifications contained herein and the normal uses for which intended. Material shall be manufactured in accordance with the best commercial practices and standards for this type of goods. All literature and products must be packaged and labeled to sell in the United States.

10. ENVIRONMENTALLY PREFERABLE PROCUREMENT

In accordance with the City of Tacoma's <u>Sustainable Procurement Policy</u>, Tacoma Public Library encourages the use of products or services that help to minimize the environmental and human health impacts of library operations. Respondents are encouraged to incorporate environmentally preferable products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. This comparison may consider raw materials acquisition, products, manufacturing, packaging, distribution reuse, operation, maintenance or disposal of the product or service.

The Library encourages the use of sustainability practices and desires any awarded contractor(s) to assist in efforts to address such factors when feasible for:

- Reduction of pollutant releases
- Toxicity of materials used
- Waste generation
- Greenhouse gas emissions, including transportation of materials and services
- Recycle content
- Comprehensive energy conservation measures
- Waste manage reduction plans
- Potential impact on human health and the environment

PART I BID PROPOSAL AND CONTRACT FORMS

BID PROPOSAL

Wheelock

General Mechanical	\$
Demolition	\$
Mechanical Insulation	\$
Natural Gas Piping System	\$
Plumbing Equipment	\$
Hydronic Piping System	\$
Hydronic Piping System-CHS/CHR	\$
Hydronic Equipment	\$
Air Handling & HVAC Units	\$
Refrigerant Piping	\$
SA/RA/OA/Relief Duct Systems	\$
Exhaust Systems	\$
Duct Accessories	\$
Controls	\$
Balancing	\$
Commissioning	\$
Electrical	\$
Wheelock HVAC Replacement Total	\$

Swasey

General Mechanical	\$
Demolition	\$
Mechanical Insulation	\$
Natural Gas Piping System	\$
Plumbing Equipment	\$
Hydronic Piping System	\$
Hydronic Piping System-CHS/CHR	\$
Hydronic Equipment	\$
Air Handling & HVAC Units	\$
Refrigerant Piping	\$
SA/RA/OA/Relief Duct Systems	\$
Exhaust Systems	\$
Duct Accessories	\$
Controls	\$
Balancing	\$
Commissioning	\$

Electrical	\$
Swasey HVAC Replacement Total	\$
Fern Hill	
General Mechanical	\$
Demolition	\$
Mechanical Insulation	\$
Natural Gas Piping System	\$
Plumbing Equipment	\$
Hydronic Piping System	\$
Hydronic Piping System-CHS/CHR	\$
Hydronic Equipment	\$
Air Handling & HVAC Units	\$
Refrigerant Piping	\$
SA/RA/OA/Relief Duct Systems	\$
Exhaust Systems	\$
Duct Accessories	\$
Controls	\$
Balancing	\$
Commissioning	\$
Electrical	\$
Fern Hill HVAC Replacement Total	\$
Subtotal (Wheelock, Swasey, and Fern Hill	
totals)	\$

\$

Tax 10.3%

Total

SIGNATURE PAGE

CITY OF TACOMA Tacoma Public Library

All submittals must be in ink or typewritten, executed by a duly authorized officer or representative of the bidding/proposing entity, and received and time stamped as directed in the **Request for Bids page near the beginning of the specification**. If the bidder/proposer is a subsidiary or doing business on behalf of another entity, so state, and provide the firm name under which business is hereby transacted.

REQUEST FOR BIDS SPECIFICATION NO. LB21-0613F Library HVAC Replacement

The undersigned bidder/proposer hereby agrees to execute the proposed contract and furnish all materials, labor, tools, equipment and all other facilities and services in accordance with these specifications.

The bidder/proposer agrees, by submitting a bid/proposal under these specifications, that in the event any litigation should arise concerning the submission of bids/proposals or the award of contract under this specification, Request for Bids, Request for Proposals or Request for Qualifications, the venue of such action or litigation shall be in the Superior Court of the State of Washington, in and for the County of Pierce.

Non-Collusion Declaration

The undersigned bidder/proposer hereby certifies under penalty of perjury that this bid/proposal is genuine and not a sham or collusive bid/proposal, or made in the interests or on behalf of any person or entity not herein named; and that said bidder/proposer has not directly or indirectly induced or solicited any contractor or supplier on the above work to put in a sham bid/proposal or any person or entity to refrain from submitting a bid/proposal; and that said bidder/proposer has not, in any manner, sought by collusion to secure to itself an advantage over any other contractor(s) or person(s).

Bidder/Proposer's Registered Name		Signature of Per into Contracts fo			Date
Address		Printed Name a	nd Title		
City, State, Zip		(Area Code) Tel	ephone Num	ber / Fax Numb	oer
E-Mail Address E.I. No. / Federal Social Security Number Used on Quarterly		State Business in WA, also known a			Number
Federal Tax Return, U.S. Treasury Dept. Form 941		State Contracto (See Ch. 18.27,		umber	
ddendum acknowledgement #1#	‡2 <u> </u>	#3	#4	#5	

THIS PAGE MUST BE SIGNED AND RETURNED WITH SUBMITTAL.

Form No. SPEC-080A Revised: 04/07/2020

Α

Herewith find deposit in the form of a cashier's checamount is not less than 5-percent of the total bid.	ck in the amount of \$	which
	SIONLIEDE	
	SIGN HERE	
ВІ	D BOND	
KNOW ALL MEN BY THESE PRESENTS:		
That we,		, as Principal, and , as Surety, are held
and firmly bound unto the City of Tacoma, as Oblig		
and the Surety bind themselves, their heirs, execut severally, by these presents.	_	eayment of which the Principal sors and assigns, jointly and
The condition of this obligation is such that if the Ol	oligee shall make any award	I to the Principal for
according to the terms of the proposal or bid made and enter into a contract with the Obligee in according shall give bond for faithful performance thereof, a Principal shall, in case of failure to do so, pay and for in the call for bids, then this obligation shall be null effect and the Surety shall forthwith pay and forfeit to of this bond.	dance with the terms of said with Surety or Sureties apportent to the Obligee the penal I and void; otherwise it sha	d proposal or bid and award and proved by the Obligee; or if the all amount of the deposit specified II be and remain in full force and
SIGNED, SEALED AND DATED THIS	DAY OF	, 20
PRINCIPAL:	SURETY:	
		, 20
Received return of deposit in the sum of \$		
		

Form No. SPEC-090A Revised: 08/2004



Certification of Compliance with Wage Payment Statutes

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date, Tuesday, March 29, 2022, that the bidder is not a "willful" violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

I certify under penalty of perjury under the laws of the state of Washington that the

foregoing is true and correct. Bidder Signature of Authorized Official* Printed Name Title Date City State Check One: Corporation □ Individual □ Partnership □ Joint Venture □ State of Incorporation, or if not a corporation, the state where business entity was formed: If a co-partnership, give firm name under which business is transacted:

^{*} If a corporation, proposal must be executed in the corporate name by the president or vice-president (or any other corporate officer accompanied by evidence of authority to sign). If a co-partnership, proposal must be executed by a partner.

	Specification No.
	Name of Bidder:
State Responsibility and Reciprocal	Bid Preference Information
Certificate of registration as a contractor (Must be in effect at the time of bid submittal):	Number:
indet be in cheet at the time of bla cabilitary.	Effective Date:
	Expiration Date:
Current Washington Unified Business Identifier (UBI) Number:	Number:
(ODI) Number.	
Do you have industrial insurance (workers' compensation)	□ Yes □ No
Coverage nor your employees working in Washington?	☐ Not Applicable
Washington Employment Security Department Number	Number:
	□ Not Applicable
Washington Department of Revenue state excise tax	Number:
Registration number:	□ Not Applicable
	□ Not Applicable
Have you been disqualified from bidding any public	□ Yes □ No
works contracts under RCW 39.06.010 or 39.12.065(3)?	If yes, provide an explanation of your disqualification on a separate page.
Do you have a physical office located in the state of Washington?	□ Yes □ No
f incorporated, in what state were you incorporated?	State: Not Incorporated
	•
f not incorporated, in what state was your business entity formed?	State:

☐ Yes

□ No

Revised: 07/20/2007, 04/12/2012, 06/21/2019

Have you completed the training required by RCW

39.04.350, or are you on the list of exempt businesses maintained by the Department of Labor and Industries?

CONTRACT

Resolution No. Contract No.

This Contract is made and entered into effective this _____day of ,20 ____, ("Effective Date") by and between the City of Tacoma, a Municipal Corporation of the State of Washington ("City"), and legal name of Supplier including type of business entity ("Contractor").

That in consideration of the mutual promises and obligations hereinafter set forth the Parties hereto agree as follows:

- I. Contractor shall fully execute and diligently and completely perform all work and provide all services and deliverables described herein and in the items listed below each of which are fully incorporated herein and which collectively are referred to as "Contract Documents":
 - 1. Specification No. Enter Spec Number and Enter Spec Title together with all authorized addenda.
 - 2. Contractor's submittal (or specifically described portions thereof) dated Enter Submittal Date submitted in response to Specification No. Enter Spec Number and Enter Spec Title.
 - 3. Describe with specific detail and list separately any other documents that will make up the contract (fee schedule, work schedule, authorized personnel, etc.) or any other additional items mutually intended to be binding upon the parties.

Delete this highlighted sentence, paragraph II and sub-bullets #1 and #2 if there are no additional attachments to the contract (attachments would be things other than a specific, contract, or bonds).

- II. In the event of a conflict or inconsistency between the terms and conditions contained in this document entitled Contract and any terms and conditions contained the above referenced Contract Documents the following order of precedence applies with the first listed item being the most controlling and the last listed item the least controlling:
 - 1. Contract
 - 2. List remaining Contract Documents in applicable controlling order.
- III. The Contract terminates on xxxxx. [May remove if not applicable]
- IV. The total price to be paid by City for Contracts full and complete performance hereunder may not exceed:
 - \$, plus any applicable taxes.
- V. Contractor agrees to accept as full payment hereunder the amounts specified herein and in Contract Documents, and the City agrees to make payments at the times and in the manner and upon the terms and conditions specified. Except as may be otherwise provided herein or in Contract Documents Contractor shall provide and bear the expense of all equipment, work and labor of any sort whatsoever that may be required for the transfer of materials and for constructing and completing the work and providing the services and deliverables required by this Contract.
- VI. The City's preferred method of payment is by ePayables (Payment Plus), followed by credit card (aka procurement card), then Electronic Funds Transfer (EFT) by Automated Clearing House (ACH), then check or other cash equivalent. CONTRACTOR may be required to have the capability of accepting the City's ePayables or credit card methods of payment. The City of Tacoma will not accept price changes or pay additional fees when ePayables (Payment Plus) or credit card is used. The City, in its sole discretion, will determine the method of payment for this Contract.
- VII. Failure by City to identify a deficiency in the insurance documentation provided by Contractor or failure of City to demand verification of coverage or compliance by Contractor with these insurance requirements shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- VIII. Contractor acknowledges, and by signing this Contract agrees, that the Indemnification provisions set forth in the controlling Contract Documents, including the Industrial Insurance immunity waiver (if applicable), are totally and fully part of this Contract and, within the context of the competitive bidding laws, have been mutually negotiated by the Parties hereto.

Supplies_PurchasedServices_PW Template Revised: 06/21/2019

- IX. Contractor and for its heirs, executors, administrators, successors, and assigns, does hereby agree to the full performance of all the requirements contained herein and in Contract Documents.
- X. It is further provided that no liability shall attach to City by reason of entering into this Contract, except as expressly provided herein.

IN WITNESS WHEREOF, the Parties hereto have accepted and executed, as of the Effective Date stated above, which shall be Effective Date for bonding purposes as applicable.

CITY OF TACOMA:	CONTRACTOR:	
Ву:	By:	

(City of Tacoma use only - blank lines are intentional)

Director of Finance:
City Attorney (approved as to form):
Approved By:

Supplies_PurchasedServices_PW Template Revised: 06/21/2019



That we, the undersigned.

PAYMENT BOND TO THE CITY OF TACOMA

Resolution No. Bond No.

as principal, and			
as a surety, are jointly and several	ly held and firmly bound to th	ne CITY OF TACOMA, in th	e penal sum of,
\$, for the payment w	hereof Contractor and Sur	ety bind themselves,
their executors, administrators, leg	jal representatives, successo	ors and assigns, jointly and	severally, firmly by these presents.
This obligation is entered into	in pursuance of the statutes	of the State of Washington	, the Ordinances of the City of
Tacoma.	·	· ·	
WHEREAS, under and pursu about to enter with the above bou			y of Tacoma, the said City has or is
Specification No.			
Specification Title:			
Contract No.			

(which contract is referenced to herein and is made a part hereof as though attached hereto), and

WHEREAS, the said principal has accepted, the said contract, and undertake to perform the work therein provided for in the manner and within the time set forth.

This statutory payment bond shall become null and void, if and when the Principal, its heirs, executors, administrators, successors, or assigns shall pay all persons in accordance with RCW 39.08, 39.12, and 60.28, including all workers, laborers, mechanics, subcontractors, and materialmen, and all person who shall supply such contractor or subcontractor with provisions and supplies for the carrying on of such work, and all taxes incurred on said Contract under Titles 50 and 51 RCW and all taxes imposed on the Principal under Title 82 RCW; and if such payment obligations have not been fulfilled, this bond shall remain in full force and effect.

The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract shall in any way affect its obligation on this bond, and waivers notice of any changes, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increased obligation.

No suit or action shall be commenced hereunder by any claimant unless claimant shall have given the written notices to the City, and where required, the Contractor, in accordance with RCW 39.08.030.

The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of claims which may be properly filed in accordance with RCW 39.08 whether or not suit is commenced under and against this bond.

If any claimant shall commence suit and obtain judgment against the Surety for recovery hereunder, then the Surety, in addition to such judgment and attorney fees as provided by RCW 39.08.030, shall also pay such costs and attorney fees as may be incurred by the City as a result of such suit. Venue for any action arising out of or in connection with this bond shall be in Pierce County, WA.

Surety companies executing bonds must be authorized to transact business in the State of Washington as surety and named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Department of the Treasury.

Form No. SPEC-100B 04/09/2020

Resolution No.

Bond No.

Specification No.

Contract No.

One original bond shall be executed, and be signed by the parties' duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed power of attorney for the office executing on behalf of the surety.

Principal: Enter Vendor Legal Name	
By:	
Surety:	
	/
By:	
Agent's Name:	
Agent's Address:	

Form No. SPEC-100B 04/09/2020



Agent's Name: ___

PERFORMANCE BOND TO THE CITY OF TACOMA

Resolution No. Bond No.

That we, the undersigned, as principal, and as a surety, are jointly and severally held and firmly bound to the CITY OF TACOMA, in the penal sum of , for the payment whereof Contractor and Surety bind themselves, their executors, administrators, legal representatives, successors and assigns, jointly and severally, firmly by these presents. This obligation is entered into in pursuance of the statutes of the State of Washington, the Ordinances of the City of Tacoma. WHEREAS, under and pursuant to the City Charter and general ordinances of the City of Tacoma, the said City has or is about to enter with the above bounden principal, a contract, providing for Specification No. Specification Title: Contract No. (which contract is referenced to herein and is made a part hereof as though attached hereto), and WHEREAS, the said principal has accepted, the said contract, and undertake to perform the work therein provided for in the manner and within the time set forth. This statutory performance bond shall become null and void, if and when the principal, its heirs, executors, administrators, successors, or assigns shall well and faithfully perform all of the Principal's obligations under the Contract and fulfill all terms and conditions of all duly authorized modifications, additions and changes to said Contract that may hereafter be made, at the time and in the manner therein specified; and if such performance obligations have not been fulfilled, this bond shall remain in force and effect. The Surety for value received agrees that no change, extension of time, alteration or addition to the terms of the Contract, the specifications accompanying the Contract, or to the work to be performed under the Contract shall in any way affect its obligation on this bond, and waives notice of any change, extension of time, alteration or addition to the terms of the Contract or the work performed. The Surety agrees that modifications and changes to the terms and conditions of the Contract that increase the total amount to be paid the Principal shall automatically increase the obligation of the Surety on this bond and notice to Surety is not required for such increase. If the City shall commence suit and obtain judgment against the Surety for recovery hereunder, then the Surety, in addition to such judgement, shall pay all costs and attorney's fees incurred by the City in enforcement of its rights hereunder. Venue for any action arising out of in in connection with this bond shall be in Pierce County, Washington. Surety companies executing bonds must be authorized to transact business in the State of Washington as surety and named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Department of the Treasury. One original bond shall be executed, and signed by the parties' duly authorized officers. This bond will only be accepted if it is accompanied by a fully executed power of attorney for the office executing on behalf of the surety. Principal: Enter Vendor Legal Name Surety:

Form No. SPEC-100A 04/09/2020

Agent's Address:	
igonico / idanoco.	

Form No. SPEC-100A 04/09/2020

GENERAL RELEASE TO THE CITY OF TACOMA

The undersigned, named as the con	ntractor for	
between(Themselves or Itself)	and the City of T	
(Themselves or Itself)	, 20, hereby releases	the City of
Tacoma, its departmental officers and age	nts from any and all claim	or claims
whatsoever in any manner whatsoever at a	any time whatsoever arisin	g out of and/or in
connection with and/or relating to said con	ntract, excepting only the	equity of the
undersigned in the amount now retained b	y the City of Tacoma und	er said contract, to-
wit the sum of \$	<u></u>	
Signed at Tacoma, Washington this	day of,	20
	Contractor	
	Contractor	
	By	
	Title	

RECORD OF PRIOR CONTRACTS

NAME		ADDRESS		
Type of Work	:	Specification No.		
Beginning Date	Completion Date	Contract With	Contact Person Phone #	Amount of Contract
Remarks:				
	·			

Form No. SPEC-160A Revised: 01/2006

PART II

SPECIAL PROVISIONS

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

DIVISION 01	- GENERAL REQUIREMENTS	
01 01 00	Summary of Work	. 5
01 04 50	Cutting, Patching, and Repairing	. 5
01 09 00	Reference Standards, Abbreviations, and Definitions	13
01 20 00	Coordination and Meetings	. 4
01 34 00	Submittals	. 5
01 34 50	Progress Schedule	
01 37 00	Schedule of Values and Application for Payment	. 3
01 50 00	Construction Facilities and Temporary Controls	
01 60 00	Material and Equipment	. 6
01 61 00	Substitution Request Form	. 1
01 70 00	Contract Closeout	. 9
DIVISION 09	- FINISHES	
09 00 00	General Building Materials	. 5
DIVISION 20	- GENERAL MECHANICAL	
20 02 00	Operation and Maintenance Manual for Mechanical	. 2
20 05 00	Common Work Results for Mechanical	
20 05 03	Existing Systems Work for Mechanical	
20 05 19	Piping Specialties for Mechanical	
20 05 29	Hangers and Supports for Mechanical	
20 05 30	Sleeves and Seals for Mechanical	
20 05 48	Vibration Controls for Mechanical	. 3
20 05 93	Testing, Adjusting, Balancing for Mechanical	
20 07 00	Mechanical Insulation	
DIVISION 23	- HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	
23 09 00	Instrumentation and Control for HVAC	. 2
23 11 23	Facility Natural Gas Piping	
23 21 13	Hydronic Piping	
23 21 15	Mechanically Coupled Piping	. 6
23 21 23	Hydronic Pumps	
23 21 28	HVAC Condensate Piping	
23 21 29	Combustion Condensate Piping	. 4
23 31 00	HVAC Ducts and Casings	. 8
23 33 00	Duct Accessories	. 5
23 52 16	Condensing Boilers	. 8
23 65 01	Cooling Tower Refurbishment	. 6
23 81 44	Air-Source Split-System Heat Pumps	
23 81 46	Water-Source Unitary Heat Pumps	. 6
DIVISION 25	- INTEGRATED AUTOMATION	
25 50 00	Integrated Automation Facility Controls	. 8
25 90 00	Integrated Automation Control Sequence	. 8
DIVISION 26	- ELECTRICAL	
26 01 00	Electrical General Requirements	
26 04 00	Electrical Demolition	
26 05 00	Basic Materials and Methods	
26 05 26	Grounding and Bonding	
26 29 00	Motor Control	
	- ELECTRONIC SAFETY AND SECURITY	
28 31 00	Addressable Fire Alarm System	_

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Work Description.
- B. Use of Premises.
- C. Protection of Property.
- D. Owner Occupancy.
- E. Time of Completion.

1.02 RELATED REQUIREMENTS

- A. Instructions to Bidders.
- B. Agreement Form.
- C. General and Supplementary General Conditions.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. The work of this Contract comprises the replacement of HVAC equipment at three Libraries with new equipment for the Tacoma Public Library. Work involves general contractor work, HVAC work, piping work, controls work, balancing work, and electrical work.
 - 1. Fern Hill Library: Replace four split system air to air heat pumps with new.
 - 2. Swasey Library: Replace three split system air to air heat pumps with new.
 - 3. Wheelock Library: Replace eight water source heat pumps with new, refurbish the fluid cooler, replace the electric boiler with two new gas boilers, and replace water circulating pumps with new.
- B. The above is a summary description only. Provide for the work as shown in the Contract Documents including all labor, materials, equipment, transportation and services required to complete the project.

1.04 CONTRACT METHOD

A. Construct the Work under a single fixed-price contract, which includes general, mechanical and electrical work.

1.05 CONTRACTOR'S USE OF PREMISES

A. Confine all materials, equipment, storage, staging areas, refuse, employee parking to within the extent of work line established at the building area. Where the extent of the work line is not clear to the Contractor, or if areas outside the work line are needed, coordinate and discuss with the Architect/Engineer to obtain clarification and approval. Secure Architect/Engineer's approval for any areas of question. The building will remain in use by Owner and shall not be used by the Contractor other than for the work of this

project.

- B. Schedule any work outside the extent of the work line at the convenience of the Owner and take measures to insure the safety of the Owner's employees and the public.
- C. Fill all trenches crossing traffic lanes and sidewalks on a daily basis to restore a drivable/walkable surface. Leave no open trenches or excavations unprotected.
- D. Before starting the work, establish with the Owner and Architect/Engineer (and with their approval), the point of entry to each site and the route within the site that may be used by Contractor's personnel to gain access to the work area.
- E. Conduct all operations in such a manner as to avoid damage to existing structures, walks, curbs, paving, grass areas, plantings, etc., that are to remain. Damaged items shall be replaced to match pre-construction conditions.
- F. Provide the necessary protection and replace, repair or restore all damaged surfaces to their original condition; the expense of such work shall be borne by the Contractor.
- G. Perform operations in such a manner and sequence that interference with the operations and activities of the Owner is kept to an absolute minimum.
- H. Coordinate with Owner utility tie-ins and work requiring access closures to minimize impact to Owner's normal operations.
- I. Contractor shall limit his use of the premises for Work and for storage, to allow for:
 - 1. Owner occupancy of existing buildings.
 - 2. Public use of existing buildings, parking lots and grounds.
 - 3. Public use of all roadways.
 - 4. Minimize downtime of mechanical and electrical systems.
- J. Assume full responsibility for the protection and safekeeping of products under this Contract, stored and installed on the site.
- K. Move any stored products, under Contractor's control, which interfere with operations of the Owner.
- L. Obtain and pay for the use of additional storage or work areas needed for operations.
- M. Control dust, heat, smoke, water and pollutants as required by Agencies having jurisdiction.
- N. Complete cleanup of all construction area, both inside and outside of the building, and retrieval of any litter material from construction which has spread off-site.
- O. Remove all waste material resulting from construction, as it occurs, to prevent accumulation; dispose of off-site at Contractor's expense.
- P. Provide security of the building at Contractor's work (and material storage) areas.

Q. See also Section 01 50 00 for Construction Facilities and Temporary Controls and Division 23, 26.

1.06 PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the protection of all existing utilities, pavement and structures on or adjoining the premises, whether shown on drawings or not. In the event of damage, such items shall be immediately repaired or replaced by the Contractor at his expense to the satisfaction of the Owner.
- B. The Contractor shall be responsible for the protection of all existing property, equipment and system in the building and in the vicinity of the work from damage due to the work.

1.07 ACCEPTANCE OF SITE

A. Contractor shall accept site in an "as-is" condition.

1.08 OWNER OCCUPANCY

A. Owner will occupy the building during the project. Contractor must coordinate with the Owner and Architect/Engineer to avoid interfering with building use.

1.09 WORK RESTRICTIONS

- A. On-Site Work Hours: See plans for normal work hours. Work will not be permitted during holidays.
- B. Hours for Utility Interruptions: All utility interruptions shall be scheduled outside of normal library hours and shall be agreed upon and coordinated with the Owner. Any utility interruptions longer than one hour require prior Owner's approval. Notify Owner a minimum of three working days (72 hours minimum) in advance. Do not proceed with utility interruptions without Owners written permission.
- C. Hours for Noise Generating Work: Noisy work, including concrete drilling, saw-cutting, and similar noisy work shall not be performed during posted Library operation hours, without prior Owner approval (and requirements of authority having jurisdiction). Notify Owner a minimum of three working days (72 hours minimum) in advance and obtain permission.

1.10 TIME OF COMPLETION

- A. General: Time is of the essence in the execution of this contract. Construct work to accommodate Owner use of premises during construction and to be complete at the time agreed to in the Contract; see Division 00 for Contract Time.
- B. Substantial Completion: "Substantial Completion" is defined to mean when all equipment is completely connected up and ready to operate for the purpose intended. Final operator training and representative testing is immediately ready to occur as of this date. Contractor shall notify Engineer when he feels he is substantially complete to allow for review.
- C. Punchlist: Engineer will develop a project list of correction items once project is agreed to be substantially complete. Punchlist items shall be corrected within the time period indicated on the bid form.

D. Final Completion: This includes all punchlist items, O&M Manuals, final affidavit of wages paid, record drawings, and all related close-out documentation. Final completion shall be completed within the time period indicated on the proposal form.

1.11 CONTRACTOR/SUBCONTRACTOR WORK

- A. General: The procedure followed by the Architect/Engineer has been to contact governing authorities where necessary to obtain information needed for the purpose of preparing Contract Documents; recognizing that such information may or may not be of significance in relation to the Contractor's responsibilities for performing the Work. All trades shall contact governing authorities directly for necessary information and decisions having a bearing on performance of the Work.
- B. Trade Union Jurisdictions: The Contractor shall maintain, and shall require all trades to maintain complete current information on jurisdictional matters, regulations, actions and pending actions, as applicable to the Work. Discuss new developments at appropriate project meetings at the earliest feasible dates. Record information of relevance along with the actions agreed upon. The manner in which Contract Documents have been organized and subdivided is not intended to be an indication of jurisdictional or trade union agreements. Assign and subcontract the work, and employ tradesmen and laborers, in a manner which will not unduly risk jurisdictional disputes of a kind which could result in conflicts, delays, claims and losses in the performance of the Work.
- C. Submittals: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, in conjunction with compliance with standards and regulations bearing upon performance of the Work.

1.12 TRAFFIC WAYS

- A. Conduct work to ensure minimum interference with adjacent roads, streets, and walks. Do not close or obstruct roads, streets, walks or other occupied or used facilities without permission from the Owner authorities having jurisdiction.
- B. Provide alternate routes around closed or obstructed traffic ways (or portions of) as required by the Owner and governing authorities to ensure safe site entry/exit and allow as close to normal traffic flows as possible. Provide signage and flaggers as required.

1.13 ARCHITECT/ENGINEER REVIEWS

A. General:

- 1. Reviews: The Contract Documents require periodic reviews of the Work by the Architect/Engineer. These reviews include (but are not limited to): reviews of work prior to being concealed, witnessing of system tests (e.g. pressure tests, duct leakage test, voltage drop, control sequence reviews, functional tests, etc.), mock-up reviews, punchlist reviews, and related review activities. See individual specification sections for required reviews.
- Schedule: The Construction schedule shall be developed to allow time for these reviews and timely notifications to the Architect/Engineer. The schedule shall accommodate Architect/Engineer's schedule and the possibility of review times occurring up to 14 days after notification, and for the possible failure to satisfactorily pass Architect/Engineer's reviews requiring revisions and re-reviews.

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

- B. Notification: Notify Architect/Engineer at least 7 days in advance of readiness for reviews and arrange mutually agreed upon times for the reviews to occur.
- C. Access: Provide ladders, any special tools and safety equipment to allow Engineer's access to areas and equipment. Remove and reinstall ceiling tiles, access panels, and similar items where requested to allow for reviews.
- D. Re-Review Fees: The project budget allows for one review by the Architect/Engineer for specified reviews. The Architect/Engineer shall be compensated for additional reviews required due to failed work or failed tests; such compensation will include travel time and mileage and be billed at the Architect/Engineer's current billing rates.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

A. This Section establishes general requirements pertaining to cutting, patching, and repairing as required to accomplish the Work.

1.03 RELATED REQUIREMENTS

- A. Section 01 01 00 Summary of Work.
- B. Section 01 60 00 Material and Equipment.
- C. Division 20 General Mechanical.
- D. Division 23 HVAC.
- E. Division 25 Integrated Automation.
- F. Division 26 Electrical.
- G. Division 28 Electronic Safety and Security.

1.04 SUBMITTALS

- A. General: Comply with Section 01 34 00.
- B. Product Data: Submit product data on all products to be used (where not specified or submitted under another Section covering the work).
- C. Non Contract Cutting/Alterations:
 - 1. General: Submit a written request to Architect/Engineer well in advance of executing any cutting or alteration not indicated in the Contract Documents which affects:
 - a. Work of the Owner or any other person not under the Contractor.
 - b. Structural value or integrity of any element of the Project.
 - c. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
 - d. Efficiency, operational life, maintenance or safety of operation elements.
 - e. Visual qualities of sight-exposed elements.
 - 2. Request shall include:

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

- a. Identification of the Project.
- b. Description of affected work.
- c. The necessity for cutting, alteration or excavation.
- d. Effect of work on related areas or trades.
- e. Description of proposed work:
 - 1) Scope of cutting, patching, alteration, or excavation.
 - 2) Trades who will execute the work.
 - 3) Products proposed to be used.
 - 4) Extent of refinishing to be done.
- f. Alternatives to cutting and patching.
- g. Cost proposal, when applicable.
- Written permission of any separate contractor whose work will be affected.
- i. Date and the time of the proposed work.
- D. Substitutions: Should conditions of work or the schedule indicate a change of products from original installation, Contractor shall submit request for substitution as specified in Section 01 60 00 Material and Equipment.

1.05 GENERAL REQUIREMENTS

- A. General: Provide all labor and materials for the work, so as to:
 - 1. Make the several parts fit properly.
 - 2. Accommodate the work of all trades.
- B. Existing Construction:
 - 1. Remove and replace existing construction as required to accomplish the Work. Not all required removal, cutting, patching is indicated on the plans.
 - 2. Provide all required openings and provisions in structures for the installation of the work. Cutting and patching that is necessary to admit work, repair defective work, or by neglect of subcontractors to properly anticipate their requirements, shall be done at no cost to the Owner.
- C. Work Removal: Uncover work to provide for inspection, installation, or both, of ill-timed work. Remove and replace defective work or work not conforming to the requirements of the Contract.
- D. Repairs: Repair work of new construction, removal of existing material, or existing

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

material to remain, damaged during construction.

- E. Trades: Unless otherwise noted, each trade shall be responsible for cutting, patching and repairing of existing materials where altered to allow installation of new work. Removal of existing material in areas which are not scheduled for new work, other than cosmetic finishing, shall have any resulting opening repaired by patching. Removal of existing material shall be complete.
- F. Site Work: Each trade shall do all cutting through existing conditions for site related work and provide trenching, compacted backfill or other work as necessary and in accordance with WSDOT Standards (unless indicated otherwise). The same trade shall patch, repair, replace and restore the area of work as necessary to comply with the Contract Documents.
- G. Patching: If patching is not proper, or does not occur, the Contractor shall resolve the dispute internally or do the patching, all at no cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Comply with specifications, manufacturer's requirements, and standards for each specific product involved.
- B. Patching and Repair Materials: Patching shall be with materials of like kind and quality of the adjoining surface by skilled labor experienced in that particular trade.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Existing Conditions: Inspect existing conditions to confirm extent of the work, locations of existing systems, existing building materials, existing construction, areas where cutting and patching is required, site access, elements subject to damage or to movement during the work, and other aspects of existing building and systems and their relationship to the work.
- B. Uncovered Areas: After uncovering areas where work will occur, inspect conditions affecting installation of products, or performance of the work.
- C. Notice: Provide Architect/Engineer twenty-four (24) hours notice of intention to cover any work. If the law or ordinance of any public authority, or the requirements of any utility company, requires any work to be inspected, tested or approved, the Contractor shall arrange and pay for such inspection or test. Any work covered up without proper notification or required inspection shall, upon request of the Architect/Engineer, be uncovered for inspection and recovered when approved, at no expense to the Owner.
- D. Document Review: Carefully review all Drawings and specifications to determine areas of work and overall project requirements. Coordinate and confirm trades responsible for the project cutting and patching.

3.02 PERFORMANCE

- A. Execute cutting and demolition by methods which prevent damage to other work, and provide proper surfaces to receive installation of repairs.
- B. Execute excavating and backfilling by methods which prevent settlement or damage to other work.
- C. Employ original Installer or Fabricator to perform cutting and patching for:
 - 1. Weather-exposed or moisture-resistant elements.
 - 2. Sight-exposed finished surfaces.
- D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.
- E. Restore work which has been cut or removed; install new products to provide complete Work in accordance with requirements of Contract Documents.
- F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- G. Make no cuts or alterations to any structural framing members without explicit consent of the Architect/Engineer, and then only under his direction. Assume all building members are "structural" unless clearly evident otherwise. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. All required cutting to install new material shall be accomplished with the use of saw cutting equipment. Breaking out of existing material is not permitted.
- H. Wherever floors, walls, ceilings, plates, firestops and framing members are cut, these openings shall be reinforced and sealed as directed to maintain structural integrity and to comply with Code requirements.
- Contractor shall be held fully responsible for any weather and water damage occurring to existing buildings and their contents due to his failure to provide adequate temporary weatherproofing protection.
- J. Painting of damaged or changed existing surfaces shall match adjacent areas including the entire plane of a surface when part of the surface is damaged or changed.
- K. Where existing construction is removed to provide working access to areas previously concealed, the Contractor shall remove doors, partitions, walls, ceiling systems, piping, conduit outlet boxes, wiring, light fixtures, ductwork and equipment, etc., to provide this access and shall reinstall the same (or new materials, equipment or systems as approved by the Architect/Engineer) upon completion of work in the areas affected, and all exposed new surfaces shall be restored to a condition equal or better than the original existing condition.
- L. Protection: Protect existing items against damage, and maintain areas free from water, dust, and other damaging effects. Where necessary to prevent damage or necessary to accomplish other work:
 - 1. Provide suitable barriers, filters, or other protective methods.
 - 2. Disconnected and move furnishings, equipment and similar items to a suitable protective storage location during the project and then reinstall to their original

location.

- M. Utilities and Building Systems: Maintain existing utilities and building systems in service (unless indicated otherwise) and protect from damage during project. Where utilities or building systems must be shut-off to accomplish the work, see drawing notes, Divisions where the system are specified, and Division 01 for downtime limitations and Owner coordination and notification requirements. Coordinate interruptions with all trades.
- N. Patching: Patch all wall/floor/ceiling/roof openings left by removal of existing items where wall/floor/ceiling/roof is to remain. Patch with materials and workmanship so as to match finish of adjacent undisturbed area, and to provide conditions equivalent to the original new construction. Such patching will be required at all locations where existing items are removed and will typically include (at each location): new flooring, new base trim, new painting at all adjoining surfaces, new ceiling tile (for ceiling items), and building infill (at voids/openings where items have been demo'd).
- O. Disposal: Dispose of all demolished items and all waste materials off site in accordance with code and legal requirements.

END OF SECTION

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

- A. Definitions, acronyms used to identify reference standards and abbreviations which may be in the Contract Documents.
- B. Specification conventions.

1.03 QUALITY ASSURANCE

- A. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
- B. Publication Date: The latest published or adopted editions in effect on the date of issue of Contract Documents, except when a specific date (or edition) is referenced.

1.04 DEFINITIONS

- A. Abbreviations and Terms: The following definitions, of terms or words which may be used in the Contract Documents, are in addition to those stated elsewhere in the Contract Documents. Where not defined elsewhere in the Contract Documents, the abbreviations and terms shall be as defined in RS Means Illustrated Construction Dictionary, Fourth Addition, and in the ASHRAE Handbook of Fundamentals, Latest Edition.
- B. Where the words "approved", "or approved", "approved equal", "as approved" or "for approval" are used, means the approval or acceptance as determined solely by the Architect/Engineer unless a specific reference is made to another entity.
- C. The term "Architect," "Architect/Engineer" or "Engineer," means Hultz/BHU Engineers, 1111 Fawcett Avenue, Suite 100, Tacoma, WA, 98402.
- D. "As required" means "as necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all codes."
- E. "Concealed" means "hidden from view" as determined when areas are in their final finished condition, from the point of view of a person located in the finished area. Items located in areas above suspended ceilings, in plumbing chases, and in similar areas are considered "concealed." Items located in cabinet spaces (e.g. below sinks) are not considered concealed.
- F. "Coordinate" means "to accomplish the work with all others that are involved in the work by: directly discussing the work with them, arranging and participating in special meetings with them to discuss and plan the work being done by each, obtaining and completing any necessary forms and documentation required for the work to proceed, reaching agreement on how parts of the work performed by each trade will be installed relative to each other both in physical location and in time sequence, exchanging all necessary

information so as to allow the work to be accomplished with a united effort in accordance with the project requirements".

- G. The words "cut" or "cutting" means saw cut in a manner to allow for a neat and straight finished installation, unless other neat and straight line methods of removal are approved by the Architect/Engineer.
- H. "Finished Areas" means "areas receiving a finish coat of paint on one or more wall surface."
- I. "Furnish" means "purchase, pay for, receive and/or store the material, item or equipment at the Site ready for installation or erection" unless specifically noted otherwise.
- J. "Install" means "pay for, and do all work necessary for installing and/or erecting and/or connecting the item or material complete in place", unless specifically noted otherwise.
- K. The words "local jurisdiction", "Authority Having Jurisdiction" and "AHJ" mean governmental or other agency with authority regarding construction of the Project.
- L. The term "Owner", as used herein, shall mean as defined in Division 00 and "the appointed representative(s) of "Tacoma Public Library" for this project."
- M. "Product" includes materials, systems and equipment.
- N. "Provide" means "furnish, install, and pay for, complete in place".
- O. The term "related documents" (as used at the beginning of each specification section), and the Specification Divisions and Sections listed with it, is only an indication of some of the specification sections which the work of that section may be strongly related to. Since all items of work relate to one another and require full coordination, all specification sections, as listed in the Table of Contents, shall be considered as being "related documents", and shall be considered (by this reference) in the same manner as if they had all been listed under the term "related documents" in each specification section.
- P. Where the words "similar to" are used and followed by a manufacturers name and product, model, or type number, such manufacturer, product, model or type number shall be considered as the standard of quality for the product or work specified, in a general and technical sense, not meaning "identical".
- Q. "Trade" means "an individual or group of people providing materials and/or labor on this Project".
- R. "Verify" means "Contractor shall obtain, by methods independent of the project Architect/Engineer and Owner, the information noted and the information needed to properly perform the work".
- S. "Work included" (as used at the beginning of each specification section), and the items listed with it, is only an indication of some of the items specified in that Section and is in no way limiting the work of that Section. See complete drawings and specifications for all required work.

1.05 SPECIFICATION CONVENTIONS

A. General: The specifications are addressed to the Contractor who is legally responsible

for constructing the project. The Contractor shall furnish, install or provide, as applicable, all items and perform all operations, services, and incidentals required for completion of the Work.

- B. Writing Style: These Specifications are written in the imperative mood in most cases, in an abbreviated or "streamlined" fashion, and frequently include incomplete sentences. In sections or parts of Sections written in the imperative mood, words such as "shall", "shall be", "the Contractor shall", and similar mandatory phrases and the words "of", "the", "a", "an", and "all", shall be supplied by inference, in the same manner as for notes on the Drawings. The words "Contractor shall" are removed in most cases, and are implied to be inserted after colons where the colons are used in specification paragraphs defining products or executable tasks.
- C. Singular Reference: Wherever in these documents an article, device or piece of equipment is referred to in the singular number, such reference shall mean to include as many such articles as are shown on the drawings or are required to complete the installation.
- D. Installation Requirement Abbreviations: For purposes of abbreviation, the words "install" and/or "erect" and/or "connect" and/or "apply" in accordance with the manufacturer's written recommendations shall not, in all cases, be repeated hereinafter in these specifications. However, in all cases, each and every item, material and/or equipment shall be installed and/or erected and/or connected and/or applied strictly in accordance with the manufacturer's written recommendations.

1.06 REFERENCE STANDARDS

A. Applicable standards and codes listed include, but are not necessarily limited, to standards promulgated by the following agencies and organizations, and may be used in the Contract Documents. Obtain copies of referenced standards direct from publication source, when needed for proper performance of work, or when required for submittal by Contract Documents:

AABC Associated Air Balance Council

1518 K Street NW Washington, D.C. 20005

ACI American Concrete Institute

38800 Country Club Drive Farmington Hills, MI 48331

AHRI Air-Conditioning, Heating, and Refrigeration Institute

2111 Wilson Blvd., Suite 500

Arlington, VA 22201

AIA American Institute of Architects

1735 New York Ave. N.W. Washington, D.C. 20006

AISC American Institute of Steel Construction

One East Wacker Drive, Suite 700

Chicago, IL 60601-1802

AISI American Iron and Steel Institute

1140 Connecticut Ave., N.W., Suite 705

Washington, D.C. 20036

AMCA Air Movement and Control Association

30 West University Drive Arlington Heights, IL 60004

ANSI American National Standards Institute (Operations)

25 West 43rd Street, 4th Floor

New York, NY 10036

ASHRAE American Society of Heating, Refrigerating and

Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329

ASME American Society of Mechanical Engineers

Three Park Avenue

New York, NY 10016-5990

ASTM American Society for Testing and Materials International

100 Barr Harbor Drive

PO Box C700

West Conshohocken, PA 19428-2959

AWPA American Wood Preservers' Association

100 Chase Park South, Suite 116 Birmingham, AL 35244-1851

AWS American Welding Society

550 NW LeJeune Road

Miami, FL 33126

CDA Copper Development Association

260 Madison Avenue New York, NY 10016

CE US Army Corps of Engineers

441 G. Street, N.W.

Washington, D.C. 20314-1000

CFR Code of Federal Regulations

Available from the Government Printing Office

North Capitol Street

Between G and H Streets, N.W.

Washington, D.C. 20402

(Material is usually first published in the

Federal Register)

DLI Washington State Department of Labor & Industries

7273 Linderson Way S.W. Tumwater, WA 98501-5414

DOC Department of Commerce

1401 Constitution Ave, N.W.

Washington, D.C. 20230

DOT Department of Transportation

1200 New Jersey Avenue, S.E.

Washington, D.C. 20590

EPA Environmental Protection Agency

1595 Wynkoop Street Denver, CO 80202-1129

FAA Federal Aviation Administration

(U.S. Department of Transportation) 800 Independence Avenue, S.W.

Washington, D.C. 20591

FCC Federal Communications Commission

445 12th Street, S.W. Washington, D.C. 20554

FM Factory Mutual System

1151 Boston-Providence Turnpike

Norwood, MA 02062

FS Federal Specification

General Services Administration

Specifications and Consumer Information

Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197

Washington, D.C. 20407

GA Gypsum Association

6525 Belcrest Road, Suite 480

Hyattsville, MD 20782

IAPMO International Association of Plumbing and Mechanical Officials

4755 E. Philadelphia Street Ontario, CA 91761 – USA

IBC International Building Code of ICC

500 New Jersey Avenue, N.W., 6th Floor

Washington, D.C. 20001

IFC International Fire Code of ICC

500 New Jersey Avenue, N.W., 6th Floor

Washington, D.C. 20001

IMC International Mechanical Code of ICC

500 New Jersey Avenue, N.W., 6th Floor

Washington, D.C. 20001

NEC National Electrical Code

1 Batterymarch Park Quincy, MA 02169-7471

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

NFC National Fire Code of

National Fire Protection Association

1 Batterymarch Park Quincy, MA 02169-7471

NFPA National Fire Protection Association

1 Batterymarch Park Quincy, MA 02169-7471

OSHA Occupational Safety and Health Administration

(U.S. Department of Labor) 200 Constitution Avenue Washington, D.C. 20210

Regional Office:

300 Fifth Avenue, Suite 1280 Seattle, WA 98104-2397

PCA Portland Cement Association

5420 Old Orchard Road

Skokie, IL 20076

PS Product Standard

U.S. Department of Commerce Washington, D.C. 20203

SMACNA Sheet Metal and Air Conditioning Contractors' National

Association

4201 Lafayette Center Drive Chantilly, VA 20151-1219

UL Underwriters' Laboratories, Inc.

2600 NW Lake Rd. Camas, WA 98607-8542

UPC Uniform Plumbing Code

5032 Alhambra Avenue Los Angeles, CA 90032

- B. Washington State Regulations for Barrier Free Facilities as adopted by the Washington State Building Code Advisory Council.
- C. Rules and regulations adopted by the State Building Code Advisory Council establishing thermal efficiency and lighting standards.
- D. The State Building Code supersedes all county, city or town building regulations containing less than the minimum performance Standards and objectives contained in the State Building Code.

1.07 ABBREVIATIONS

A. Abbreviations on the following list, including symbols used as abbreviations, may be used in the Contract Documents. See drawings for additional abbreviations.

AAV AUTOMATIC AIR VENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

AB ANCHOR BOLT

ABI ACOUSTIC BATT INSULATION

ABS ACRYLONITRILE BUTADIENE STYRENE

AC AIR CONDITIONING A/C ASPHALTIC CONCRETE

ACET ACETYLENE

ADJ ADJUSTABLE OR ADJACENT

AF AIR FOIL

AFF ABOVE FINISHED FLOOR

AGG AGGREGATE

AHJ AUTHORITY HAVING JURISDICTION

ALT ALTERNATE

APD AIR PRESSURE DROP

APPROX APPROXIMATE

APWA AMERICAN PUBLIC WORKS ASSOCIATION

ARCHITECT, OR ARCHITECTURAL

ASHRAE AMERICAN SOCIETY OF HEATING. REFRIGERATING

AND AIR CONDITIONING ENGINEERS

ASME AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM AMERICAN SOCIETY OF TESTING AND MATERIALS

AUTO AUTOMATIC AW ACID WASTE

AWT AVERAGE WATER TEMPERATURE

AWWA AMERICAN WATER WORKS ASSOCIATION

BD BOARD

BHP BRAKE HORSEPOWER
BI BACKWARD INCLINED

BLDG BUILDING
BLKG BLOCKING
BM BEAM

BOD BOTTOM OF DUCT

BOT BOTTOM

BTU BRITISH THERMAL UNIT

BTUH BRITISH THERMAL UNIT PER HOUR

BTWN BETWEEN

BUR BUILT-UP ROOFING

CAP CAPACITY
CB CATCH BASIN

CFM CUBIC FEET PER MINUTE

CG CORNER GUARD

CHS CHILLED WATER SUPPLY
CHR CHILLED WATER RETURN

CI CAST IRON
CIP CAST IRON PIPE

CISPI CAST IRON SOIL PIPE INSTITUTE

CLF CHAIN LINK FENCE

CLG CEILING
CLR CLEAR

CMU CONCRETE MASONRY UNITS

CO CLEAN OUT
COL COLUMN
COMP COMPRESSOR
CONC CONCRETE

CONN CONNECT CONTINUOUS CORR CORRIDOR

COP COEFFICIENT OF PERFORMANCE CPVC CHLORINATED POLYVINYL CHLORIDE

CW COLD WATER

dB DECIBEL
DBL DOUBLE
DB DRY BULB

DEG F, F DEGREE FAHRENHEIT
DEMO DEMOLITION, or DEMOLISH

DET DETAIL

DF DRINKING FOUNTAIN

DIAG DIAGONAL DIAM DIAMETER

DIL DYNAMIC INSERTION LOSS

DIM DIMENSION DOOR LOUVER

DN DOWN
DR DOOR
DS DOWNSPOUT
DWG DRAWING

EA EACH

EAT ENTERING AIR TEMPERATURE
EBI EXISTING BOARD INSULATION

EC ELECTRICAL CONTRACTOR (DIVISION 26)

EDB ENTERING DRY BULB
EER ENERGY EFFICIENCY RATIO

EFF EFFICIENCY RA

EJ EXPANSION JOINT ELEC ELECTRICAL

ELEV ELEVATION, ELEVATOR

ENGR ENGINEER
ENT ENTERING
EOL END OF LINING

EQ EQUAL EQUIPMENT

ESP EXTERNAL STATIC PRESSURE

ETC ET CETERA

ETR EXISTING TO REMAIN EWB ENTERING WET BULB

EWT ENTERING WATER TEMPERATURE

EXH EXHAUST
(E), EXIST
EXP EXPOSED
EXT EXTERIOR

F FIRE

FA FACE AREA

FC FORWARD CURVED FCO FLOOR CLEANOUT FD FLOOR DRAIN FIRE DAMPER

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

FF FINISH FACE

FHC FIRE HOSE CABINET

FIN FINISH FLOOR

FLA FULL LOAD AMPS
FLAM FLAMMABLE
FLASH FLASHING
FLEX FLEXIBLE
FLR FLOOR

FPM FEET PER MINUTE
FPS FEET PER SECOND
FOS FACE OF STUD

FS FEDERAL SPECIFICATIONS

FT FEET OR FOOT
FTG FOOTING
FV FACE VELOCITY

FV FACE VELOCITY
FX FIRE EXTINGUISHER

G GAS
GAUGE
GAL GALLON
GALV GALVANIZED

GC GENERAL CONTRACTOR

GEN GENERAL

GI GALVANIZED IRON

GL GLASS

GLB GLUE LAMINATED BEAM
GPH GALLON PER HOUR
GPM GALLON PER MINUTE

GT GLAZED TILE

GWB GYPSUM WALLBOARD

H20 WATER
HB HOSE BIB
HC HANDICAP
HORIZ HORIZONTAL
HP HORSE POWER

HR. HOUR HEIGHT

HVAC HEATING, VENTILATING, AIR CONDITIONING

HW HOT WATER

HWC HOT WATER CIRCULATION
HWR HOT WATER RETURN
HWS HOT WATER SUPPLY

IAPMO INTERNATIONAL ASSOCIATION OF PLUMBING AND

MECHANICAL OFFICIALS

IBC INTERNATIONAL BUILDING CODE

ID INSIDE DIAMETER
INSUL INSULATION
INT INTERIOR
INV INVERT
IN INCH

I.E. INVERT ELEVATION

IEEE INSTITUTE OF ELECTRICAL AND ELECTRONICS

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

ENGINEERS

IMC INTERNATIONAL MECHANICAL CODE

IN INCH INTEGRAL

JAN JANITOR JT JOINT

KW KILOWATT

L LENGTH

LAT LEAVING AIR TEMPERATURE

LAV LAVATORY LB POUND

LB/HR POUNDS PER HOUR LDB LEAVING DRY BULB

LEED LEADERSHIP IN ENERGY AND ENVIRONMENTAL

DESIGN

LH LEFT HAND LIN LINEAL

LRA LOCKED ROTOR AMPS
LWB LEAVING WET BULB

LWT LEAVING WATER TEMPERATURE

MACH MACHINE
MAT MATERIAL
MAX MAXIMUM

MBH THOUSAND BTUH

MC MECHANICAL CONTRACTOR
MCA MINIMUM CIRCUIT AMPS

MIN MINIMUM
MECH MECHANICAL
MEZZ MEZZANINE
MFR MANUFACTURER

MH MANHOLE MIN MINIMUM

MISC MISCELLANEOUS MP MEDIUM PRESSURE

MS MILITARY SPECIFICATIONS

MSS MANUFACTURERS STANDARDIZATION SOCIETY

MTL METAL MAKE UP AIR

NA NOT APPLICABLE NC NORMALLY CLOSED

NEC NATIONAL ELECTRICAL CODE

NEMA NATIONAL ELECTRICAL MANUFACTURERS

ASSOCIATION

NFPA NATIONAL FIRE PROTECTION ASSOCIATION

NIC NOT IN CONTRACT NO NORMALLY OPEN

NO. NUMBER NOM NOMINAL

NPSH NET POSITIVE SUCTION HEAD NRC NOISE REDUCTION COEFFICIENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

NTS NOT TO SCALE

OA OUTSIDE AIR

OBD OPPOSED BLADE DAMPER

OC ON CENTER

OD OUTSIDE DIAMETER

OPG OPENING
OPP OPPOSITE
ORIG ORIGINAL

OS&Y OUTSIDE SCREW AND YOKE

OV OUTLET VELOCITY

OXY OXYGEN

PD PRESSURE DROP

PDI PLUMBING AND DRAINAGE INSTITUTE

PER IN ACCORDANCE WITH

PEX CROSS LINK POLYETHYLENE

PH PHASE PLCS PLACES

PL PROPERTY LINE

PLAS PLASTER PAIR

PRV PRESSURE REDUCING VALVE PSI POUNDS PER SQUARE INCH

PT POINT

PVC POLYVINYL CHLORIDE

R RETURN
RA RETURN AIR
RAD RADIUS
RD ROOF DRAIN
REF REFERENCE
REFRIG REFRIGERATOR

REINF REINFORCED, OR REINFORCING

REQ'D REQUIRED
RH RIGHT HAND
RL RAIN LEADER
RLA RATED LOAD AMPS

RM ROOM

RO ROUGH OPENING

RPM REVOLUTIONS PER MINUTE

S SINK

SA SUPPLY AIR SCHED SCHEDULE

SCO SURFACE CLEANOUT

SECT SECTION
SF SQUARE FEET
SHEATH SHEATHING
SHT SHEET
SIM SIMILAR

SIM OPP SIMILAR, OPPOSITE HAND

SMACNA SHEET METAL AND AIR CONDITIONING

CONTRACTORS NATIONAL ASSOCIATION

S.O. SCREENED OPENING

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

SP STATIC PRESSURE SPEC SPECIFICATION

SQ **SQUARE** SQ. IN. SQUARE INCH SS OR SST STAINLESS STEEL ST STORM DRAIN STD **STANDARD** STL STEEL STOR **STORAGE STRUCT STRUCTURAL SUSP** SUSPENDED

SWP STEAM WORKING PRESSURE

SYM SYMMETRICAL

TD TRANSFER DUCT
T&G TONGUE AND GROOVE
TG TRANSFER GRILLE
TEMP TEMPERATURE
TEMP'D TEMPERED
TOS TOP OF SLAB

TSP TOTAL STATIC PRESSURE

TSTAT THERMOSTAT TYP TYPICAL

UC UNDERCUT DOOR

UL UNDERWRITER'S LABORATORY
UNO UNLESS NOTED OTHERWISE
UPC UNIFORM PLUMBING CODE

USGBC UNITED STATES GREEN BUILDING COUNCIL

V VOLTS, VOLTAGE
VAV VARIABLE AIR VOLUME
VB VAPOR BARRIER
VCP VITRIFIED CLAY PIPE

VEL VELOCITY
VERT VERTICAL
VEST VESTIBULE

VFD VARIABLE FREQUENCY DRIVE

VTR VENT THROUGH ROOF

W WASTE, OR WATER, OR WASHER, OR WIDTH

W/ WITH WATT WB WET BULB

WCO WALL CLEAN OUT WC WATER CLOSET

WD WOOD WET BULB

w.g. WATER GAUGE (INCHES OF WATER)

WH WATER HEATER WM WATER MAIN

WP WORKING PRESSURE WPD WATER PRESSURE DROP

WSEC WASHINGTON STATE ENERGY CODE

WWM WELDED WIRE MESH

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

XBRDG CROSS-BRIDGING

END OF SECTION

TACOMA PUBLIC LIBRARY
HVAC REPLACEMENT
BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

A. Project requirements related to coordination and meetings for the project.

1.03 WORK INSTRUCTIONS

- A. Instructions to Contractor: All instructions to the Contractor, whether verbal, written, or by telephone will be given by the DES Project Manager. No other instructions shall be recognized. Any verbal instructions shall be confirmed in writing to the Contractor. Minor clarifications may be confirmed in site reports, or meeting minutes.
- B. Operational Issues: May be coordinated with the Site Representative. Items involving change in costs or change in time of completion must be provided as noted in the preceding paragraph.
- C. Correspondence Identification: All correspondence shall be identified by the project title and contract number as provided on the first page of this document.

1.04 COORDINATION

- A. General: Coordinate scheduling, submittals, and work of the various sections of specifications to assure proper efficient and orderly sequence of preparation and installation of interdependent construction elements, with provisions for accommodating items installed later. Prior to preparing the Construction Schedule, consult with the Owner to determine scheduling and coordination requirements.
- B. Equipment Utilities: Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Space Requirements: Coordinate space requirements and installation of mechanical and electrical work. Route pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. Locations: Coordinate locations of all items with finish elements.
- E. Completion Clean-up: Coordinate completion and cleanup of work of separate sections in preparation for completion and for portions of the work designated for Owner's partial occupancy or use.
- F. Site Access: Coordinate access to site for all work, and for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
- G. Coordination Meetings: Conduct periodic coordination meetings with all trades; issue

TACOMA PUBLIC LIBRARY
HVAC REPLACEMENT
BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

correspondence and schedule information to coordinate work. At least one day prior to the regular Progress Meeting, Contractor shall meet with his subcontractors, at a time and location to be established by the Contractor, to discuss such matters as he deems necessary for his use in the next job coordination meeting.

H. Security: Coordinate all access to site and security issues with all trades and with Owner.

1.05 ALTERATION PROJECT PROCEDURES

- A. Materials: Match existing products and work for patching and extending work.
- B. Opening Protection: Close openings in interior and exterior surfaces to protect existing work from weather and extremes of temperature and humidity.
- C. Minimize Damage: Remove, cut, and patch work in a manner to minimize damage and to provide a means of restoring products and finishes to original condition.
- D. Where new work abuts or aligns with existing, match lines and grades to perform a smooth and even transition. Patched work to match existing adjacent work in texture and appearance.
- E. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.
- F. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect/Engineer.
- G. Where a change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition for Architect review.
- H. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections as a result of new work.

1.06 PRECONSTRUCTION CONFERENCE

- A. Architect/Engineer will schedule a conference after notice to proceed is issued.
- B. Attendance Required: Owner, Owner's Representative, Architect/Engineer, and Contractor.

C. Agenda:

- 1. Discussion of list of Subcontractors, list of products, schedule of values, and progress schedule.
- 2. Designation of personnel representing the parties in contract and the Architect.
- 3. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, change orders and contract closeout procedures.
- 4. Scheduling.

- Coordination with Owner.
- 6. Testing and inspection coordination.
- 7. Procedures for maintaining record documents.
- 8. Requirements for start-up of equipment.
- 9. Inspection and acceptance of equipment put into service during construction period.

1.07 PROGRESS MEETINGS

- A. Architect/Engineer will schedule and administer progress meetings. Progress meetings will be held on a regularly scheduled basis not exceeding once per week.
 - 1. Architect/Engineer will record minutes.
 - 2. The Architect/Engineer will reproduce and distribute copies of minutes to the Owners Representatives, Consultants and General Contractor. The General Contractor will be responsible to distribute copies to his field representative and to all Subcontractors.
- B. Location of Meeting: Progress meetings will be held at the job site.
- C. Attendance: Contractor, Job Superintendent, Subcontractors, and Suppliers as appropriate to agenda; Owner, Architect/Engineer, professional consultants and others may attend as appropriate.
- D. Minimum Agenda:
 - 1. Approval of minutes of previous meetings.
 - 2. Review project schedule.
 - 3. Review safety plan and any safety issues.
 - 4. Review work progress since previous meeting.
 - 5. Review work planned.
 - 6. Review submittal status and schedules; expedite as required.
 - 7. Review Architect, Consultant, Owner, and Contractor issues.
 - 8. Review any planned deliveries.
 - 9. Review proposed changes and associated documents covering such changes.
 - 10. Review as-built drawings.
 - 11. Field observations.
 - 12. Inspection and test reports.

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

- 13. Establish next meeting time and confirm actions required prior to.
- E. Prior to each meeting, the Contractor will prepare a 2 week schedule of work that is in progress for the current week and work planned for the next week. This 2 week schedule, which is revised weekly by the Contractor, will be presented by the Contractor at the progress meeting and a copy will be given to the Architect/Engineer and to the Owner at that time.
- F. Representatives of Contractor, Subcontractors and Suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- G. Contractor and Subcontractors shall have the updated Record Documents presented at the meeting to be held just prior to each monthly payment request.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

TACOMA PUBLIC LIBRARY
HVAC REPLACEMENT
BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

A. Submittals.

1.03 SUBMITTALS PROCEDURES

- A. Schedule: Schedule submittals to expedite the project. Transmit submittals in accordance with approved Progress Schedule and in such sequence to avoid delay in the work. Coordinate submission of related items with schedule.
- B. Contractor Review: Review all submittals for conformance to project requirements prior to submitting to the Architect/Engineer and note such review (and any comments or requirements) on each submittal (or by an appropriate page attached to and clearly identifying the submittal it pertains to). Only submittals meeting the Contract Document requirements are to be forwarded to the Architect/Engineer.
- C. Organization: Organize submittals in logical groupings matching the specifications sections where the work is specified and where the inter-relationship of the items may affect the review (e.g. finishes which involve selection of colors, textures, or patterns or items that function with other items and need to be coordinated).
- D. Media Type: Selected by Contractor (unless indicated otherwise):
 - 1. Paper Copies: Where submittals will be done using paper copies, submit sufficient quantity to allow for 3 copies being retained (for Architect/Engineer and Owner use).
 - 2. Electronic: Electronic (*.pdf format) of submittals is acceptable; provided the information submittal fully complies with the requirements specified herein. If electronic submittal method is used, then all submittals shall be electronic, except for final required closeout documents as specified (i.e. O&M's, as-builts, etc.)
- E. Distribution: Make and deliver all submittals to Architect/Engineer. Reproduce and distribute copies of reviewed submittals to all other concerned parties. Instruct parties to promptly report any inability to comply with provisions. Pay all costs for reproduction, distribution and materials.
- F. Transmittals: Accompany submittals with transmittal letter containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. Description of submittal.

- 5. Number of copies of shop drawings, product data or samples submitted.
- G. Final Copies: Submit paper copies of all submittals at the end of the project in a 3-ring tabbed notebook with index. Notebook along with an electronic copy in *.pdf format on a CD. Tabs shall match specification sections or equivalent logical organization.

1.04 SUBMITTAL GENERAL INFORMATION

- A. Submittal Identification: Identify each submittal with either a cover sheet or directly on each submittal the following information:
 - 1. Name of Project, Owner, and any Owner project number assigned.
 - 2. Specification Section reference number and paragraph.
 - 3. Contractor name, address, phone number.
 - 4. Subcontractor name, address, phone number (responsible for the work which the submittal applies to).
 - 5. Product manufacturers name, address, phone number and local representative's (or local supplier's) name, address, and phone number.

B. Additional Information:

- 1. Applicable standards.
- Finishes.
- 3. Identification of deviations from Contract Documents.
- 4. Relation to adjacent structure or materials.
- 5. Fabrication methods, assembly, special installation requirements, accessories, fasteners, and other pertinent information.
- 6. Field dimensions, clearly identified.
- 7. Coordination with other trades. Stamped and signed by affected trades.
- 8. Detail number and location in Construction Documents (or other designation to allow confirmation of what the submittal pertains to).
- 9. See specific specification division and sections for additional requirements.
- C. Variations: Only variations that are specifically identified as specified herein will be considered. Provide with the product data submittal a "Variation Notice" sheet with the following information: date, name of product, description of proposed variation, indicate who is proposing the variation, why the variation is being proposed, any cost changes associated with the variation, and other pertinent data to allow review. Failure to submit information on the variation in this way will result in the submittal review being conducted without considering the variation.
- D. Limitations: Identify product or system limitations which may be detrimental to successful

performance of the completed work. Failure to identify is Contractor and suppliers affirmation that the product is suitable for the application.

1.05 PROPOSED PRODUCTS LIST AND SUBCONTRACTOR'S LIST

- A. Prior to submission of First Invoice Voucher, submit complete list of subcontractors and suppliers to be used for the work. Provide specification section identification number, addresses and telephone numbers for each listed subcontractor and supplier.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.06 SHOP DRAWINGS

- A. General: Present in clear and thorough manner. Title each drawing with project name and number, drawing title, name of firm preparing the drawing, General Contractor name, label each element in drawings, include room number of Contract Documents as needed to show application. Identify field dimensions; show relation to adjacent or critical features or work or products.
- B. Minimum Size: $8-1/2 \times 11$ inches; except where shop drawing is illustrating an installation on the building plan, size shall match contract drawing size, with a scale not less than 1/8" = 1'0".
- C. Drawing Technique: Drawing may be hand-drafted or by use of AutoCAD (or similar CAD drafting program) in accordance with professional drafting practices as published by AIA. "Freehand" sketches will not be accepted.
- D. AHJ Approval: On shop drawings requiring AHJ approval, submit in format and media required by the AHJ. Include information required by Project Documents and AHJ.

1.07 PRODUCT DATA

- A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to specification Section and paragraph number. Show: reference standards, performance characteristics, item's capacities, wiring and piping diagrams, control details, component parts, finish, dimensions, and required clearances.
- B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete (or cross out) information that is not applicable.

1.08 SAMPLES

- A. Submit full range of manufacturer's standard and special finishes except when more restrictive requirements are specified, indicating colors, textures, and patterns, for Architect/Engineer selection.
- B. Submit samples which may be used in the work as indicated in the specification section.
- C. Label each sample with identification required for transmittal letter.
- D. Submit two samples of each product requiring color or texture/finish selection unless

specified otherwise in individual specification sections; samples will be retained by Architect/Engineer.

- E. Field samples are to be maintained at the site of the work and are to be removed after substantial completion unless directed otherwise.
- F. Reviewed samples which may be used in the work are indicated in individual specification sections.

1.09 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification sections, submit manufacturer's certificate to Architect/Engineer for review, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect/Engineer.

1.10 CONTRACTOR REVIEW

- A. Revise and resubmit submittals as required, identify all changes made since previous submittals.
- B. Shop Drawings and Product Data:
 - 1. Revise initial drawings or data, and resubmit as specified for the initial submittal.
 - Indicate any changes which have been made including those requested by the Architect.
- C. Samples: Submit new samples as required.

1.11 ARCHITECT/ENGINEER REVIEW

- A. Architect/Engineer will review shop drawings, product data and samples and return submittals within 14 calendar days (or sooner if Architect/Engineer can accommodate and project schedule requires).
- B. Reviewing is only for general conformance and compliance with project design concept and Contract Documents. Any action shown is subject to Contract Document's requirements. Contractor is responsible for dimensions (confirm and correlate at job site); fabrication processes; construction techniques; quantities; space requirements; coordination of work with that of all other trades; union jurisdiction; infringements of patent rights; possible cause of injury to persons or property; and satisfactory performance of the work.
- C. Architect/Engineer's review of separate items does not constitute review of assembly in which it functions.

PART 2 - PRODUCTS

SECTION 01 34 00 SUBMITTALS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

A. Progress Schedules.

1.03 GENERAL REQUIREMENTS

- A. General: The intent of the progress schedule is to assist the Contractor, Architect/Engineer and Owner in monitoring the construction progress for the purpose of coordination, communication, evaluation of Applications and Certificates for Payment, and evaluation of time extension requests.
- B. Review: The Architect's/Engineer's review of the schedule will be to ensure that it conforms to the requirements of the specifications. The sequence and scheduling of the work is the Contractor's responsibility. Contract completion date(s) is as specified in the Contract Documents. The Architect's/Engineer's review of the schedule does not change, revise, or amend that date(s). Allow 7 days for Architect's/Engineer's review and an additional 7 days for Owner's review. No work shall commence prior to this review period unless requested in writing and approved by the Owner.

1.04 FORMAT

- A. Listings: Reading from left to right, in ascending order for each activity. Identify each activity with a description of the activity the applicable specification section number.
- B. Diagram Sheet Size: 11 x 17 inches.
- C. Scale and Spacing: Weekly increments to be a minimum of 5/8" long. Lettering to be a minimum of 1/16" high. Schedule to be legible and allow for notations and revisions.

1.05 SCHEDULES

A. General: Provide a time scaled diagram with a separate activity bar for each work activity. Diagram Schedule to illustrate order and interdependence of activities and sequence of work, how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities. Indicate early and late start, early and late finish, manpower loading and description of each activity. Indicate critical path.

B. Activities:

- 1. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities.
- 2. Provide as many activities as necessary to clearly show how the project will be constructed within the time allowed. As a minimum, every item on the schedule of values must be shown on the progress schedule. Provide sub-net schedules where necessary to enhance clarity.

- 3. Show accumulated percentage of completion of each item of work at time of each Application for Progress Payment.
- 4. Show time for balancing, commissioning, and punchlist activities.
- 5. As a sub-net show submittal dates including specified Architects'/Engineer review time for shop drawings, product data, and samples. Indicate decision date for selection of finishes (where finishes are reviewed).
- C. Delivery Dates: Show product delivery dates, for major components and those on the critical path; including those furnished and/or installed by Owner.
- D. Permits: Show dates when application for separate permits (i.e., fire alarm, fire sprinkler, etc.) will be made and when permit will be received.
- E. Completion Dates: Show dates when application substantial completion will be made, warranties/guarantees will be submitted, and final completion, Owner Training, closeout documents. Final payment will not be made until all warranties/guarantees have been received and found to be acceptable.

1.06 UPDATING SCHEDULES

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity at the time of the revision date. Update diagrams to graphically depict current status of work.
- C. Indicate revision date on revised schedule.
- D. Show changes occurring since previous schedule submission such as:
 - 1. Any major changes in scope;
 - 2. Activities modified since previous submission;
 - 3. Revised projections for progress and completion, as applicable;
 - 4. Any other identifiable changes.
- E. Provide narrative report with each revision to define:
 - 1. Problem areas; anticipated delays; and impact of these on schedule.
 - 2. Corrective action recommended, and its effect.
- F. The Applications and Certificates for Payment will not be processed until the progress schedule is updated as specified.

1.07 SCHEDULE SUBMITTALS

- A. Schedules may be submitted in electronic (pdf) or paper format. Provide two copies when submitting by paper.
- B. Within 14 days after date established in Notice to Proceed, submit proposed preliminary

network diagram defining planned operations for the project.

- C. If required by Architect/Engineer, participate in review of preliminary and complete network diagrams jointly with Architect/Engineer.
- D. Within 7 days after review of proposed preliminary network diagram, submit draft of proposed complete network diagram for review.
- E. Within 7 days after review of proposed complete network diagram, submit complete network analysis consisting of network diagrams and mathematical analysis.
- F. Submit updated schedule with each Application and Certificate for Payment, or more frequently if directed by the Architect/Engineer.
- G. Application and Certificate for Payment will not be processed until schedule has been reviewed by Architect/Engineer and found to be in conformance with requirements of the specifications.

1.08 DISTRIBUTION

- A. Distribute copies of reviewed schedules to project site file, Subcontractors, Suppliers, Architect/Engineer, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

- A. Submit to the Architect/Engineer a Schedule of Values, including labor and materials, for their work and subcontracted work for each specification section of the Project within ten (10) days after the date of Notice of Award. Schedule of Values shall directly relate to the Progress Schedule.
- B. Upon request of the Architect/Engineer, support the values with data which will substantiate their correctness.
- C. The Owner approved Schedule of Values, shall be used as the only basis for the Contractor's Application for Payment.

1.03 RELATED REQUIREMENTS

Conditions of the Contract.

1.04 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Type schedule on 8-1/2 inch x 11 inch white paper; Contractor's standard forms and automated printout will be considered for approval by Architect/Engineer upon Contractors request. Identify schedule with:
 - 1. Title of Project and location.
 - 2. Architect and Project number.
 - 3. Name and Address of Contractor.
 - 4. Contract designation.
 - 5. Date of submission.
 - 6. Percent of work completed.
- B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. Follow the table of contents of this Project Manual as the format for listing component items.
 - 1. Identify each line item with the number and title of the respective major section of the specifications.
 - 2. Provide line items for mobilization, bond, O&M manuals, various categories of site work, demolition, mechanical, electrical, tanks, piping, and equipment.

D.

1. Mobilization, Bonding, Insurance.

Provide a breakdown as follows:

- 2. Submittals and Project Coordination.
- 3. O&M Manuals, Owner Instruction.
- 4. Demolition/Cutting.
- 5. Miscellaneous General Work.
- 6. Boilers, Pumps.
- 7. Piping, Valves, Accessories.
- 8. HVAC Equipment; broken down by each branch location.
- 9. Sheetmetal; broken down by each branch location.
- 10. Controls; broken down by each branch location.
- 11. Electrical; broken down by each branch location.
- 12. Punchlist, Closeout, and Owner Training.
- E. The dollar value for "Punchlist, Closeout, and Owner Training" shall in no case be less than 3% of the total dollar value of the work.
- F. For the various portions of the Work:
 - 1. Each item shall include a directly proportional amount of the Contractor's labor, materials, overhead and profit.
 - 2. Identify items on which progress payments will be requested for site(s) stored materials and break down the value into:
 - a. The cost of the materials, delivered, unloaded, and stored.
 - b. The total installed value.
 - 3. Do not list off site(s) stored materials. Payment will not be made for materials stored off site(s).
- G. The sum of all values listed in the schedule shall equal the total Contract Sum.

1.05 SUBSTANTIATING DATA

A. When Architect/Engineer requires substantiating information, submit data justifying line item amounts in question.

1.06 APPLICATION AND CERTIFICATE FOR PAYMENT

A. See General Conditions of the Contract.

- B. The approved Schedule of Values will be typed by the Contractor onto pay application forms provided by the Owner.
- C. Submit draft payment application form to Engineer for review prior to final.
- D. Submit four signed copies of agreed upon pay application form monthly.

1.07 CHANGES IN CONTRACT

A. See General Conditions regarding changes in the Contract, use of Change Order Proposal (COP) forms, Field Authorization (FA) forms, and associated procedures.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Section 01 01 00 Summary of Work.
- C. Section 01 60 00 Material and Equipment.
- D. Section 01 70 00 Contract Closeout.

1.02 WORK INCLUDED

- A. Electricity, Lighting.
- B. Heat, Ventilation, Cooling.
- C. Phone Service.
- D. Water.
- E. Sanitary Facilities.
- F. Fire Watch.
- G. Barriers and Security.
- H. Temporary Enclosures.
- I. Cleaning During Construction.
- J. Safety.
- K. Pollution/Environmental Controls.
- L. Waste Management Plan.
- M. Owner Impact Damages.

1.03 SUBMITTALS

- A. Site Specific Safety Plan.
- B. Waste Management Plan.

1.04 PROJECT UTILITIES

- A. General: Provide all temporary utilities and services as needed to allow for the project construction and to maintain safe and sanitary working conditions. All temporary systems shall comply with code and recognized standards.
- B. Electrical and Lighting:

- 1. Provide any needed temporary electrical services to support the work (i.e. temporary wiring for power, for lighting, communications, etc.), as required for the work of all trades. Design and select system arrangement, capacity, and distribution.
- 2. Lighting: Provide any needed temporary lighting services to support the work (light fixtures, lamps, and accessories), as required for the work of all trades. Provide adequate lighting for proper exiting, safety, and security purposes.
- 3. Existing building electrical power systems may be used.
- 4. Electrical power will be paid by Owner.
- Heat and Ventilation: Provide temporary heat, including fuel and power, and ventilation C. as required to protect site(s) stored materials, and to allow for the work.
- D. Phone: Provide cellular type telephones to the project superintendent and to his assistance.
- E. Water: Provide water for drinking and for construction from a proven safe source, for all those connected with the work. Pipe or transport in such a manner as to keep it clean and fresh. Owner's site water facilities may be used.

F. Sanitary Facilities:

- Provide adequate temporary toilet facilities for all those connected with the work. 1. Locate where directed when work is started; keep in sanitary condition. Remove from site upon completion of the work.
- 2. Existing building restrooms may be used by construction personnel.

1.05 BARRIERS AND SECURITY

- A. Provide barriers and security as required to prevent non-authorized entry to construction areas, to provide for Owner's use of facilities, and to protect existing facilities and adjacent properties from damage from construction operations and to allow for normal use of the site and adjacent areas.
- B. Provide barricades as required by governing authorities for public rights-of-way and for access to existing buildings.
- C. Provide barriers around trees and plants to remain. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.
- D. Keep construction area secure by fencing, temporary partitions or other proven means. The Contractor may provide additional security measures, guards, etc.
- E. Required fencing shall be chain link type, minimum 6-feet high, secured, anchored and attached to resist a 200 pound lateral force without separating of sections or fencing, or moving more than 6-inches.

1.06 CLEANING DURING CONSTRUCTION

B. All Owner areas used by Contractor shall be kept clean (including mechanical rooms, outside areas, etc.). If areas are not kept sufficiently clean, the Owner will clean such areas and charge the Contractor \$100.00 per hour to cover the cleaning costs for each man-hour spent in cleaning.

Control accumulation of waste materials and rubbish; periodically dispose of off-site.

1.07 SAFETY

A.

- A. The Contract Documents and actions of the Contractor and all associated subcontractors shall be governed at all times by the requirements of the Washington Industrial Safety and Health Act (WISHA) in the enforcement of the Federal Safety and Health Regulations for Construction, as amended, and with the State of Washington, Department of Labor and Industries, Division of Safety "General Safety Requirements" and "Safety Actuated Tools" and "Occupational Health Standards" where same are more restrictive than the federal laws and standards. Train staff in best safety practices. Conduct weekly (as a minimum) safety meetings to review project hazards and safety issues.
- B. Provide measures to ensure the safety of all personnel; including non-construction personnel near the work area. Such measures shall include signage, fencing, barricades, trench protection, drainage and surface water protection, dust and fume control provisions, site debris collection, temporary construction to shield and protect adjacent areas, etc.
- C. The Contractor and each subcontractor shall be required to immediately report all project accidents, injuries or health hazards to the WISHA officials in charge.
- D. Have on site first aid supplies readily available to site personnel, clearly labeled and supplied with materials to allow treatment of possible injuries. Have on site at least two clean extra sets of personal safety equipment (hard hat, eye protection, hearing protection, reflective vest) available for use by the Architect/Engineer and other authorized visitors to the project site.
- E. Develop a site specific safety plan indicating safety procedures to be followed, possible safety hazards, actions to take in response to safety issues, directions to local medical facilities, and related safety information.
- F. Provide a COVID-19 safety/health plan indicating protocols used; follow State and local requirements.

1.08 DUST CONTROL

- A. Provide positive methods and apply dust control materials to minimize raising dust from dispersing into the atmosphere.
- B. Provide exhaust fan and ducting to keep work areas negatively pressurized to prevent dust from dispersing into occupied areas of the building.
- C. Provide effective air/wall barriers to separate construction areas from non-construction areas.

1.09 WATER CONTROL

A. Provide methods to control surface water. Prevent damage to Project, site and adjoining

properties. Control fill, grading, and ditching to direct surface drainage away from excavations, pits, tunnels, construction areas, existing systems and existing construction. Direct all drainage to proper run-off.

- B. Provide, operate, and maintain hydraulic equipment of adequate capacity to control surface water.
- C. Dispose of drainage water in a manner to prevent flooding, erosion, siltation, and other damage to any portion of the site or adjoining areas.

1.10 DEBRIS CONTROL

- Maintain all areas under Contractor's control free of extraneous debris.
- B. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking areas, or along access roads and haul routes.
 - 1. Provide containers for deposit of debris.
 - 2. Prohibit overloading of trucks to prevent spillages on access and haul routes. Provide periodic inspection of traffic areas to enforce requirements.
- C. Schedule periodic collection and disposal of debris. Provide additional collections and disposal of debris whenever the periodic schedule is inadequate to prevent accumulation.
- D. Keep roof drainage systems and storm sewers free of debris or extraneous materials. All roof drainage systems shall be free draining at completion of the project. Drains, downspouts, etc. shall be free draining under heavy rainfall conditions.

1.11 POLLUTION CONTROL

- A. Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere. Allow no discharge of noxious substances from construction operations.
- B. Provide equipment and personnel to perform emergency measures required to contain any spillages. Remove contaminated soils or liquids. Excavate and dispose of any contaminated earth off site. Replace with suitable compacted fill and topsoil.
- C. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to bodies of water, or in sanitary or storm sewers.
- D. Provide systems for control of atmospheric pollutants.
 - 1. Prevent toxic concentrations of chemicals.
 - 2. Prevent harmful disposal of pollutants into the atmosphere.
 - 3. Provide adequate ventilation in all areas during and after application of paint, when welding, or for any activity that may release hazardous or odorous fumes.
- E. Provide and operate drainage and pumping equipment; maintain excavations, roofs and site construction free of standing water.

EROSION CONTROL 1.12

- A. Plan and execute construction and earth work by methods of control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentations.
 - 1. Hold the areas of bare soil exposed at one time to a minimum.
 - 2. Provide temporary control measures such as berms, dikes, and drains.
- B. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
- C. Periodically inspect earthwork to detect any evidence of the start of erosion, apply corrective measures as required to control erosion.

1.13 NOISE CONTROL

- A. Conform to Regulatory Agencies requirements. Be familiar with applicable laws and ordinances.
 - 1. Test all powered construction equipment for noise emission.
 - Use Standard sound level. a.
 - 1) Do not exceed established requirements.
 - Modify or replace equipment exceeding established levels. 2)
 - 2. When available, use electric powered pumps rather than gas or diesel.
 - Use trucks, dozers, loaders, compressors, and the like equipped with 3. satisfactorily functioning air effective exhaust mufflers.
 - 4. Equip jack hammers with air outlet silencers and sound controlling pick housing.
 - 5. If earth drills are used, equip with sound-controlling housings made of leaded vinyl or other effective sound controlling materials.
 - 6. Substitute quiet fabricating techniques for noise such as welding in lieu of riveting.
 - 7. Mix concrete off site.

WASTE MANAGEMENT PLAN 1.14

- A. General: Provide waste management plan as required by code, Division 00, and herein.
- В. Plan Requirements: Plan shall identify:
 - 1. What is being demolished.
 - 2. Where items are being disposed.

- 3. Indicate if materials are being recycled (or approximate percentage); indicate if unknown.
- 4. How waste products are being handled, and any special procedures for handling.
- 5. List of companies doing the waste removal and disposal work.
- 6. Statement that all materials are being legally disposed of.
- C. Hazardous Materials: For hazardous materials, provide manifests/receipts tracking removal and proper disposal (as required by code); may be submitted as addenda to the initial waste management plan.

1.15 SITE IMPACT PLAN

A. General: Provide a site plan (may be via Google Maps or similar) showing areas on the site where the owner's use of the site are impacted; indicate the dates and times of such impact. Items to include on the plan: site laydown area, temporary fencing locations, and other disruptions of vehicle and personal movement on site, and building egress.

1.16 OWNER IMPACT DAMAGES

- A. General: The Contractor shall reimburse the Owner for damages or costs incurred by the Owner (or their representative) as a result of actions (or inaction) by the Contractor. Such damages could include (and is not limited to) fee or fines imposed on the Owner by others due to the Contractor, added time incurred by the Owner to troubleshoot or repair incomplete work that was represented as being complete, providing access to areas after work was to be complete but found to be incomplete, added project management time due to delays in completing the project, and impacts due to non-functioning systems. Such amounts will be deducted from the Contractor by a deductive change order.
- B. Nuisance Fire Alarms: Since the local Fire Department imposes a fine to the Owner for nuisance fire alarms, the Contractor shall pay the Owner the amount of \$250 for every nuisance fire alarm event that is caused by the Contractor. A nuisance fire alarm event is when the fire alarm is tripped without coordination and permission from the Fire Department and Owner which results in mobilization of the Fire Department or Owner's forces
- C. HVAC System Operation: As an active facility various items in the facility are sensitive to lack of temperature and humidity control and could be damaged. The cost of such damage could be considerable. The Contractor may be held liable for damage to various facility items due to the HVAC system being inoperative, or due to actions (or inactions) which affect the HVAC system and create detrimental conditions.

END OF SECTION

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

- A. Products.
- B. Workmanship.
- C. Manufacturers' Instructions.
- D. Transportation and Handling.
- E. Storage and Protection.
- F. Product Options.
- G. Substitutions.

1.03 RELATED REQUIREMENTS

- A. Instructions to Bidders
- B. General and Supplementary General Conditions.
- C. Section 01 01 00 Summary of Work.
- D. Section 01 34 00 Submittals.
- E. Section 01 70 00 Contract Closeout.

1.04 ACCEPTABLE MANUFACTURERS

- A. Any reference in the Specifications or on the Drawings to any article, device, product, material, fixture, form or type of construction by manufacturer, name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.
- B. The manufacturers listed as Acceptable Manufacturers are approved to bid the project for the items indicated without obtaining prior approval. Other manufacturers desiring to bid the project require prior approval. See paragraph entitled "Substitutions" in this specification section and Section 01 61 00, for requirements.
- C. The listing of a manufacturer as an Acceptable Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those manufacturers which may be capable of manufacturing, or have in the past manufactured, items equal to those specified, and is intended to aid the Contractor in identifying manufacturers. The Architect/Engineer shall be the final judge as to whether an item is equal to that specified.

- D. Products provided by Acceptable Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the plans and specifications. The Architect/Engineer shall be the final judge as to whether an item meets these requirements or not. If a manufacturer is not certain that his product meets these requirements or not then the manufacturer shall submit data as required in paragraph entitled "Substitutions" in this specification section, to obtain the Architect/Engineer's approval prior to bidding.
- E. The approval of a manufacturer applies to the Manufacturer only and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications.
- F. Contractor shall be responsible for all costs to other trades and all revisions required to accommodate any products which are different than those specified or shown.
- G. In reviewing a manufacturer for acceptance, factors considered include the following: engineering data showing item's performance, proper local representation of manufacturer, likelihood of future manufacturer's local support of product, service availability, previous installation, previous use by Owner/Engineer/Architect and record, product quality, availability/quality of maintenance and operation data, capacity/performance compared to specified items, acoustics, items geometry/access utility needs, and similar concerns.

1.05 PRODUCTS

- A. Products include material, equipment, and systems.
- B. Comply with Specifications and referenced standards as minimum requirements.
- C. Components required to be supplied in quantity within a Specification section shall be the same, and shall be interchangeable.

1.06 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.07 MANUFACTURERS' INSTRUCTIONS

- A. When work is specified to comply with manufacturers' instructions, submit copies as specified in Section 01 34 00, distribute copies to persons involved, and maintain one set in field office.
- B. Perform work in accordance with details of instructions and specified requirements. Should a conflict exist between Specifications and instructions, consult with Architect/Engineer.

1.08 TRANSPORTATION AND HANDLING

- A. Transport Products by methods to avoid Product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.
- B. Provide equipment and personnel to handle Products by methods to prevent soiling or damage.
- C. Promptly inspect shipments to assure that Products comply with requirements, quantities are correct, and Products are undamaged.

1.09 STORAGE AND PROTECTION

- A. Store Products in accordance with manufacturers' instructions, with seals and labels intact and legible. Store sensitive (roofing) products in weathertight enclosures; maintain within temperature and humidity ranges required by manufacturers' instructions.
- B. For exterior storage of fabricated Products, place on sloped supports above ground. Cover Products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- D. Arrange storage to provide access for inspection. Periodically inspect to assure Products are undamaged, and are maintained under required conditions.
- E. After installation, provide coverings to protect Products from damage from traffic and construction operations, remove when no longer needed.

1.10 PRODUCT OPTIONS

A. Provide all product submittals and shop drawings complete in accordance with Section 01 34 00.

1.11 SUBSTITUTIONS

A. Definitions:

- Equipment Substitution: As applied to equipment means "equipment that is different than the 'Basis of Design' equipment scheduled on the drawings (or otherwise indicated in the contract documents)". Where no manufacturer is specifically indicated, any of the Acceptable Manufacturers specified may be equally considered the "Basis of Design".
- 2. Product Substitution: As applied to products other than equipment it means "products that are different than the basis of design product, or by a manufacturer not listed as one of the Acceptable Manufacturers".
- B. When Considered: Substitutions will be considered during bidding until 8 days before bids are opened. Substitutions will be considered after notice to proceed and throughout the project provided that there is sufficient time (allow 14 days) to allow for Engineer and Owner's review of the proposed substitution without a delay to the Work.
- C. Substitution Request Procedure:

TACOMA PUBLIC LIBRARY
HVAC REPLACEMENT
BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

- 1. Submit to the Architect/Engineer:
 - a. Substitution Request Form, completely filled out. See Section 01 61 00. (Note: A substitution request form is not required for a product listed as an "Acceptable Manufacturer" unless there is ambiguity in the use of a particular manufacturer's product model/series number which may be able to be clarified via the substitution request process.)
 - b. Along with the Substitution Request Form, submit Information substantiating compliance of proposed substitution with Contract Documents; to include data which would normally be submitted for product review. Information shall include (but is not limited to): product identification and description, manufacturer's product data, performance data, compliance with specified or code standards, and samples (where applicable).
 - c. Upon request, submit an itemized comparison of the proposed substitution with the product specified, with data relating to Contract time schedule, design and artistic effect (where applicable), and product's relationship to separate contracts.
 - d. Accurate cost data on the proposed substitution in comparison with the product specified; regardless of whether the substitution will result in a change order or not.
- Architect/Engineer Review: Architect/Engineer will determine acceptability of proposed substitution. If accepted prior to bidding, the product will be listed as an "Acceptable Manufacturer" in an addendum. After bidding (if allowed--see above requirements) the substitution request form will be annotated by the Architect/Engineer as to status.
- D. Representation: The substitution request constitutes a representation that Contractor:
 - 1. Has investigated proposed Product and determined that it meets or exceeds, in all respects, specified Product.
 - 2. Will provide the same warranty for substitution as for specified Product.
 - 3. Will coordinate installation, provide all redesign and make other changes which may be required for Work to be complete in all respects.
 - 4. Certifies that the cost data presented is complete and includes all related costs under this Contract, and that he waives all claims for additional costs related to the substitution which subsequently becomes apparent.

1.12 SUBSTITUTION DESIGN IMPACTS

A. General: The Contract Documents show design configurations based on particular manufacturers. Use of other manufacturers' equipment (i.e. substituted equipment) and products from what is shown (and specified) may require redesign of mechanical, plumbing, controls, fire protection, electrical, structural, and general building construction to accommodate the substituted equipment. Such redesign shall be done by the Contractor and shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication.

TACOMA PUBLIC LIBRARY
HVAC REPLACEMENT
BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

- B. Redesign: Review the requirements associated with substitutions and provide a redesign of all affected construction. The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of maintenance, piping routing and connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns.
- C. Submittal: In addition to other required submittals, submit shop drawings showing the redesign for substituted equipment; submittal shall include installation plans and sections, connecting services (i.e. ducts, piping, electrical) locations and routing, required service clearances, and related installation details. Submit data required by other disciplines to allow review of the impact of the substitution (i.e. weights, electrical).
- D. Costs: Cost of redesign and all additional cost incurred to accommodate the equipment shall be borne by the Contractor.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Standard Products: Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two year use shall include applications of equipment and materials under similar circumstances and of similar size. The two years' experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Except that equipment changes made solely to satisfy code requirements, to improve unit efficiency, or to comply with unique project requirements are not required to have two year prior operation.
- B. Service Support: Qualified permanent service organizations for support of the equipment shall be located reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- C. Compatibility: All components and materials used shall be compatible to the conditions and materials the items will be exposed to. All items exposed to the weather shall be galvanized, or be of stainless steel or similar corrosion resistant material.
- D. Non-Specified Items: Materials shown on the drawings but not specified shall be provided as shown and as required to suit the application illustrated and intended and shall be of commercial quality, consistent with the quality of similar type items provided on the project. Not all items shown on the drawings necessarily have a corresponding specification; such items shall be provided per this paragraph and so as to provide complete, finished, fully functioning mechanical systems.
- E. Standardization: All products of the same type shall be by the same manufacturer and have the same characteristics and features to allow for Owner's standardization.
- F. Model Numbers: Any reference to a manufacturer's "model number" is a reference to a manufacturer's series number or type of product, and it not a complete "model number", and does not indicate all features, accessories, and options that are required. These series numbers are only meant to convey a type of product that may meet the project

SECTION 01 60 00 MATERIAL AND EQUIPMENT

requirements. Where conflicts or discrepancies occur regarding a listed manufacturer's series or "model" number and specified capacities or features, the more stringent and expensive shall prevail.

PART 3 - EXECUTION

NOT USED

END OF SECTION

TO:

Address

SECTION 01 61 00 SUBSTITUTION REQUEST FORM

SUBSTITUTION REQUEST FORM

TO:	Hultz/ BHU End 1111 Fawcett A Tacoma, WA 9	Ävenue, Suite 100						
PROJE	CT NAME:							
Section	1		oduct instead of specified i cified Item	tem for above project:				
Propos	ed Substitution:							
Include		sional information and technic nation on changes to drawings r installation.						
and ap	pearance to that	necessary samples and substantials which is specified. Clearly modes in quality of materials and	ark manufacturer's literatu	re to indicate equality in				
The un	dersigned states	s that the following paragraphs	s, unless modified on attac	hments, are correct:				
1. 2. 3. 4. 5. 6.	The proposed substitution does not affect dimensions shown on drawings. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution. The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements. Maintenance and service parts will be locally available for the proposed substitution. The proposed substitution will have no affect on applicable codes. The manufacturer's guarantees or warranties of proposed product is equivalent to or exceeds that of the specified product.							
	·	ion of three similar projects or	n which products was used	I, date of installation, and				
PERFO ASSUN	FICATE OF EQU DRMANCE AND MPTION OF LIAI QUAL PERFOR	BILITY	FOR USE BY ARCHITEC	Accepted as Noted				
			Not Accepted	Rec'd Too Late				
	RSIGNED ATTE TON AND QUAL		Ву					
	. TO OR SUPEF FIED ITEMS.	RIOR TO	Date					
	bmitted By:		Remarks					
Signatu	ıre	Title	City, State	Zip				
Firm			Telephone	Date				
Address			Above signature must be by person having authority to legally bind his firm to the above terms.					

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 REQUIREMENTS INCLUDED

- A. Closeout Procedures.
- B. Final Cleaning Adjustment.
- C. Demonstration and Instruction.
- D. Punch List Reviews.
- E. Final Record Documents.
- F. Operation and Maintenance Manuals.
- G. Spare Parts and Related Requirements.
- H. Submittals before Final Payment.
- I. Warranty Inspection of the Project.
- J. Re-Review Fees.
- K. Final Adjustment of Accounts.

1.03 RELATED REQUIREMENTS

- A. Conditions of the Contract.
- B. Section 01 01 00 Summary of Work.
- C. Section 01 50 00 Construction Facilities and Temporary Controls.
- D. Division 20 General Mechanical.
- E. Division 26 Electrical.

1.04 CLOSEOUT PROCEDURES

- A. General: Comply with Division 00 for Project closeout and issuance of Certificate of Final Acceptance.
- B. 75% Completion: When Contractor considers Work is 75% complete, submit written notification stating that. A pre-closeout 75% meeting will be arranged to review work needed to reach 100% completion; review will include; work remaining, closeout requirements, schedule, final coordination, and related items to allow for timely closeout.

- C. Written Notification: When Contractor considers Work has reached final completion, submit written certification that Contract Documents have been reviewed, Work has been inspected, governing authorities have completed all inspections and signed project off as complete, all closeout documents have been submitted and accepted, and that all Work is complete in accordance with Contract Documents and ready for closeout.
- D. Final Change Order: Architect/Engineer will issue a final change order reflecting approved adjustments to Contract Sum not previously made by Change Order.
- E. Final Pay Request: Provide items specified in paragraph titled "Submittals Before Final Payment" in this specification Section; after receipt and acceptance by the Architect/Engineer of these items and completion of all Contract Document requirements submit a final pay request.

1.05 FINAL CLEANING

A. General:

- 1. Perform final cleaning prior to final inspection.
- 2. Clean all interior and exterior surfaces exposed to view, clean glass, remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces. Follow manufacturer's recommendations for cleaning installed products.
- 3. Leave entire Work perfectly clean and ready for use including existing surfaces exposed to view that are not re-finished under this Contract.
- 4. Clean all areas affected by the work; e.g. clean construction debris from roofs, gutters, downspouts, and drainage systems.
- B. Damaged Surfaces: Replace or repair damaged surfaces as directed to new condition and to match adjacent surfaces.
- C. Equipment: Clean equipment to new condition. Dusty, dirty equipment will not be accepted.
- D. Filters: Replace filters of operating equipment where filters life is less than 50% of expected life.
- E. Site: Clean site; sweep paved areas, rake clean landscaped surfaces. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.06 ADJUSTMENT

A. Adjust operating products and equipment in accordance with manufacturer's recommendations and specification section to ensure smooth and unhindered operation.

1.07 DEMONSTRATION AND INSTRUCTION

A. Demonstration: Prior to final inspection, demonstrate operation of each system to Architect/Engineer and Owner. See each specification Division and Section for further requirements.

B. Instruction: Instruct Owner's personnel in operation, adjustment and maintenance of equipment and systems, using the operation and maintenance data as the basis of instruction.

1.08 ARCHITECT/ENGINEER PUNCH LIST REVIEWS

- A. Substantial Completion: Notify the Architect/Engineer, in writing, that the work is substantially complete and ready for a punch list review and provide a written list of items that the Contractor's inspection has revealed are not complete. After the Contractor completes any incomplete work which the Architect/Engineer determines would affect substantial completion, and agreeing that the work appears substantially complete, the Architect/Engineer will make a review of the Work and record any deficiencies in such work in a written report to the Contractor (i.e. punch list). See attached "Substantial Completion Checklist" used to confirm substantial completion. After this review the Architect/Engineer will issue confirmation of the date of substantial completion.
- B. Corrections: The Contractor shall correct the punch list items, and shall notify the Architect/Engineer in writing when such items are corrected.
- C. Back Check: The Architect/Engineer shall then re-review the Work to verify that all noted punch list items have been corrected. If any such deficiencies are found not to have been corrected, the Owner may be liable for added Architect/Engineer fees for this additional review work. The Owner may in turn seek reimbursement for these added costs from the Contractor.

1.09 FINAL RECORD DOCUMENTS

- A. Field Record Drawings: The Contractor shall maintain a set of full size contract plans at the project site upon which all changes from the as-bid plans are noted. These plans shall also include actual locations (with dimensions) of all underground utilities, including mechanical and electrical systems. Connection points of utilities (exiting the building) to site utilities shall be located by field measurements and so noted on these record drawings. All addenda, change order, field orders, design clarifications, request for information, and all other clarifications and revisions to the plans shall also be made a part of these record drawings. See individual specification sections for additional requirements. Plans shall be available for weekly review by the Architect/Engineer.
- B. Final Record Drawings Submittal: Upon completion of the work, prior to final acceptance, deliver to the Architect/Engineer the original field record drawings and two full size copies. Label drawings "As-Builts" with date, name of Contractor, and name of individual overseeing the construction work.

1.10 OPERATION AND MAINTENANCE MANUALS

A. General:

- 1. General Contents: Operation and Maintenance manuals shall be compiled containing maintenance and operating information and maintenance schedules for all products installed in this project.
- 2. Timing: Manual shall be submitted and approved prior to Owner instruction occurring (unless noted otherwise).

- 3. Preliminary Copy: A preliminary review copy of the maintenance manual shall be submitted to the Architect/Engineer prior to completion of the work. The Architect/Engineer will review this preliminary copy and will inform the Contractor of any additional items or revisions required before final copies are delivered. Before submitting this preliminary review copy, the Contractor shall submit to the Architect/Engineer for approval an outline and description of the proposed manual organization.
- 4. Final Copies: Shall be delivered to the Architect/Engineer after all revisions and additions have been made.
- 5. Final Copy Quantities: Three hard copy sets and three CD electronic copies.
- 6. Specific Requirements: See each specification Section for additional requirements.

B. Manuals:

- 1. Identification: Notebooks shall be labeled "Operation and Maintenance Manual," with name of the Project, Owner, Owner Project Number, Engineer, General Contractor and year of completion. Where multiple volumes are required, label each with volume number and brief label indicating contents (e.g. "Mechanical"). Coordinate labeling so that all volumes have consistent labeling fonts. CD's shall be labeled "O&M Manual" with name of Project, Owner, Owner Project Number, and date.
- 2. CD Electronic Copy: Shall contain pdf open format copies of the entire O&M manual, pdf open format copies of record drawings, and ACAD files for record drawing where ACAD shop drawings or ACAD record drawings are required (see individual specifications Sections for requirements). Files shall be bookmarked by section and by product. Drawings shall be bookmarked and labeled by sheet number and name.

3. Notebook Hard Copy:

- a. Format: 8-1/2" x 11" size pages; neat, clean copies; provide 11" x 17" or larger pages where necessary, accordion folded. All writing in the manuals shall be typewritten and divider sheets with typed identification tabs between sections.
- b. Notebooks: Copies shall be punched and placed in a three-ring notebook, with clear plastic pocketed covers and spine. Notebook shall have inside pockets at front and rear. Where multiple volumes are required, all notebooks shall be of same size and type. Provide sufficiently sized notebooks to allow easy removal of material and future addition of Owner's added maintenance data. Coordinate notebook style with all trades and specification Divisions to provide same notebook style (i.e. same divider tabs, same organizational theme) for all trades and specification Divisions.
- 4. General Organization: Shall have general overall project information followed by sections which match the project specification Divisions or (where approved by Architect/Engineer) into building systems or similar logical groupings. Each of these sections shall be further broken down into subsections which cover each

specification Section, or similar logical grouping (i.e. by building system, or (equipment).

- 5. Specific Organization: Manual shall be organized into the following sections; submit proposed arrangement for review prior to finalizing:
 - a. Table of Contents.
 - b. Directory.
 - c. Warranty Statements.
 - d. Proof of Code Compliance and any required tests.
 - e. Training and spare parts sign-offs (as applicable).
 - f. Sections according to project specification Divisions, with Submittal Data, Technical Operation and Maintenance Data, and added data as required by each specification Section.

C. Contents:

- 1. Table of Contents: Provide detailed list of contents of entire manual.
- 2. Directory:
 - Provide directory listing names, addresses, and telephone numbers of Architect, Engineer, Contractor, all Subcontractors and all Equipment/Material Suppliers and their local representative or service agent.
 - b. Provide names, addresses and phone numbers for at least one service agency for each equipment requiring maintenance.
- 3. Warranty Statements: Provide Contractor authorized warranty statements; reference other sections of the manual for other manufacturer warranties.
- 4. Code Compliance: Include copies of Code sign-off; any required tests; reference other sections of the manual as necessary.
- 5. Submittal Data and Technical Operation and Maintenance Data:
 - a. General: This portion consists of the bulk of the Operation and Maintenance Manual and consists of multiple sections providing submittal data and technical Operation And Maintenance data for all equipment and materials.
 - b. Submittal Data: Provide manufacturer's technical product data, with manufacturer's model number, description of the product noting capacities, options, features and accessories. Label products with same designation as used in the Contract Documents. This information may consist of the same information as the submittal data (clearly identified and marked to suit each item). This information shall be provided for all items requiring maintenance and for items that may require replacement

over a 30 year period or be revised due to an Owner building improvement.

- c. Technical O&M Data: Provide for each item requiring maintenance.

 Data to include:
 - Manufacturer's operating and maintenance manuals and instructions.
 - 2) Itemized list of maintenance activities and their scheduled frequency.
 - 3) Maintenance instructions for each maintenance activity.
 - 4) Manufacturer's parts list.
 - 5) Items recommended or required by the manufacturer in order to perform maintenance (i.e. lubricants, cleaners, special tools, etc.).
 - 6) Size, quantity and type of any replaceable and consumable items associated with the product (e.g. filters, belts, etc.).
 - 7) See individual specification Section for additional requirements.

1.11 SPARE PARTS AND RELATED REQUIREMENTS

- A. General: Provide products, spare parts and maintenance materials in quantities specified in each Section, in addition to that used for construction of work. Coordinate with Owner, deliver to project site (or designated Owner location) and obtain receipt of acceptance by the Owner.
- B. Paints: List of paints and colors used on the project, and prepared paint samples with their composition noted, to be delivered to the Owner's maintenance personnel.
- C. Test Records: Copies of results of all tests required by public authorities, utility companies, or by these specifications.
- D. Signed Receipts: Provide an original signed receipt for all materials furnished to the Owner in substantially the following form. No other evidence of delivery is acceptable, unless the Owner agrees to having received the item. A copy of each receipt shall be delivered to the Architect/Engineer. Receipt to be substantially in the following form:

(Owner)						
(Address)						
SUBJ: (Project)						
We, as representatives/personnel for the (Owner), would like to attest to the fact that the below stated materials were furnished for future maintenance needs by a representative of (Contractor/Subcontractor) for the (Project).						
OWNER	DATE					

TACOMA PUBLIC LIBRARY
HVAC REPLACEMENT
BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

SECTION 01 70 00 CONTRACT CLOSEOUT

		OWNE	ER	DATE	
		GENE	RAL/SUBCONTRACTOR	_	
	E.		m being provided.		
1.12		MITTALS BEFORE FINAL PAYMENT			
1.12	A.			, 1.08 and 1.09 above, submit the items required by	
			eneral Conditions, and the follow		
		1.	Submit Contractor's Affidavit of	f Payment of Debts and Claims.	
		2.		o the Owner, covering the entire work for one-year ptance. Letter to be substantially as follows:	
			(Owner)		
			(Address)		
			SUBJ: (Project)		
			of Substantial Completion (ereby warrant for a period of one year from the date) all work performed under the terms of Ve) will remedy at my (our) expense any defects od due to poor or defective materials and/or or any damage resulting from occurrence of said me.	
			The following subcontractors one-year warranty as stated a	performed or furnished materials subject to the bove.	
			Subcontract Mechanical Electrical	Firm Name (John Doe Company) (Smith & Smith Co.)	
		3.		onnel have been instructed in operation, adjustment t and systems, in substantially the following form:	
			(Owner)		
			(Address)		
			SUBJ: (Project)		
			that a representative of (sul	nnel for the (Owner), would like to attest to the factocontractor) has given us an orientation on the the (products) for the (Project).	
			OWNER	 DATE	

SECTION 01 70 00 CONTRACT CLOSEOUT

	_	
OWNER	DATE	
SUBCONTRACTOR	_	

- 4. State Department of Labor & Industries Affidavit of Wages Paid (S.F. 9843).
- 5. Electrical Inspector's certificate of acceptance of the electrical work.

1.13 WARRANTY INSPECTION OF THE PROJECT

A. A general inspection of the Contract work will be made by the Contractor, Architect, project engineer, maintenance director or Owner's representative a month prior to expiration of the one year warranty period.

1.14 RE-REVIEW FEES

- A. Basic Reviews: The project budget provides for one punch list review and one punch list back check by the Architect/Engineer. The first will be in response to the Contractor's notice of substantial completion, the second will be after notification by the Contractor that all punch list items have been corrected.
- B. Added Reviews: Should additional reviews by the Architect/Engineer be required due to the Contractor's failure to correct all deficient work, the Owner may be required to compensate the Architect/Engineer for these added review services (including travel time, mileage, etc.). The Owner may seek reimbursement for these costs from the Contractor.

1.15 FINAL ADJUSTMENT OF ACCOUNTS

- A. General: Submit a final statement of accounting to Architect/Engineer.
- B. Format: Reflect all adjustments to Contract Sum. Indicate following:
 - 1. The Original Contract Sum;
 - 2. Additions and deductions resulting from:
 - a. Previous change orders;
 - b. Alternates;
 - c. Unit price adjustments;
 - d. Deductions for uncorrected work;
 - e. Deductions for liquidated damages;
 - f. Deductions for additional review services;
 - g. Other adjustments;
 - 3. Total Contract Sum, as adjusted;

SECTION 01 70 00 CONTRACT CLOSEOUT

- 4. Previous Payments; and
- 5. Sums remaining due.
- C. Final Payment Processing: Prior to processing of Final Application and Certificate for Payment. All work must be fully complete, including all Closeout Documents (e.g. Project Record Documents, Operations and Maintenance Manuals, Warranty Binders etc.).

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

1.02 WORK INCLUDED

- A. Framing and Sheathing.
- B. Fasteners.
- C. Gypsum Wallboard.
- D. Painting.
- E. Concrete and Grout.

1.03 GENERAL REQUIREMENTS

A. General Materials: Materials shall allow patching to match existing undisturbed areas. Materials shall be same kind as existing to allow uniform appearance and construction.

1.04 SUBMITTALS

- A. Products: Provide complete product literature on roofing materials, flashing, and water proofing compounds to be used in construction.
- B. Submit manufacturers application instructions and recommendations for waterproofing compound(s) used.

1.05 REFERENCES

A. MPI: Master Painters Institute Architectural Painting Specification Manual.

PART 2 - PRODUCTS

2.01 LUMBER - GENERAL

- A. Lumber Standards: Wood shall comply with PS 20 "American Softwood Lumber Standard" with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies:
 - 1. WCLIB West Coast Lumber Inspection Bureau.
 - 2. WWPA Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade.
- D. Nominal sizes are indicated unless noted otherwise. Provide dressed lumber, S4S.

Provide seasoned lumber with maximum 19% moisture at time of dressing.

2.02 NON-STRUCTURAL METAL FRAMING

- A. Type: "C" shaped metal framing for framed GWB assemblies.
- B. Construction: Fabricated from galvanized steel sheet in accordance with ASTM C 645 with a minimum yield strength of 33,000 psi. Galvanized coating shall comply with ASTM A 1003 and ASTM A 653 with a G60 designation.
- C. Size: minimum 1-1/4-inch flange with 1/4-inch return, and minimum web depth of 3-5/8-inch; unless indicated otherwise or larger size required to properly suit the application.
- D. Gauge: Minimum 18 gauge, unless indicated otherwise.
- E. Accessories: With each type of metal framing required, provide manufacturer's standard steel runners, blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer and as detailed for applications indicated, as needed to provide a complete metal framing system.
- F. Track/Runners: Same material as framing members; gauge no less than framing members; size/shape to accommodate adjoining members and application.
- G. Fasteners: Type as recommended by metal framing manufacturer for proper framing anchoring and interconnections.

2.03 WOOD SHEATHING

- A. Type: Shall be plywood or Oriented Strand Board.
- B. Plywood: Shall be group 1 or group 2 species, C-D grade exposure 1 conforming to PS 1-83. Each piece shall bear the grade trademark of the American Plywood Association.

2.04 FASTENERS

A. General:

- Fasteners/Hardware: Provide rough hardware of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer and so as to provide substantial anchorage and support.
- 2. Where exposed to moisture provide fasteners with hot dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel (unless a specific type is noted).
- B. Nails, Brads, Wire, Staples: FS FF-N-105.
- C. Wood Screws: ANSI B18.6.1.
- D. Lag Bolts: ANSI B18.2.1.
- E. Bolts: Steel, complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and flat washers.

F. Framing Connectors: Shall have ICBO approval and be manufactured by Simpson Co., San Leandro, CA, or approved.

2.05 GYPSUM WALLBOARD

- A. Type: Gypsum wallboard, 5/8-inch thick (unless indicated otherwise), type "X" UL fire rated.
- B. Construction: Conforming to ASTM C 36, tapered long edges, square cut ends.
- C. Accessories: Provide all trim accessories, joint treatment compound, joint tape, fasteners, plaster veneer, and miscellaneous materials to allow for work indicated and complete and proper GWB installation and finish.

2.06 PAINTING

- A. Painting: Items designated to be painted shall be painted by skilled painters in conformance with standard professional practice including cleaning and priming of materials to be painted. Colors shall be selected by the Owner.
- B. All materials and workmanship shall comply with the Master Painters Institute (MPI) Architectural Painting Specification Manual. Work shall include cleaning surface with appropriate solvents or cleaners, applying two prime coats and at least one finish coat of paint.
- C. Items Requiring Painting:
 - 1. Paint all damaged finishes to match pre-construction finishes.
 - 2. New gas piping; bright yellow.

2.07 CONCRETE AND GROUT

- A. Concrete: Shall be made with Portland Cement ASTM C-150 Type 1, course and fine aggregate ASTM C-33, all aggregate grading shall be size #67 unless otherwise noted, water clean and potable, and shall be ready-mixed per ASTM C-94 unless otherwise approved. Add to all exterior concrete and air-entraining agent to attain 5% to 7% entrained air, by volume, conforming to ASTM C-260. No aluminum (conduit, miscellaneous items, etc.) shall be embedded in any concrete.
- B. Granular Base: Washed pea gravel, naturally rounded, particle size 1/8" to 3/4", with no more than 3% passing a No. 8 sieve.
- C. Reinforcing Materials:
 - 1. Welded Wire Fabric: ASTM A 185; 6 x 6 pattern unless indicated otherwise.
 - 2. Metal reinforcement (Concrete): All reinforcing shall conform to ASTM A 615, Grade 60, Detail, fabricate and place per ACI 315 and ACI 318. Splices shall be 40 bar diameters or 24" minimum.
- D. Drypack Grout: Make from one part ASTM C-150 Type 1 Portland Cement, one part fine sand ASTM C 33, and one part "Embecco" by Master Builders or equal. Mix dry as can be worked, and pack solid to fill entire space under plates and shapes.

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 3 - EXECUTION

3.01 GENERAL

- A. Provide nailing and anchoring per ICBO standards. Securely anchor rough carpentry to meet code and recognized standards.
- B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and properly fitted.
- C. Install sheathing in accordance with "APA Design/Construction Guide Residential and Commercial."
- D. General: Use professional practices and recognized standards for selection of materials and workmanship. Patch all damaged areas to match existing undisturbed areas.
- E. Painting: Clean all items and prepare work area per MPI best practices. Provide prime paint coat and finish paint. All painting work shall comply with MPI.
- F. Materials: Shall comply with the Master Painters Institute (MPI) Architectural Painting Specification Manual.

3.02 CONCRETE WORK

- A. General: Mix, Place, Vibrate, and Cure concrete per ACI 301.
- B. Forms: Design, erect, support, brace, and maintain formwork, to support loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.
- C. Reinforcement: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations. Clean reinforcement of materials that reduce or destroy bond with concrete. Accurately position, support, and secure reinforcement against displacement. Install welded wire fabric in as long lengths as practicable; lap adjoining pieces at least one full mesh and lace spices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- D. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect/Engineer. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Embedded Items: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provide by suppliers of items to be attached thereto.
- F. Concrete Placement: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If

a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location. Maintain reinforcing in proper position during concrete placement.

G. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work form physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

H. Finishing:

- Rough Form Finish: For formed concrete surfaces not exposed to view (or located outdoors and used for equipment mounting) rough finish may be provided. This is the concrete surface having texture imparted by form-facing material used, with tie hoes and defective areas repaired and patched and fins and other projections exceeding 1/8 inch in height rubbed down or chipped off.
- 2. Trowel Finish: For locations exposed to view, apply trowel finish to monolithic slab surfaces. Provide first trowel finish using equipment and techniques to provide the required finish appearance. Finish appearance shall surface be free of trowel marks, uniform in texture and appearance, and with surface leveled to a tolerance not exceeding 1/8 inch in 10 feet when checked with a 10 foot straightedge. Grind smooth surface defects.
- 3. Abut to Existing: Where concrete abuts existing concrete provide a finish that will match the existing.
- I. Finish/Protection: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures and excessive rate of moisture loss. Provide curing and sealing compound as recommended for the application, site conditions, and as needed to match existing adjacent concrete surfaces.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Operation and Maintenance Manual.

1.03 SUBMITTALS

- A. General: Comply with Section 20 05 00 and Division 01.
- B. Preliminary O&M: Submit preliminary review O&M manual for review.
- C. Final O&M: Submit Final O&M manuals per Division 01.

PART 2 - PRODUCTS

2.01 GENERAL

A. General Contents: A maintenance manual shall be compiled containing maintenance and operating information and maintenance schedules for all project mechanical systems. See Division 01 for quantities, organization, format, and other requirements; meet additional requirements as specified herein.

2.02 SUBMITTAL DATA AND TECHNICAL O&M DATA

- A. Submittal Data: Provide manufacturer's technical product data, with manufacturer's model number, description of the equipment, equipment capacities, equipment options, electrical power voltage/phase, special features, and accessories. Label equipment and fixtures data with same designation as used on contract documents. This information may consist of the same information as the submittal data (clearly identified and marked to suit each item). This information shall be provided for all items requiring maintenance and for items that may require replacement over a 30 year period or be revised due to an Owner building improvement.
- B. Technical O&M Data: Provide for each equipment or item requiring maintenance. Label O&M data to clearly indicate which equipment on the project it applies to (use same designation as used in the Contract Documents). Data to include:
 - 1. Manufacturer's operating and maintenance manuals and instructions.
 - 2. Itemized list of maintenance activities and their scheduled frequency.
 - 3. Maintenance instructions for each maintenance activity.
 - 4. Manufacturer's parts list.

- 5. Manufacturer's recommended lubricants.
- 6. Size, quantity and type of filters required (as applicable).
- 7. Size, quantity and type each belts unit requires (as applicable).
- 8. Size, quantity and type of fuses (as applicable).
- C. Sources: Provide names, addresses, and phone numbers for local manufacturer's representative, service companies, and parts sources for mechanical system components.
- D. Start-Up Reports: Include copies of all equipment and system start-up reports.

2.03 MAINTENANCE SCHEDULES

- A. General: Provide Maintenance schedules with an itemized list of maintenance activities and their scheduled frequency (i.e., weekly, monthly, semi-annually, etc.) for item requiring maintenance.
- B. Special Maintenance: List any critical maintenance items or areas requiring special attention.
- C. Start-Up/Shut-Down: Provide normal start-up, operating, and shut-down procedures; emergency shut-down procedures; and (where applicable) seasonal shut-down procedures.

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Division 23 Heating, Ventilation, and Air Conditioning (HVAC) Systems.
- C. Division 25 Integrated Automation.

1.02 WORK INCLUDED

- A. General Mechanical System Requirements.
- B. Mechanical System Motors.
- C. Identification and Labeling.

1.03 DEFINITIONS

- A. Abbreviations and Terms: Where not defined elsewhere in the Contract Documents, shall be as defined in RS Means Illustrated Construction Dictionary, Fourth Addition and in the ASHRAE Handbook of Fundamentals, latest edition.
- B. "As required" means "as necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all codes."
- C. "Concealed" means "hidden from view" as determined when areas are in their final finished condition, from the point of view of a person located in the finished area. Items located in areas above suspended ceilings, in plumbing chases, and in similar areas are considered "concealed." Items located in cabinet spaces (e.g. below sinks) are not considered concealed.
- D. "Coordinate" means "to accomplish the work with all others that are involved in the work by: directly discussing the work with them, arranging and participating in special meetings with them to discuss and plan the work being done by each, obtaining and completing any necessary forms and documentation required for the work to proceed, reaching agreement on how parts of the work performed by each trade will be installed relative to each other both in physical location and in time sequence, exchanging all necessary information so as to allow the work to be accomplished with a united effort in accordance with the project requirements".
- E. "Finished Areas" means "areas receiving a finish coat of paint on one or more wall surface."
- F. "Mechanical", where applied to the scope of work, includes all project fire suppression systems, plumbing systems, HVAC systems, and controls for these systems and all work covered by specification Divisions 20, 23, and 25. Such work is shown on multiple drawings and is not limited to a particular set of sheets, or sheets prefaced with a particular letter.

- G. The term "related documents" (as used at the beginning of each specification section), and the Specification Divisions and Sections listed with it, is only an indication of some of the specification sections which the work of that section may be strongly related to. Since all items of work relate to one another and require full coordination, all specification sections, as listed in the Table of Contents, shall be considered as being "related documents", and shall be considered (by this reference) in the same manner as if they had all been listed under the term "related documents" in each specification section.
- H. "Work included" (as used at the beginning of each specification section), and the items listed with it, is only an indication of some of the items specified in that Section and is in no way limiting the work of that Section. See complete drawings and specifications for all required work.
- "Verify" means "Contractor shall obtain, by methods independent of the project I. Architect/Engineer and Owner, the information noted and the information needed to properly perform the work". Where used as "verify existing" the reference is to all existing items related to the work (i.e. piping systems, duct systems, electrical power, controls, structural conditions, space available, building construction type, etc.); the "verify" definition shall include "Confirm by means independent of any existing field labeling and independent of the Architect/ Engineer and Owner what the existing piping (or duct) system contains, sizes, what the flow direction is, what normal pressures/temperatures are, what other systems and areas the piping (or duct) is interconnected to; what the existing control voltages/signal types are by direct measurement; what the existing electrical power voltages and phases are by direct measurement; and additional field verification and coordination to ensure that compatible products are provided, correct connections made, and all work performed to allow for fully functioning systems." "Means independent of existing field labeling" shall include methods such as: the use of exterior pressurized sources to pressurize piping system lines, use of flow tests with dyes, physical tracing of piping and all connections to, electronic detection methods, electronic/electric line tracing, electrical measurements, physical disassembling of system, excavation or uncovering of concealed systems, use of insertion cameras and similar efforts.
- J. "Substitution": As applied to equipment means "equipment that is different than the 'Basis of Design' equipment scheduled on the drawings (or otherwise indicated in the contract documents)".

1.04 GENERAL REQUIREMENTS

- A. Scope: Furnish all labor, materials, tools, equipment, and services for all mechanical work. This section applies to all Division 20, 23, 25 specifications and to all project mechanical work.
- B. General: All work shall comply with Division 00, General Conditions, Supplementary Conditions, Division 01, and all other provisions of the Contract Documents.

C. Code:

 Compliance: All work shall be done in accordance with all applicable codes and ordinances. Throughout the Project Documents, items are shown or specified in excess of code requirements; in all such cases, the work shall be done so that code requirements are exceeded as indicated. Comply with code accessibility requirements.

- 2. Documentation: Maintain documentation of all permits and code inspections for the mechanical work; submit documentation showing systems have satisfactorily passed all AHJ inspections and requirements.
- 3. Code Knowledge: Contractor and workers assigned to this project shall be familiar and knowledgeable of all applicable codes and ordinances. Code requirements are typically not repeated in the Contract Documents. submitting a bid, the Contractor is acknowledging that the Contractor and workers to be utilized on this project have such knowledge.
- Proof of Code Compliance: Prior to final completion, satisfactory evidence shall 4. be furnished to show that all work has been installed in accordance with all codes and that all inspections required have been successfully passed. Satisfactory evidence includes signed inspections by the local code authority, test lab results, qualified and witnessed field tests, and related acceptance certificates by local code authorities, and field notes by the Contractor as to when all inspections and tests occurred.
- D. Complete Systems: Furnish and install all materials, appurtenances, devices, and miscellaneous items not specifically mentioned herein or noted on the drawings, but which are necessary to make a complete working installation of all mechanical systems. Not all accessories or devices are shown or specified that are necessary to form complete and functional systems.

E. Review and Coordination:

- 1. General: To eliminate all possible errors and interferences, thoroughly examine all the Drawings and Specifications before work is started, and consult and coordinate with each of the various trades regarding the work. Such coordination shall begin prior to any work starting, and continue throughout the project.
- 2. Suppliers: Suppliers of products shall review the documents to confirm that their products are suitable for the application and that all manufacturers requirements and recommendations have been satisfactorily addressed in the Contract Documents. Where not addressed the supplier shall notify bidders and the Engineer prior to bidding to resolve any issue or include in their bid an adequate amount to resolve the issue.
- F. Conflicts and Discrepancies: Notify the Architect/Engineer of any discrepancies or conflicts before proceeding with any work or the purchasing of any materials for the area(s) of conflict until requesting and obtaining written instructions from the Architect/Engineer on how to proceed. Where conflicts occur, the most expensive and stringent requirement (as judged by the Architect/Engineer) shall prevail. Any work done after discovery of such discrepancies or conflicts and prior to obtaining the Architect/Engineer's instructions on how to proceed shall be done at the Contractor's expense.
- G. Drawings and Specifications: Drawings and specifications are complementary and what is called for in either is binding as if called for in both. The drawings are diagrammatic and show the general arrangement of the construction and therefore do not show all offsets, fittings and accessories which are required to form a complete and operating installation. Mechanical work is shown on multiple drawings and is not limited to a particular set of sheets, or sheets prefaced with a particular letter.

Offsets/Fittings: Η.

- Piping Systems: Include in bid all necessary fittings and offset to completely connect up all systems, maintain clear access paths to equipment, and comply with all project requirements. Offsets are required to route piping around building structural elements, roof slopes, mechanical systems, electrical systems, and numerous other items. Due to the schematic nature of the plans such offsets are typically not shown. Contractor is responsible to determine the quantity of offsets and fittings required, and the labor involved. No added payment or "extras" will be granted for the Contractor's failure to correctly estimate the number of offsets and fittings and labor required.
- 2. Duct Systems: Include in bid all necessary fittings, offsets, and transitions to completely connect all systems, maintain clear access paths, and comply with all project requirements. Offsets are required to route piping around building structural elements, roof slopes, mechanical systems, electrical systems, and numerous other items. Due to the schematic nature of the plans such offsets are typically not shown. Contractor is responsible to determine the quantity of offsets and fittings required, and the labor involved. No added payments or "extras" will be granted for the Contractor's failure to correctly estimate number of offsets, fittings, transitions and labor required. Contractor is advised that transitions are required at connections to all equipment, to all air inlets/outlets, crossing of beam lines, at crossing with piping, and similar locations.
- I. Design: The level of design presented in the documents represents the extent of the design being furnished to the Contractor; any additional design needed shall be provided by the Contractor. All design by the Contractor shall be performed by individuals skilled and experienced in such work, and where required by local code (or elsewhere in the documents) shall be performed by engineers licensed in the State where the project is located. Include in bid the costs of all such project design; including engineering, drafting, coordination, and all related activities and work. Such designs services are required for many building systems; including but not limited to ductwork at equipment, piping at fixtures and equipment, hanger/support systems, temporary duct/piping systems, mechanical offsets/adjustments to suit other system, and for methods/means of accomplishing the work.
- J. Special Tools: Furnish to the Owner one complete set of any and all special tools such as odd size wrenches, keys, etc. (allen wrenches are considered odd), which are necessary to gain access to, service, or adjust any piece of equipment installed under this contract. Each tool shall be marked or tagged to identify its use. Submit a written record listing the special tools provided, date, and signed by the Owner's representative receiving the tools.
- K. Standards and References: Shall be latest edition unless a specific edition, year, or version is cited, or is enforced by the AHJ.

L. Warranties:

1. General: Products and workmanship shall be warranted to be free from all defects, capable of providing satisfactory system operation, and conforming to the requirements of the Contract Documents. Include in the project bid all costs associated with project warranties to ensure that the warranty extends for the required period; possible project delays and failure by others to complete their work may cause the start of the warranty period to be delayed. The Contractor shall be responsible for increasing the warranty dates by corresponding amounts to provide the required warranty periods.

- 2. Basic Project Warranty: As described in the General Conditions, Supplementary Conditions, and Division 01. See individual specification sections for specific warranty requirements. Start date and duration are as indicated in General Conditions, Supplementary Conditions, and Division 01. Where not indicated otherwise, the basic project warranty shall start at project substantial completion and be for one year.
- 3. Special Warranties: See individual specification sections for special warranty requirements and extended warranty periods beyond the basic project warranty.

M. Permits and Fees:

- 1. Obtain and pay for all permits, licenses, fees and inspections as required by the Code and as specified herein (unless noted otherwise).
- 2. Pay all charges made by any utility company or municipality for material, labor or services incident to the connection of service (unless noted otherwise).

1.05 SUBSTITUTIONS

A. General: See Division 00 and 01 for information and requirements regarding substitutions. Manufacturers not scheduled on the plans or listed as "Acceptable Manufacturers" require prior approval and shall submit a substitution request form (see Division 01 for requirements and limitations). See Paragraph 2.01 this specification section regarding "Acceptable Manufacturers".

B. Redesign:

- The Contract Documents show design configurations based on particular manufacturers. Use of other manufacturers' products (i.e. substitutions) from what is shown (or specified) may require redesign of mechanical, plumbing, controls, fire protection, electrical, structural, and general building construction to accommodate the substitution.
- 2. Review the installation requirements for substitutions and provide redesign of all affected construction. The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of maintenance, utility connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns.
- 3. Redesign shall be done by the Contractor and shall meet the requirements and have the approval of the Architect/Engineer prior to beginning work. Apply for and obtain all permits and regulatory approvals.
- C. Construction Modifications: Provide all required construction modifications to accommodate the substituted products; this includes all mechanical, plumbing, controls, fire protection, electrical, structural, and general building construction. Construction modification shall comply with code, specifications, and be equal to designed construction.
- D. Costs: Cost of redesign, construction costs, and all additional costs incurred to accommodate substituted equipment shall be borne by the Contractor.

E. Submittals: In addition to other required submittals, submit shop drawings showing the redesign for substituted equipment; submittal shall include installation plans and sections, connecting services (i.e. ducts, piping, electrical) locations and routing, required service clearances, and related installation details. Submit data required by other disciplines to allow review of the impact of the substitution (i.e. weights, electrical).

1.06 QUALITY ASSURANCE

- A. Experience: All work shall be performed by individuals experienced and knowledgeable in the work they are performing, and experienced with the same type of systems and building type as this project. By virtue of submitting a bid, the Contractor is acknowledging that workers to be utilized on this project have such experience and knowledge. Upon request of the Engineer, submit resumes showing the work history, training, and types of projects worked on, for individuals assigned to this project.
- B. Code: Utilize workers experienced and knowledgeable with codes pertaining to their work; verify code compliance through-out the project.
- C. ASME: All pressure vessels, pressure vessel safety devices, and pressure vessel appurtenances shall comply with the standards of, and bear the stamp of ASME.
- D. Quality Assurance Checks: Prior to ordering products and making submittals, confirm the following for each:
 - General: Product is suitable for the intended purpose and complies with the Contract Documents.
 - 2. Manufacturer: Product's manufacturer is listed as an acceptable manufacturer in the Contract Document's or a substitution request (where allowed) has been submitted and the manufacturer has been listed as acceptable.
 - 3. Electrical (for products requiring electrical power):
 - a. Product is for use with the voltage/phase as indicated on the electrical plans (or for the electrical circuit the item will be connected to).
 - b. Product's ampacity requirements (MCA) do not exceed that indicated on the electrical plans (or for the electrical circuit the item will be connected to).
 - c. Where product is a replacement for an existing product, and is to be reconnected to an existing circuit, the existing voltage/phase has been field verified and product matches voltage/phase available.
 - 4. Weight: Product's weight is no greater than that indicated.
 - 5. Space Verification: Product will fit in the space available, and along the path available to install the item, will have adequate service clearances, and will not impede on any clearances required for other items in the space the item will be located.
 - 6. Installation: A suitable method for installing the product has been selected which meets the project schedule and other requirements.

- 7. Lead Time: The product's fabrication, shipping, and delivery period meets the project schedule requirements.
- 8. Substituted Equipment: Where equipment is not the basis of design confirm all requirements for substituted equipment have been met and shop drawings of construction revisions have been (or are being) prepared.
- 9. Controls: Item is compatible with the controls it will be connected to and has been coordinated with the firm providing the project control work.
- 10. Listing: Item is Listed when required to be as such. And if the item is to be installed as part of a Listed system or assembly, it is compliant with the Listing of the overall system or assembly.
- 11. Existing Buildings/Systems: Product size, weight, connecting services (i.e. electrical, controls, power, plumbing, etc.) are configured and suitable for existing items they connect to or interface with.
- E. Check-Out: The Contractor shall be responsible to verify that proper installation and proper connections have been provided for all mechanical work. Contractor shall provide installation checkout, start-up services, and perform a thorough check of all mechanical systems to verify proper installation and operation. Contractor shall operate all items multiple times under varying conditions to confirm proper operation. Contractor shall submit a checklist listing all equipment, fixtures, and similar items furnished on this project, with a date and initials indicating when the item was checked, a list of what was checked, and by whom. Such check shall, as a minimum utilize documents provided by the equipment manufacturer. Such a check-out is in addition to any commissioning activities specified (unless noted otherwise).

1.07 SUBMITTALS - GENERAL

- A. Variations: Only variations that are specifically identified as described herein will be considered. Provide with the submittal (in addition to other information required): description of the proposed variation, entity who is proposing the variation, why the variation is being proposed, any cost changes associated with the variation, and any other pertinent data to allow for review. Failure to submit information on the variation as described will result in the submittal review being conducted without considering the variation.
- B. Quality Assurance: By submitting an item for review, the Contractor is claiming that all "Quality Assurance Checks" (see paragraph 1.06 this specification Section) have been performed and satisfactorily passed and no further comment from the submittal reviewer is required for the "Quality Assurance Checks".
- C. Product Submittals Information Required:
 - 1. Manufacturer's catalog information, containing product description, model number, and illustrations. Mark clearly to identify pertinent information and exact model and configuration being submitted.
 - 2. List of accessories and options provided with product.
 - 3. Product dimensions and clearances required.

- 4. Product weight.
- 5. Submittal identified with product name and symbol (as shown on the drawings or written in the specifications) and specification Section and paragraph reference.
- 6. Performance capacity and characteristics showing compliance with the Contract Documents.
- 7. Manufacturer's and local manufacturer's representative names, addresses, and phone numbers.
- 8. For equipment requiring piping or duct connections:
 - a. Type of connections required.
 - b. Size and locations of connections.
- 9. For electrically operated equipment:
 - a. Number and locations of electrical service connections required.
 - b. Voltage required.
 - c. Fuse or circuit breaker protection requirements.
 - d. Motor starter requirements; if motor starter is furnished with the equipment, submit product information on motor starter.
- 10. For equipment requiring control connections:
 - a. Type of control signals required.
 - b. Control communication protocol.
 - c. Information on control devices furnished with equipment.
 - d. Location of control connections.
- 11. Manufacturer's installation instructions.
- 12. See each specification Section for additional submittal requirements.
- D. Shop Drawing Submittals: Provide for the following systems:
 - 1. For any parts of any system which are to be installed differently than as shown on the drawings.
 - 2. Construction revisions to accommodate Substituted Equipment.
 - 3. Other areas/work as noted in the Contract Documents.
 - 4. For those systems requiring shop drawings, reference system's specification Section for additional requirements.

1.08 RECORD DOCUMENTS

- A. Field Record Drawings: Maintain a set of full size contract plans at the project site upon which all changes from the as-bid plans are noted. Plans shall be maintained clean, dry and legible; with information recorded concurrent with construction progress. These plans shall also include actual locations (with dimensions) of all underground and concealed mechanical systems. Connection points to outside utilities shall be located by field measurements and so noted on these record drawings. All addenda, change order, field orders, design clarifications, request for information, and all other clarifications and revisions to the plans shall also be made a part of these record drawings. Plans shall be available for weekly review by the Architect/Engineer. Label drawing "As-Builts" with date, name of Contractor, and name of individual overseeing the work.
- B. Final Field Record Drawings Submittal: Deliver to the Architect/Engineer the original Field Record drawings and one full size copy.

1.09 PRODUCT HANDLING, PROTECTION AND MAINTENANCE

A. Protection:

- 1. Protect all products from contamination, becoming unclean, and from damage of any kind and whatever cause; when being handled, in storage, and while installed, until final project acceptance.
- 2. Completely cover fixtures, motors, control panels, equipment, and similar items to protect from becoming unclean and damage of any kind.
- 3. Protect premises and work of other trades from damage due to Mechanical work.
- B. Openings: Cap all openings in pipe, ductwork and equipment to protect against entry of foreign matter until all work that could cause unclean conditions or damage is complete (including work that has dust or fumes associated with it). Caps shall be of sufficient strength and seal integrity to prevent entry of water or fumes for the most extreme conditions they may be exposed to (i.e. high velocity water spray, high winds, concrete splash, etc.).
- C. Storage: Provide properly conditioned and sheltered storage facilities for products to prevent damage of any kind and to maintain new condition. Provide adequate venting arrangements to avoid condensation damage.

D. Operation and Maintenance:

- 1. General: Inspect products periodically to confirm conditions and maintenance needs. Keep records of inspections and (upon request) forward to the Architect/Engineer prior to project final acceptance. Operation and Maintenance shall be in accordance with manufacturer's written procedures and recognized best maintenance practices. Keep records of maintenance and (upon request) forward to the Architect/Engineer prior to project final acceptance.
- 2. Stored Products: Provide maintenance (i.e. equipment rotation, lubrication, flush, cleaning, etc.) and inspection on products while stored to maintain new condition.
- 3. Installed Products: Provide maintenance and inspection of products and operate mechanical systems until substantial completion or specified Owner Instruction

has been provided (whichever is later). Maintenance shall include all labor and materials and all manufacturers' recommended maintenance (i.e. strainer cleaning, filter changes, bearing lubrication, belt tensioning, etc.). In addition to scheduled maintenance, review all equipment periodically to allow detection of improper operation or any special maintenance needs; review shall be consistent with best practices for the product but in no case less than a site visit every two weeks. Document all maintenance activities.

E. Damaged Products: Damaged products shall be replaced with new. Where damage is limited to paint (or similar finish), the product may remain if the finish is restored to a new condition (as judged by the Architect/Engineer).

1.10 JOB CONDITIONS

A. Special Requirements:

- 1. Maintain emergency and service entrance usable to pedestrian and vehicle traffic at all times. Where trenches are cut, provide adequate bridging for traffic.
- 2. Coordinate startup and shutdown of all mechanical systems and utilities with related trades and the Owner's representative.
- 3. Coordinate all construction activities with the Owner's Representative and cooperate fully so as to minimize conflicts and to facilitate Owner usage of the premises during construction.
- 4. Provide temporary services to occupied areas to accommodate Owner's use during construction. All temporary work shall comply with same specifications as for new work and be of same quality.

B. Downtime Restrictions:

- Contractor shall notify the Owner at least 72 hours in advance of any intended shut-down of any building services or systems and obtain Owner approval prior to proceeding.
- 2. Electrical power to the building shall not be interrupted at any one time for more than 15 minutes.
- C. Schedule of Work: Arrange work to comply with schedule of construction, and so as not to violate any downtime restrictions, and to accommodate the Owner's scheduled use of the premises during construction.

1.11 ENGINEER FIELD REVIEWS AND TEST WITNESSING

- A. General: Arrange construction schedule and notifications to the Engineer to accommodate Engineer's schedule and the possibility of review times occurring up to 14 days after notification, and for the possible failure to satisfactorily pass Engineer's reviews requiring revisions and re-reviews.
- B. Notification: Notify Engineer at least 7 days in advance of readiness for reviews; arrange mutually agreed upon times for the reviews to occur.

C. Access: Provide ladders, any special tools and safety equipment to allow Engineer's access to areas and equipment. Remove and reinstall ceiling tiles, access panels, and

similar items where requested to allow for reviews.

D. Review of Systems with Equipment:

- 1. Prior to Engineer's review, system's equipment shall have received specified start-up and be substantiated by a written report.
- 2. Prior to Engineer's review, systems shall have been operating properly for at least five consecutive days prior to the scheduled review date.
- 3. Personnel shall be present to operate the system's equipment and controls, and to vary system settings as directed by the Engineer to allow for a review of operation over a range of settings.
- E. Re-Review Fees: The project budget allows for one review by the Engineer for specified reviews and witnessing. See Division 00 and 01 for compensation to the Engineer for required re-reviews.

1.12 REFERENCES

A. ASME A13.1: Scheme for the Identification of Piping Systems.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General: Any reference in the Specifications or on the Drawings to any article, device, product, material, fixture, form or type of construction by manufacturer, name, make, model number, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The manufacturers listed as Acceptable Manufacturers may bid the project for the items indicated without submitting a substitution request; however that does not relieve the products from having to comply with the Contract Documents.
- B. Substitutions: Products by manufacturers listed as "Acceptable Manufacturers" (other than those listed as the "Basis of Design") are considered substitutions and shall comply with the requirements for substitutions. See Paragraph titled "Substitutions" in Part 1 of this specification section.
- C. Considerations: In reviewing a manufacturer for acceptance, factors considered (as compared to the specified item) include: engineering data showing item's capacity, performance, proper local representation of manufacturer, likelihood of manufacturer's future local support of product, service availability, previous installations, previous use by Owner/Engineer/Architect, product quality, availability/quality of maintenance and operation data, electrical requirements, capacity/performance, acoustics, physical dimensions, weight, items geometry and access requirements, utility needs, and similar concerns.
- D. Limitations of the Term "Acceptable Manufacturer": The listing of a manufacturer as an Acceptable Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those

manufacturers which have represented themselves as being capable of manufacturing, or have in the past manufactured, items equal to those specified. The burden to review products to confirm equivalency with the specified products is on the Contractor. The Architect/Engineer shall be the final judge as to whether an item is equal to that specified.

- E. Quality: Products provided by Acceptable Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the Contract Documents. The Architect/Engineer shall be the judge as to whether an item meets these requirements or not.
- F. Manufacturer: To be considered as being made by a particular manufacturer, the product must be made directly by the manufacturer and have the manufacturer's name (or nameplate with name) affixed to the product (or on the product container where direct labeling is not possible). Example: manufacture "A" is listed as an acceptable manufacture; manufacturer "B" is not listed as an acceptable manufacturer; manufacturer "A" owns "B"; products from "B" do not qualify as being made by an acceptable manufacturer by virtue of ownership.

2.02 PRODUCTS - GENERAL

- A. Standard Products: Products shall be standard products of a manufacturer regularly engaged in the manufacture of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two year use shall include applications of equipment and materials under similar circumstances and of similar size. The two year's experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Except that equipment changes made solely to satisfy code requirements, to improve unit efficiency, or to comply with unique project requirements are not required to have two year prior operation.
- B. Latest Design: Products shall be the latest design and version available from the manufacturer, including software. Discontinued products shall not be used.
- C. Service Support: Qualified permanent service organizations for support of the equipment shall be located reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- D. Manufacturer's Nameplate: Equipment shall have a manufacturer's nameplate bearing the manufacturer's name, address, model number, serial number, and additional information as required by code. Nameplate shall be securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable. Nameplate shall be of durable construction, easily read, with lettering minimum size 12 font.
- E. Compatibility: All components and materials used shall be compatible to the conditions and materials the items will be exposed to. All items exposed to the weather shall be galvanized, or be of stainless steel or similar corrosion resistant material.
- F. Sizes: Sizes indicated for products manufactured to standardized sizes (e.g. pipe, pipe fittings, valves, material gauges, etc.) are minimums. During bidding confirm that the sizes are available and meet project requirements. Where indicated sizes are not available provide the next larger available size; confirm this larger size will suit the construction and meet Contract Document requirements prior to ordering. Such size revisions are subject to Engineer's review; indicate size revisions on the product submittal and why the size is being revised.

- G. Non-Specified Items: Materials shown on the drawings but not specified shall be provided as shown and as required to suit the application illustrated and intended and shall be of commercial quality, consistent with the quality of similar type items provided on the project. Not all items shown on the drawings necessarily have a corresponding specification; such items shall be provided per this paragraph and so as to provide complete, finished, fully functioning mechanical systems.
- H. Weights: Do not exceed the weights shown unless added structural supports are provided. Such supports shall meet the requirements of the project Structural Engineer. The Contractor shall bear all costs for all redesign and added supports to accommodate heavier equipment. The Contractor shall reimburse the Engineer for all time associated with all review and analyses regarding the use of equipment heavier than that indicated.
- I. Temperature/Pressure Rating: All materials and components furnished shall be suitable for the temperature and pressures they will be exposed to. Contractor shall consider possible operating modes to ensure proper material ratings.
- J. Standardization: All products of the same type shall be by the same manufacturer and have the same characteristics and features to allow for Owner's standardization.
- K. Model Numbers: Any reference to a manufacturer's "model number" is a reference to a manufacturer's series number or type of product, and is not a complete "model number" in having all the necessary numbers/letters to convey all of the features, accessories, and options that are required. These series numbers are only meant to convey a type of product that may meet the project requirements. Where conflicts or discrepancies occur regarding a listed manufacturer's series or "model" number and specified capacities or features, the more stringent and expensive shall prevail.

2.03 ELECTRICAL

- A. General: All electrical devices, wiring, products, and work shall comply with the Division 26 specifications and code. See drawings for building occupancy type, types of construction, and areas which may require special wiring methods or other electrical work.
- B. Equipment: All equipment requiring power shall be factory wired to an equipment mounted junction box (or an accessible compartment with power terminals or electrical device) arranged to allow for connection of electrical power.
- C. Overcurrent protection: Circuit breakers, circuit breaker disconnects, fuses, and other current limiting devices indicated to be provided, shall be rated to suit the maximum overcurrent rating of the item served, and have other ratings, as required by code. Circuit breakers for HVAC and refrigeration unit equipment shall be UL listed by HACR type.
- D. Short Circuit Current Rating (SCCR): All equipment (or components) requiring the use of electrical power shall have a SCCR value to comply with code. The minimum rating shall be 65,000 Amps RMS Symmetrical unless a lower value is indicated on the plans or allowed by code. Where the Contractor wishes to utilize equipment having a lower rating, the Contractor shall be responsible to provide calculations substantiating that a lower SCCR is acceptable (and complies with code), or make revisions to the electrical system to accommodate the proposed equipment (or components).
- E. Product Certification (Listing): Products which require connection to electrical power shall be certified (i.e. listed) by a Nationally Recognized Testing Laboratory (NRTL) and be labeled (in a conspicuous place) with such certification (or certification mark).

Certification shall comply with code, OSHA Standards, and Authority Having Jurisdiction (AHJ) requirements. NRTL's shall be recognized as such by OSHA and the AHJ. Certification shall be for the complete assembly (approval of individual components is not acceptable). Field evaluations to obtain certification shall be performed by accredited product testing laboratories acceptable to the AHJ and Engineer, be performed in accordance with code, NFPA 791, recognized practices, and be labeled to identify the certification. Certification is not required where the AHJ does not require it.

2.04 MOTORS

- A. General: Where a piece of equipment specified includes an electric motor, the motor shall be factory installed and mounted. Motor starters and motor electrical disconnect switches shall be provided by the Contractor doing the work of the Section where the item was specified, unless specifically shown to be provided by Division 26 (or another Division). Wiring from the motor to motor starters and to electrical disconnects shall be by the Contractor doing the work of the Section where the item was specified, unless specifically shown to be provided by Division 26.
- B. Acceptable Manufacturers: General Electric, TECO-Westinghouse, Reliance, Gould, Century, Baldor, U.S. Motors, Marathon, and acceptable manufacturers for the equipment (see individual specification sections).
- C. Type: Motor type shall comply with code and applicable standard requirements and be configured to suit the application. Motors located indoors shall be open frame, drip-proof type, unless indicated otherwise. Motors located outdoors exposed to weather shall have corrosion resistant finish and shall be totally enclosed fan cooled (TEFC) or totally enclosed non-ventilated (TENV) type, unless indicated otherwise.
- D. Listing: All motors shall be UL listed.
- E. Efficiency: Motor efficiencies shall comply with code. Fractional horsepower motors shall be the electronically commuted (EC) type with speed control where noted and where non-EC motors are not available which comply with code efficiency requirements. Motor power factor shall comply with code, local utility requirements, and as indicated. Provide added power factor correction devices as necessary to comply.
- F. Sizing: Motors shall not be smaller than indicated and of adequate size to start and drive the respective equipment when handling the quantities specified without exceeding the nameplate full load current at the conditions indicated and for the expected operating conditions. If it becomes evident that a motor furnished is too small to meet these requirements as a result of the Contractor using substituted equipment or having revised the system arrangement, the Contractor shall replace it with a motor of adequate size at no additional cost to the Owner. Contractor shall also arrange with the Electrical Contractor to increase the size of the wiring, motor starter and other accessories as required to serve the larger motor at no additional cost to the Owner.
- G. Service Factor: Minimum 1.15.
- H. Variable Frequency Drive (VFD) Applications: Motors used with Variable Frequency Drives (VFD's) shall be rated for such use per IEEE standards and have shaft grounding protection.
- I. EC Motors (ECM):

- General: Electronically commutated type with integral inverter to convert AC power (of voltage/phase indicated) to DC power, and solid state circuitry to vary output power and speed of motor. Motor shall have permanently lubricated bearings with an L10 life of 100,000 hours at expected operating conditions. Motor shall have rotor position and rotation detection as required for operation.
- 2. Speed Range: Motor speed shall be controllable down to 25% of full speed.
- 3. Manual Speed Control: Provide with manual speed adjustment dial for motor speed control. Dial shall be motor mounted unless indicated otherwise, operable by a screwdriver or by hand. Motor mounted controls shall be factory wired. Remote mount dials shall be hand operable (i.e. no tools required), shall be for mounting on a standard 2 x 4 electrical junction box, and be able to be located up to 100 feet remote from the motor. Motor control wiring for remote mount dials shall be factory wired from the motor to an equipment mounted junction box (with field supplied wiring from this J-box to the remote dial).
- 4. EMCS Control: Motor speed shall be adjustable via a remote 0-10V input signal (unless noted otherwise) from the building EMCS. Control wiring shall be factory wired from the motor to an equipment mounted junction box. EMCS control is not required where not indicated to be provided or where not utilized as part of the control sequence.
- 5. Control Power: Provide with integral transformer, factory wired, as needed to power motor controls. Locate transformer at motor or equipment.

2.05 IDENTIFICATION AND LABELS

A. General: All piping, valves, and mechanical equipment shall be labeled. Labels in concealed accessible spaces shall be reviewed and verified by Architect/Engineer prior to being concealed.

B. Piping:

- Type: Self-sticking colored identification markers, lettered to identify the pipe contents, and banded at each end with arrow tape indicating the direction of flow. Markers shall be similar and equal to Brady "System 1" and Seton "Opti-Code" markers. Spray painted stencil labeling is not acceptable. Some labels may be special order.
- 2. Identification Colors: Comply with ASME A13.1, and as follows:

Conveyed Material/SystemBackgroundLettersHydronic SystemsYellowBlackRefrigerationBlackWhite

3. Lettering: Lettering shall identify the material conveyed in each pipe and shall match the designation used on the plans, but without abbreviations. Systems which have supply and return piping shall have piping labeled as such (i.e. heating water return, heating water supply, etc.). Systems that have different pressures shall be labeled to indicate such (i.e. Steam-Low Pressure, Steam-Medium Pressure, Natural Gas-Low Pressure, Natural Gas-Medium Pressure, etc.).

4. Size: Size of letters and color field shall comply with ASME A13.1, repeated here for convenience:

Outside Diameter of	Length of	
Pipe or Covering	Color Field	Size of Letters
3/4 to 1-1/4 Inches	8 Inches	1/2 Inches
1-1/2 to 2 Inches	8 Inches	3/4 Inches
2-1/2 to 6 Inches	12 Inches	1-1/4 Inches
8 to 10 Inches	24 Inches	2-1/2 Inches
Over 10 Inches	32 Inches	3-1/2 Inches

- 5. Applications: Install on all exposed piping adjacent to each shut-off valve, at branches to indicate changes of direction, where pipes pass through walls and floors, on 20 foot centers or at least one in each room on each pipe. Markers shall be installed on all concealed accessible piping (i.e., piping above suspended ceilings, behind access doors, in accessible chases, etc.) near the point of access. For piping above suspended ceilings, markers shall be installed the same as if the piping was exposed (i.e., same as if the suspended ceiling was not in place). Markers shall be installed so as to be easily read by a person standing on the floor. Provide additional flow arrows at each pipe connection at valves having more than 2 ports (i.e. 3-way control valves).
- 6. Other Requirements: See other specification Sections for additional requirements.

C. Valves:

- 1. Labels: Laminated plastic or phenolic material, at least 1/16-inch thick, with black surface layer and white (unless other color indicated) sub-layer for letter engraving to expose sub-layer. Labels shall not be less than 3" x 1" in size. Label shall be pre-drilled at one end for attachment to valve. Attach to valve with No. 6 polished nickel-steel jack chain of sufficient length to allow label to hang free.
- 2. Lettering: Engrave label with valve size, name of system served (cold water, heating water supply, chilled water supply, etc.) and purpose of valve. Lettering size 3/16-inch, except where needed to be smaller to fit label size.
- 3. Application: Labels shall be installed on all valves except valves at hydronic system coils and equipment where the valve purpose is readily obvious.

D. Equipment:

- 1. Labels: Laminated plastic (or phenolic) material, 1/16-inch thick, with black surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Minimum 2-inch high (unless indicated otherwise or required due to equipment size) with length to contain required lettering. Label shall be pre-drilled and be mechanically fastened to the equipment. Prior to making labels, submit a list of all proposed labels.
- Lettering: All caps, engraved on label, with equipment designation (same designation as used on Contract Drawings; e.g. HVAC-101, EF-22, CP-1A). Air handling equipment (i.e. VAV terminal units, fans, etc.) labels shall include the room names and numbers or area of building served (use final installed room designations). Where systems serve portions of the building (i.e. wings or floors),

include on label the area served. Lettering shall be in multiple rows, with equipment label on top row. Equipment lettering to be 5/8-inch high; area served lettering to be 3/8-inch high (except that smaller lettering may be used if necessary to fit label size).

3. Application: All scheduled mechanical equipment shall be labeled. The label shall be located on a side of the equipment so as to be easily read, with the marking visible to a person standing at the access level near the equipment (assuming any necessary access to a concealed unit has been made).

E. **Electrical Devices:**

- 1. Labels: Minimum 1/4-inch high (unless indicated otherwise) lettering, all caps, engraved on laminated plastic or phenolic material, at least 1/16-inch thick. Laminated plastic (or phenolic) shall have black surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sublayer. Label shall be pre-drilled and be mechanically fastened to the item; where mechanical fastening is not possible use 3M VHB double sided specialty tape No. 4945. Prior to making labels, submit a list of all proposed labels.
- 2. Lettering: Label shall identify the item served (using the same designation as indicated on the Contract Drawings), the source of power (by panel and circuit breaker), and comply with code.
- 3. Application: Variable frequency drives, motor starters, disconnects, contactors, relays and similar items which control power to equipment and system components shall be labeled. The label shall be located so as to be easily read. See Division 25 for labeling of low voltage control components.

PART 3 - EXECUTION

3.01 **GENERAL**

- A. Workmanship: Furnish and install products to provide complete and functioning systems with a neat and finished appearance. If, in the judgment of the Architect/Engineer, any portion of the work has not been installed in accordance with the Contract Documents and in a neat workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall be required to revise the work so that it complies with the Contract Documents, at no increase in cost to the Owner.
- Coordination: Coordinate the work with all trades that may be affected by the work to В. avoid conflicts and to allow for an organized and efficient installation of all systems.
- C. Examination and Preparation: Examine installation conditions and verify they are proper and ready for the work to proceed. Verify compatibility of materials in contact with other materials, and suitability for conditions they will be exposed to. Do not proceed with the work until unsatisfactory conditions have been corrected. Prepare area to accept the work and prepare products for the installation.
- D. Field Conditions: Check field conditions and verify all measurements and relationships indicated on the drawings before proceeding with any work. In verifying existing conditions, the Contractor shall verify by direct physical inspection, complete tracing out of systems, by applying test pressures, by excavation and inspection, use of pipeline

cameras, and other suitable absolute certain methods to confirm the actual physical conditions that exist.

- E. Openings and Cutting and Patching in Existing Construction:
 - Openings--General: Provide all openings and cutting as needed to accommodate all work. Provide patching to restore all damaged and disturbed areas to preconstruction conditions (or better). The Contractor or subcontractor requiring the opening shall be responsible for making that opening. The opening shall be made by skilled labor experienced in providing openings in the material being penetrated.
 - 2. Areas To Be Cut and Patched: Wherever floors, walls, ceilings, plates, firestops and framing members are cut, these openings shall be substantially reinforced and sealed so as to maintain the strength and sealing ability of the element equal to that as if it had not been cut. All reinforcement/sealing shall satisfy the Architect/Engineer and comply with the governing codes. Such cut areas shall be patched and restored to a finished condition, equal to adjacent final finished areas that have not been cut.
 - 3. Cutting of Structural Features: Make no cuts or alterations to any structural framing members without explicit consent of the Engineer, and then only under his direction. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. All required cutting to install material shall be accomplished with the use of saw cutting equipment.
 - 4. Patching Materials: Patching shall be with materials of like kind and quality of the adjoining surface by skilled labor experienced in that particular trade.
- F. Cleaning: Clean all products (whether exposed to view or not) of all construction debris, and other materials; grease and oil spots shall be removed with appropriate cleaning agents and surfaces carefully wiped clean. Where cleaning cannot restore items to new conditions, the item shall be replaced with new.
- G. Site Work: All trenching, backfilling, compacting, and similar groundwork for utilities shall comply with specification, code, manufacturer, best construction practices, and WSDOT Standard Specifications for Road, Bridge, and Municipal Construction. Provide minimum 6-inch deep sand bedding, minimum 6-inch thick surrounding sand backfill, and 6-inch deep compacted backfill at buried items, unless noted otherwise or required otherwise. Washed 3/8-inch minus pea gravel may be used where allowed by product manufacturer and code. Subsequent backfill shall be in 6-inch lifts, and be compacted to 95% maximum density. Backfill material (above initial 6-inch sand) shall be free of organic material, and rocks larger than 3-inches in any direction.

3.02 INSTALLATION

- A. General: Work shall be in accordance with manufacturer's written installation instructions, code, applicable standards, and best construction practices.
- B. Space Verification: Prior to ordering materials verify that adequate space exists to accept the products, and along the installation path. Such verification shall be by direct field measurement of the actual space available and use of manufacturer's final submittal dimensions. Where the project involves new construction and long lead items and a time schedule not allowing for such direct field measurements, confirm in writing with all trades associated with building the space that adequate room is available. Review maintenance

and service access space required and confirm requirements will be met. No submittals shall be made until such space verification work has been performed, and confirmed that adequate space is available. By virtue of making a submittal that Contractor affirms he has completed this verification.

C. Installation Locations:

- 1. General: Unless dimensioned locations for items are shown, select the precise location of the item in accordance with the Contract Documents, coordinated with other trades and item connection locations, and subject to the Architect/Engineer's review. No allowances will be granted for failure to obtain the Architect/Engineer's review, failure to coordinate the work, and failure to comply with Contract Document requirements.
- 2. Manually Operated Components: Valves, damper operators, on/off switches, keypads, controls, and other devices which are manually adjustable or operated shall be located so as to be easily accessible by a person standing on the floor adjacent to the item. Any such items which are not in the open shall be made accessible through access doors in the building construction. See individual specification sections for additional requirements.
- 3. Monitoring Components: Gauges, thermometers, instrumentation, and other components which display visual information (i.e. operating conditions, alarms, etc.), shall be located and oriented so as to be easily read by a person standing on the floor. Provide necessary brackets, hangers, remote read devices and accessories as needed. Equipment control panels and graphic displays furnished with equipment (or integral to equipment) shall be located to be easily accessible by a person standing on the floor adjacent to the equipment, and be located between 4-feet and 6-feet above the finished floor.
- 4. Installation Issues: If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Architect/Engineer before installing the item in a location that will result in poor access.
- 5. ADA Accessibility: Locate items which are required to be ADA accessible in accordance with code (including but not limited to IBC, ICC A117.1 and local amendments) for accessibility; verify accessibility requirements with the AHJ.
- D. Replacement and Maintenance: Install mechanical equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance (e.g. coils, heat exchanger bundles, sheaves, filters, bearings, etc.) can be removed. Relocate items which interfere with access or revise item installation location, orientation, or means of access.
- E. Building Access Doors: Provide access doors where indicated and where needed to provide access to valves, drains, duct access doors, and similar items requiring service or access that would otherwise be inaccessible. Consult architectural drawings and coordinate location and installation of access doors with trades which are affected by the installation. Access doors are typically not shown on the drawings. The Contractor shall review all construction details and types and locations of items requiring access to determine quantity and sizes of access doors required.

- F. Rotating Parts: Belts, pulleys, couplings, projecting setscrews, keys and other rotating parts which may pose a danger to personnel shall be fully enclosed or guarded in accordance with Code, and so as not to present a safety hazard.
- G. Equipment Pads: All ground and slab mounted mechanical equipment shall be installed on a minimum 4-inch thick concrete pad, (unless indicated otherwise). Where the largest dimension for any pad exceeds 6 feet provide a 6 x 6 10 gauge welded wire fabric reinforcement in the pad (unless noted otherwise). Concrete shall be same as used for building footings (unless noted otherwise). Concrete shall be same as used for building footings (unless noted otherwise).
- H. Dissimilar Metals: Provide separations between all dissimilar metals. Where not specified in another way, use 10 mil plastic tape wrapped at point of contact or plastic centering inserts.
- I. Electrical Offsets: Provide offsets around all electrical panels (and similar electrical equipment) to maintain space clear above and below electrical panels to structure, and clearance of 3.5 feet directly in front of panel, except where indicated otherwise or required by code to be more. Such required offsets are typically not shown on the plans but are to be provided per this paragraph. Include in bid offsets for all systems near electrical panels.
- J. Piping Through Framing: Piping through framing shall be installed in the approximate center of the member. Where located such that nails or screws are likely to damage the pipe, a steel plate at least 1/16-inch thick shall be installed to provide protection. At metal framing, wrap piping to prevent contact of dissimilar metals. At metal and wood framing, provide plastic pipe insulators at piping penetrations through framing nearest each equipment connection and on at least 32-inch centers.
- K. Safety Protection: All ductwork, piping and related items installed by this Contractor that present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) shall be covered (at hazardous area) with 3/4" thick elastomeric insulation and reflective red/white self-sticking safety tape. All sharp corners on supports and other installed items shall be ground smooth.
- Equipment Access: Access to equipment is of utmost importance. Contractor shall apply extra attention to the location of pipe and duct routings and in coordinating all work so that equipment access and a clear maintenance pathway to equipment is maintained. Poor maintenance access will not be accepted. Contractor shall note that in essentially all areas piping and ducts need to run with slopes parallel to the roof (or floor above), in necessitating elbows/fittings/transitions at crosses of ducts/pipes and at all connections to mains and branches; and requiring added fittings to maintain a clear walking path over attic walkways.
- M. Pressure Tests: Maintain documentation of all pressure (and leakage) tests performed on systems and submit with project closeout documents. Records shall contain (as a minimum): date of test, system name, description portion of system being tested, method of test, initial and final test pressures (or of measured leakage rates, as applicable), indication of test pass or fail, name and signature of individual performing (or documenting) the test, initials of independent witness of test.

3.03 PENETRATION PROTECTION

A. Exterior and Watertight Penetrations: Where any work pierces the building exterior (or construction intended to be watertight) the penetration shall be made watertight and

weatherproof. Provide all necessary products (e.g. caulking, flashing, screens, gaskets, backing materials, siding, roofing, trim, etc.). Where not detailed or indicated how to install submit shop drawings of the proposed methods. Flashing arrangements shall be per SMACNA Architectural Sheet Metal Manual unless noted otherwise. Caulking alone is not an acceptable means of sealing penetrations.

B. Equipment: Equipment or products located outdoors shall be watertight (except for provisions designed to intentionally accept water and having drain provisions) and shall be designed and intended by the manufacturer to be used outdoors at the project location. Where any work pierces the unit casing exposed to the outdoors the penetration shall be made watertight and weatherproof; provide all necessary products (e.g. caulking, flashing, gaskets, backing materials, etc.).

3.04 START-UP

- A. General: Provide inspections, start-up and operational checks of all mechanical systems and equipment. Maintain documentation of all start-up work and submit with project closeout documents. See individual specification Sections for additional requirements.
- B. Personnel: Inspection and start-up services shall be done by individuals trained in the operation, and knowledgeable with, the systems being started-up. Equipment start-up shall be by the manufacturer's authorized service representative where indicated (see individual specification Sections).
- C. Scheduling and Agenda: Submit a proposed detailed start-up schedule with proposed dates and times at least 30 days prior to the earliest proposed system start-up. Revise dates and times as mutually agreed upon with trades involved, and witnesses, before submitting a final start-up schedule.
- D. Witnessing: Start-up may be witnessed by the Engineer and Owner's representative (at their option). Notify the Engineer and Owner 7 days prior to the proposed start-up time.

3.05 OWNER INSTRUCTION

- A. General: Provide instruction to the Owner on the operation and maintenance of all installed mechanical systems.
- B. Personnel: Instruction on the operation and maintenance of products shall be by individuals trained and experienced in the installation, operation and maintenance of these products. Instruction shall be by the product manufacturer's authorized service representative where indicated (see individual specification Sections).
- C. Scheduling and Agenda: Submit a proposed instruction schedule (with proposed dates and times) and an instruction agenda at least 30 days prior to the earliest proposed instruction period. Coordinate Owner and Architect/Engineer review and arrange mutually agreed upon instruction schedule and the instruction agenda, and submit a final instruction schedule and agenda. Organize instruction by sub-systems corresponding to the project specifications (or similar logical grouping).
- D. Instruction: Demonstrate and explain normal start-up, normal shut-down, normal operation, normal settings, adjustments, signs of abnormal operation, emergency shut-down, safety concerns, and related information. Demonstrate and explain system maintenance requirements with references to the O&M Manual. Show how maintenance is performed, including how items are accessed, maintenance procedures, tools and

parts required, and related information. Review typical repairs and explain how performed.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Protection of Items from Damage.
- B. Maintaining Utilities and Building Services.
- C. Cleaning.
- D. Temporary Systems.
- E. Review of Existing Conditions.
- F. Utility Locate.
- G. Cutting and Patching.
- H. Deactivation and Cap-off of Systems.
- I. Mechanical Demolition and Disposal.
- J. Salvage and Reinstallation.

1.03 DEFINITIONS

- A. "Remove", "demo", and "demolish" mean "Remove and legally dispose of item and item accessories; except where indicated to be reinstalled, salvaged, or some other required work is indicated."
- B. "Salvage and Reinstall (or Reinstallation)" means to "carefully remove, clean, pack for movement (drain of fluids, seal and protect from damage) and relocate to Contractor's selected (and suitable) storage area; reinstall as indicated after other work has been completed and as required by project schedule."

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials: All materials used for capping, temporary piping, repairs, reconnecting, reinstalling, and related work shall be same as specified for new systems.

PART 3 - EXECUTION

3.01 GENERAL

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

- Protection: Existing items not being demolished shall be protected against damage. A. Where necessary to prevent damage or necessary to accomplish other work, items shall be disconnected and moved to a suitable protective storage location during the project and then reinstalled to their original location.
- В. Utilities and Building Systems: Maintain existing utilities and building systems in service (unless indicated otherwise) and protect from damage during project. Where utilities or building systems must be shut-off to accomplish the work, see drawing notes, Section 20 05 00, and Division 01 for downtime limitations and Owner coordination and notification requirements; coordinate interruptions with other trades.
- C. Cleaning: All existing items that remain during construction and were affected by the construction shall be cleaned to a like new condition.
- D. Equipment and System Contents: Equipment and systems contain fluids that are typical for such items (e.g. HVAC units contain refrigerant, oils; hydronic systems contain ethylene glycol, corrosion control chemicals, etc.) and require special removal methods and disposal.

E. **Existing Items:**

- Information and Field Verification: Routing, locations, and identification of existing items on plans are approximate and are limited. The relative location of systems shown on plans has not been verified, and is schematic only. verify locations, contents, and flow direction of all piping and ducts prior to performing any work associated with such systems (see also Section 20 05 00). Do not rely on existing labeling of systems; such labeling shall be considered wrong until verified by other physical evidence.
- 2. Work Around: Existing building cavities (ceiling spaces, walls, etc.) contain a multitude of systems (e.g. conduit, wiring, fire suppression, light fixtures, low voltage system components, piping, ducts, etc.) typical for buildings of the type of this project. Added effort is required to identify and locate these systems, to work around such systems, and to temporarily disconnect and reconnect (and possibly remove and store) various building components to accommodate the work. Existing building elements will also require the work to be installed in smaller sections (i.e. shorter pipe or duct lengths) than normally possible, and to make system connections in awkward or cramped locations.
- 3. Revisions: Revise existing systems as needed to accommodate project work and new finishes. Work shall include adjusting locations of items to suit new ceiling heights, revisions to building element locations, revisions to finishes, and other changes.
- 4. Electrical: Verify voltage, phase, horsepower, panel circuits, and other electrical parameters of existing items prior to beginning work and ordering replacement products. Electrical data listed on the drawings for such items has not been field verified.
- 5. Hydronic Systems: Unless noted otherwise, work on hydronic systems will require complete system drain down and re-filling to accomplish the work. Refilling shall restore the system to pre-construction chemical concentration conditions, as indicated by the latest Owner's chemical test results. Systems that contain glycol may have the glycol salvaged and reused in refilling the system provided the fluid to be reused is filtered through a 20 mesh strainer.

6. Controls: Verify existing communication protocol, existing component manufacturers, and model numbers, LAN type(s), software, location of devices, quantity of system points, methods used in terminating communication wiring,

overall system performance, and sequences.

F. Cutting: Provide all cutting and openings as necessary to accomplish the work indicated. No structural members shall be cut unless Structural Engineer's approval is obtained first. Assume all building members are "structural" unless clearly evident otherwise. See Section 20 05 00 and Division 01 for additional requirements.

- G. Patching: Patch all wall/floor/ceiling/roof openings left by removal of existing items where wall/floor/ceiling/roof is to remain. Patch with materials and workmanship so as to match finish of adjacent undisturbed area, and to provide conditions equivalent to the original new construction.
- H. Disposal: Dispose of all demolished items and all waste materials off site in accordance with code and legal requirements.
- Owner's Salvage: Owner has first right to all items shown to be demolished. All items not wanted by Owner, and not indicated to be salvaged for reuse, shall be removed by the Contractor.

3.02 REVIEW OF EXISTING CONDITIONS

- A. General: Provide field investigation of all systems and existing conditions to confirm extent of demolition, routing of existing systems, existing building materials of construction, mechanical system types and materials involved, areas where cutting and patching is required, site access, sizes of existing system components, and all other aspects of existing building and systems and their relationship to the Work.
- B. Review Timing: Review existing conditions prior to bidding, again prior to commencing any work or ordering materials, and continually throughout the project.
- C. Review for Space and Routing:
 - 1. Review existing conditions (including dimensions) where equipment must be moved through to confirm adequate space and path.
 - 2. Review existing conditions (including dimensions and locations of existing systems) where work will occur to determine impact on the locations and routing of new systems; include time to develop shop drawings and revisions to routing shown on the design drawings to accommodate existing conditions.
- D. Existing Record Drawings: Existing record drawings located at the Engineers office Architect's office OR Owner's facilities office are available for review.
- E. Site Utility Locate: Contact utility agencies and utility locate services to locate utilities. Where such locate services are not provided by public utility locate services retain the services of a private locate company. Such locate work shall include the use of ground penetrating radar (or equivalent technology) and pot-holing to determine the exact location of utilities where connections to these utilities occurs, and to determine the location of utilities in the vicinity of the work.
- F. Construction Thickness: Where needed to perform the work, and to prevent damage to

adjacent construction, verify the thickness of existing concrete floors and other elements by selective drilling or saw cutting.

3.03 DEMOLITION

- A. General: Review site conditions and identify all demolition work; include in bid all costs for demolition and disposal. Coordinate all demolition work with other trades. Confirm items to be salvaged or reused, and overall demolition scope.
- B. Scope: Not all items to be demolished are necessarily shown on the drawings, but are covered by notes and specifications. In addition to demolishing items indicated, demolish all associated items (unless indicated otherwise); this includes such items as supports, insulation, piping, drains, control wiring/conduit, power wiring/conduit, unions, valves, and similar accessories. Demolish all utilities serving demolished items completely or back to active mains where mains are to remain active; assume such utilities extend at least forty feet from the demolished items (unless indicated otherwise). Demolish all mechanical items located in building elements which are being demolished (i.e. located in walls, chases, roof assemblies, etc.). Demolish items as required to accomplish the work.
- C. Prevent Damage: Where existing building systems are to be reused to serve new items, carefully execute the demolition work to prevent damage to items to be reused and to prevent the demolition of items that are intended for reuse.
- D. Depth: Abandoned items, anchors, inserts, and other projections embedded in existing construction and not being concealed by new construction shall be removed to 1" below the adjacent finished surface, and the disturbed area patched.

E. Cap-Offs and Terminations:

- Permanent: Provide cap-off of all existing utilities and systems that are cut or served demolished items. All cap-offs shall occur in concealed locations (unless indicated otherwise). Cap-off's shall be of equivalent material as the item being capped and be insulated where the connected system was insulated or where doing so will reduce energy consumption or prevent condensation.
- 2. Temporary: Provide temporary cap-off of all existing utilities and systems to allow continued use of all systems until the final system components are installed and connected.
- 3. Wiring Terminations: Terminate all control wiring and electrical power connections in a manner that complies with code and allows remaining items to function as intended.

3.04 REMOVAL AND REINSTALLATION

- A. General: Where items are required to be removed to allow for other work and then be reinstalled when the other work is done, comply with the following.
- B. Removal: Carefully remove items to prevent damage and in a manner to allow for reinstallation. Remove all related items to the extent needed to allow for the Work.
- C. Package: Package item to allow for transport and storage without damaging. Label packaging to identify contents; include unique identifier number, brief description, and location (room number) item was removed from.

- D. Documentation: Compile list of removed items and documentation needed to allow for their reinstallation.
- E. Storage: Store items in secure and protective area until ready for reinstallation.

F. Reinstallation:

- 1. Reinstall items and accessories as completion of other work allows. Provide all necessary connections and services to allow item to function properly; not all such connections are illustrated on the plans.
- 2. Provide new fasteners, supports, anchors, gasketing, seals, pipe connectors, unions and related items to allow for complete and proper connections and operation of reinstalled items.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Thermometers.
- B. Pressure Gauges.
- C. Strainers.
- D. Unions.
- E. Flexible Connectors.
- F. Test Ports.
- G. Access Doors.

1.03 SUBMITTALS

- A. General: Comply with Section 20 05 00.
- B. Product Data: Submit product information data for all items to be used.

1.04 REFERENCES

- A. ANSI Z21.24: Connectors for Gas Appliances.
- B. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.
- C. ASME B16.39: Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300.
- D. ASME B40.3 Bimetallic Activated Thermometers.
- E. ASME B40.100 Pressure Gauges and Gauge Attachments.
- F. IFGC: International Fuel Gas Code.
- G. IMC: International Mechanical Code.
- H. UPC: Uniform Plumbing Code.

1.05 GENERAL REQUIREMENTS

A. Domestic (Potable) Water Systems: All items in contact with potable water shall be lead free in accordance with ANSI/NSF 61. Plastic piping system components shall comply with ANSI/NSF 14.

B. System Requirements: Products shall comply with additional requirements cited for the specific systems the products are being installed in; see specific system specification sections.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.
- B. Thermometers: Trerice, Weiss, Winters.
- C. Pressure Gauges: Trerice, Weiss, Winters.
- D. Strainers: Watts, Keckley, Mueller, Sarco, Taco, Paco, Bell & Gossett, Armstrong, Wilkins.
- E. Unions: Anvil, Nibco, Watts, Epco, Victaulic, Ward, Jefferson Union.
- F. Dielectric Connecters: Victaulic Precision Plumbing Products, Elster Perfection.
- G. Flexible Connectors: Universal, Mason, Dormont, OPW, Unisource, Twin City Hose.
- H. Test Ports: Autoflow, Flowset, Peterson Equipment.
- I. Access Doors: J.R. Smith, Zurn, Josam, Acudor, Elmdoor, Kees, J.C. Industries.
- J. Escutcheons: Selected by Contractor.

2.02 THERMOMETERS - INDUSTRIAL

- A. Type: 7 inch scale, adjustable angle, red reading mercury, industrial thermometer.
- B. Construction: Aluminum or polyester case, acrylic plastic or heavy glass window, aluminum face, stem of brass or aluminum construction, with separate brass socket (i.e. thermowell). Bulb chambers tapered to match taper in thermowell to give metal to metal contact. Scale case adjustable over a minimum 180° range, with locking fastener.
- C. Stem Length: Stem insertion length approximately one-half of pipe diameter. Where installed on tanks, minimum insertion length is 5". Where installed on insulated piping systems, provide a longer stem thermometer and extended neck socket (thermowell) to extend thermometer base past the insulation.
- D. Display: White background with bold black numerals and Fahrenheit degree markings, red reading mercury.
- E. Accuracy: Plus or minus 1% of full scale.
- F. Ranges: Plus or minus 50% of systems normal operating temperature (at point of measurement), with figure intervals approximately 1/20th of range. For systems with multiple operating temperatures wider ranges may be used to allow the same thermometer type through-out the system.

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

2.03 PRESSURE GAUGES

- A. General: 4-1/2" round dial, stem mounting, black impact resistant phenolic (or fiberglass reinforced polypropylene) flangeless case, white face with black numerals, phosphor bronze bourdon tube rated to minimum 250 psi, brass socket, acrylic window, and 1/4" npt (or ½" npt) bottom connection. Shut off cock not allowed (use ball valve). Rated for use with the system pressures and temperatures to be exposed to, but be rated for no less than 250° F. Accuracy shall be 0.5% per ASME B40, 100 Grade 2A.
- B. Liquid Fill: Gauges used on pumps and where vibration or pulsation are present shall be liquid filled and be provided with a snubber. Liquid fill shall be suitable for ambient temperatures from 0 to 150° F, and for system temperatures to be encountered.
- C. Pressure Gauge Ranges: 0 to 1.5 times systems normal operating pressure (at point of measurement), with numeral figures on 5 psig for gauges reading to 100 psi, and 10 psig on gauges reading to higher values. Except: systems which operate at a vacuum, provide range from 30 to 0 inches mercury vacuum; where measuring differential pressure provide range 1.5 times normal measured pressure.

2.04 STRAINERS

A. Water Systems:

- 1. Copper Piping Systems 2-1/2" and Smaller: Bronze body, "Y" type, screwed or solder type end connections, 125 lb class (rated 125 psi steam working pressure at 350 deg F minimum) and 400 psi (WOG) rated working pressures at 210 deg F, stainless steel 20 mesh wire screen, and gasketed retainer cap. Reinforce wire mesh with perforated stainless steel sheet for sizes 2" and 2-1/2". Ratio of net free area of screen to pipe free area greater than 3.5. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the hydronic piping system specification section.
- 2. Copper Piping Systems 3" and Larger: Bronze or ductile iron body, "Y" type, flanged end connections, 150 lb class (rated 150 psi steam working pressure at 400 deg F minimum), brass or stainless steel screen with 3/64" perforations for 3" and 3/32" perforations for larger sizes; with gasketed threaded retainer cap. Ratio of net free area of screen to pipe free area greater than 3. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the hydronic piping specification section.
- 3. Steel Piping Systems: Ductile iron, cast iron, or carbon steel construction, "Y" type, 250 lb class (rated 250 psi steam working pressure at 450°F minimum), with stainless steel screen. Screen shall be 20 mesh for strainers up to 2" in size, and have 3/32" perforations on larger sizes. Sizes 2-1/2 inch and less shall have threaded end connections; larger sizes shall have flanged end connections. Provide with bolted and gasketed strainer cap on flanged strainers; provide threaded gasketed retainer cap on threaded strainers. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the hydronic piping system specification section.
- B. Pump Suction Diffusers: Cast iron body, angle type, with steel straightening vanes, steel orifice cylinder (shall be stainless steel on open cooling tower systems), 16 mesh bronze

start-up strainer, and permanent removable magnet. Orifice cylinder shall be designed to withstand differential equal to pump shutoff head (maximum 75 psi) and shall have a free area equal to 5 times cross section area of pump suction opening. Straightening vanes shall extend the full length of the orifice cylinder and shall be replaceable. Unit shall be rated for 175 psi service up to 250 degrees F. Suction diffuser inlet shall match system piping (or next pipe size to), outlet shall match pump inlet. Unit shall have an adjustable foot support and minimum 3/4-inch NPT blowdown tapping and 1/4-inch NPT gauge tapping.

2.05 UNIONS

- A. Dielectric Unions: Shall not be used. Provide "dielectric connector" with standard union where union is required at connection point of dissimilar materials.
- B. Unions on Copper Pipe:
 - 1. General: Pressure and temperature ratings to match (or exceed) piping system being installed in; minimum Class 125.
 - 2. 2-Inch Pipe and Smaller: Wrought copper solder joint copper to copper union, complying with ASTM B16.18.
 - 3. 2-1/2-Inch Pipe and Larger: Brass flange unions.
- C. Unions on Steel Pipe:
 - 1. General: Pressure and temperature ratings to match (or exceed) piping system being installed in: minimum Class 150.
 - 2. Threaded: Malleable iron union, threaded connections, with ground joints, complying with ASME B16.39. Provide with brass-to-iron seat (except provide iron-to-iron seat where the conveyed material is detrimental to brass).
 - 3. Welded and Flanged: Flange unions; see individual system specification sections.
- D. Dielectric Connector: Schedule 40 steel pipe nipple, zinc electroplated, with internal thermoplastic lining which is NSF/FDA listed and meeting all code requirements for potable water applications. Suitable for continuous use up to 225 deg F and 300 psi. "Clearflow" dielectric waterway (or approved). For systems operating at temperatures greater than 225 deg F provide flanged connections with insulating gaskets.

2.06 FLEXIBLE CONNECTORS

- A. Piping Flexible Connectors:
 - General Use: Corrugated hose type with outer braided wire sheath covering. Corrugations shall be close pitch annular type. Minimum working pressure of 250 psig, minimum length of 12 inches (or 12 times the connector's nominal diameter, whichever is more), and screwed or flanged end connections. Metal for hose shall be bronze or stainless steel; braided sheath shall be stainless steel, any type of ASTM 300 series.
 - 2. Fuel Gas Piping 1-1/4 Inch and Smaller: Factory fabricated flexible gas

connector, constructed of type 304 stainless steel tubing, corrugated, with brass or stainless steel threaded end fittings, and heavy PVC coating. Listed for use in fuel gas piping systems; complying with ANSI Z21.24 and IFGC. Size flexible connector to match pipe size shown on plan, with reducer after the flexible connector to match the equipment connection size (where connecting to equipment). Length as required to accommodate equipment movement relative to piping; minimum 18-inch length for sizes 1/2-inch diameter and less; minimum 24-inch length for larger sizes. Where used on appliances that require to be moved for cleaning or servicing, provide type listed for mobile appliance application, with adequate length to allow for appliance movement, and with a restraining cable and mounting hardware to prevent strain applied to gas connector.

- 3. Fuel Gas Piping Larger than 1-1/4 Inch: Factory fabricated flexible gas piping connector, constructed of series 304 or 321 stainless steel, with braided exterior, carbon steel (or stainless steel) threaded or flanged end connections, rated for 350 psig working pressure, For use with fuel gas piping systems and complying with IFGC. Size flexible connectors to match pipe size shown on plan, with reducer after the flexible connector to match the equipment connection size.
- B. Pump Flexible Connectors: Twin sphere type, constructed of peroxide cured EPDM with Kevlar tie cords, multilayered. Embedded solid steel rings shall be used at raised face flanged ends. Shall have an external ductile iron reinforcement ring between spheres. Rated minimum 225 psi at 230°F. Control rods shall be used as recommended by the manufacturer for the application; rods shall have 1/2-inch thick neoprene bushings, washers and accessories sized to accommodate system loads and conditions. Same size as pipe installed end, with end connections to suit connecting piping. Mason Industries "SafeFlex" SFDEJ Series, and SFDCR Series.

2.07 TEST PORTS

A. Temperature/Pressure Type: Test port for installation in tee in piping allowing insertion of probe for measurement of pressure and/or temperature. Valve shall be of brass construction, have 1/4-inch or 1/2-inch NPT male connection, with dual valves to prevent leakage and gasketed cap with attachment to test port. Rated for minimum 500 psi and 275 deg F. Provide extended length on insulated piping systems so that insulation does not cover the test port.

2.08 ACCESS DOORS

- A. Hinged lockable steel access door, for mounting on face of wall, with minimum 16 gauge frame and 16 gauge door, concealed hinge, cam and cylinder lock, and anchor straps or anchor frame with mounting holes. Provide Type 304 stainless steel construction with No. 4 finish where used in restrooms, locker rooms, kitchens, and similar "wet" areas. Provide steel construction with prime coated finish in other areas. Door shall have rounded corners, and concealed pivoting rod hinge. Size shall be 12" x 12" (unless indicated otherwise) but shall be large enough to allow necessary access to item being served and sized to allow removal of the item (where access door is the only means of removal without disturbing fixed construction).
- B. Fire Rating: Door shall maintain fire rating of element installed in; reference drawings for required rating.
- C. Access doors shall all be keyed alike. Provide two (2) keys for each door.

2.09 ESCUTCHEONS

- A. Type: Circular metal collar to seal pipe penetrations at building elements (i.e. walls, floors, cabinets, and ceilings); one piece type except that split hinge type may be used for applications on existing piping.
- B. Construction: Constructed of chrome plated brass or polished stainless steel, sized to tightly fit pipe exterior surface (or pipe insulation where insulated) and to fully cover the building element penetration.
- C. Projection: Shallow face type with maximum projection from wall not to exceed 1.2 times inner diameter of escutcheon.
- D. Special Applications: For sprinkler heads and similar special applications see items' specification Section.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Thermometers: Install thermometers and thermal wells in piping at locations indicated, and so as to be easily read.
- B. Pressure Gauges: Install pressure gauges at inlet and outlets of all pumps; at each side of pressure reducing valves; and as indicated. Provide with ball-type isolation valves.
- C. Strainers: Install strainers ahead of each control valve, and as indicated. Provide valve in blow-off connection on strainers, valve shall be same size as blow-off tapping.
- D. Unions: Install unions in pipe connections to control valves, coils, regulators, reducers, all equipment, and where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise. Dielectric unions shall not be used.
- E. Dielectric Connectors: Install connectors between all connections of copper and steel piping (or equipment), and other dissimilar metals. Where flanged connections occur use insulating type flanges. Dielectric unions shall no be used.
- F. Flexible Connectors Piping: Install at pipe connections to equipment with rotating elements (except not required at hydronic heating/cooling coils unless specifically noted), at building expansion joints, and where indicated. Provide flexible connector in gas piping connections to all equipment; size flexible connectors to match pipe size shown on plan, with reducer after the flexible connector to match the equipment connection size.
- G. Access Doors: Provide access doors where indicated on the drawings and where needed to provide access to trap primers, water hammer arresters, cleanouts, valves, coils, controls, mechanical spaces, and similar items requiring service or access that would otherwise be inaccessible. Consult architectural drawings and coordinate location and installation of access doors with trades which are affected by the installation. Access doors are typically not shown in the plans. Review ceiling and wall types and locations of items requiring access to determine quantity and sizes of access doors required.

H. Escutcheons: Provide at all pipe penetrations through building elements, except where penetration is concealed (unless specifically noted otherwise). Items located in accessible cabinet spaces (e.g. below sinks) are not considered concealed.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- Pipe Hangers and Supports.
- B. Duct Hangers and Supports.
- C. Mechanical Equipment Anchors and Supports.

1.03 QUALITY ASSURANCE

- A. Pipe Hanger Standards: Manufacturers Standardization Society (MSS) Standards SP-58, SP-89, SP-69, and SP-90.
- B. General: All methods, materials and workmanship shall comply with Code; including IBC, IMC, UPC, NFPA Standards, and ASME standards.

1.04 SUBMITTALS

- A. General: Submittals shall comply with Section 20 05 00.
- B. Product Data: Submit product data for all hangers, supports, and anchors. Data to include finish, load rating, dimensions, and applicable agency listings. Indicate application for all items by system type, size, and other criteria as appropriate to project.

C. Shop Drawings:

- 1. General: Shop drawings shall clearly indicate dimensions, anchor and support type, anchor and support size, anchor and support spacing, finish, configuration, and systems/equipment to be applied to.
- 2. Attachments: Submit shop drawings for proposed attachment methods to building structure where the method of attachment has not been shown on the drawings, or where attachment methods other than those shown on the drawings are desired to be used.
- 3. Fabricated Supports: Submit shop drawings for all fabricated supports.
- 4. Finished Areas: Submit shop drawings for all supports that will be exposed in finished areas.

1.05 GENERAL REQUIREMENTS

A. Seismic: Provide adequate hangers, supports, anchors, and bracing to serve as seismic restraints. Seismic anchoring and bracing methods shall comply with SMACNA SRM, Mason SRG, and code. Seismic restraints system shall be able to withstand seismic

forces as required by code but no less than two times the weight of the supported (or anchored) item (including contents) in an upward direction and a force equal to the weight of the item (including contents) in a horizontal direction, without placing excess stress on the item or allowing excess movement of the item (i.e. movement that would cause damage to the item or adjacent items or cause support failure). Forces on equipment shall be applied to the center of gravity of the equipment.

B. Design and Manufacture: All pipe hangers and supports shall be designed and manufactured in accordance with MSS-SP 58.

1.06 REFERENCES

- A. ADC: Air Duct Council Flexible Duct Performance and Installation Standard, 5th Edition.
- B. ASHRAE-F: American Society of Heating, Refrigeration, and Air Conditioning Engineers, Handbook of Fundamentals.
- C. ASME B31.1: Power Piping.
- D. ASME B31.9: Building Services Piping.
- E. ASTM A36: Standard Specification for Carbon Structural Steel.
- F. ASTM A108: Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
- G. ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- H. ASTM A153: Standard specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- I. ASTM A653: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
- J. ASTM A907: Standard Specification for Steel, Wire, Epoxy Coated.
- K. ASTM A924: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.
- L. IBC: International Building Code.
- M. IMC: International Mechanical Code.
- N. Federal Spec QQ-W-461H: Wire, Steel, Carbon (Round, Bare, and Coated).
- O. Mason SRG: Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, Electrical Systems and Floor Mounted Equipment, 6th Edition.
- P. MSS SP-58: Pipe and Hangers and Supports Materials, Design and Manufacture.
- Q. MSS SP-69: Pipe and Hangers and Supports Selection and Application.
- R. MSS SP-89: Pipe Hangers and Supports Fabrication and Installation Practices.

- S. MSS SP-90: Guidelines on Terminology for Pipe Hangers and Supports.
- T. SMACNA-DCS: HVAC Duct Construction Standards, 3rd Edition.
- U. SMACNA SRM: Seismic Restraint Manual Guidelines for Mechanical Systems, 2nd Edition.
- V. UPC: Uniform Plumbing Code.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.
- B. Hangers and Supports: Grinnell, B-Line Systems, Unistrut, Erico, PHD, Basic-PSA, Pate, Caddy, Unisource, Metraflex, American Insulation Sales, Thermal Pipe Shields.
- C. Anchors: Rawplug, Phillips, Hilti, Michigan, Simpson, Fastenal, Grinnell, B-Line Systems, Unistrut, PHD, Basic-PSA, Metraflex.

2.02 GENERAL

A. Finish:

- 1. Indoor Applications: Electro-plated zinc in accordance with ASTM B 633, or hotdip galvanized after fabrication in accordance with ASTM A 123; except that hanger straps may be formed from pre-galvanized steel.
- 2. Outdoor Applications: Hot-dip galvanized after fabrication in accordance with ASTM A 123, ASTM A 153, or ASTM A 653 (as applicable to item).
- B. Identification: Steel pipe hangers and supports shall be stamped with the manufacturer's name, part number, and size.
- C. Hanger Rods: Threaded hot rolled steel. Hanger rods shall be sized so that the total load imposed (including pipe or duct, insulation, hangers, and fluid) does not exceed the following:

Nominal Rod Diameter	Maximum Load
1/4 Inch	240 Pounds
5/16 Inch	440 Pounds
3/8 Inch	610 Pounds
1/2 Inch	1130 Pounds
5/8 Inch	1810 Pounds
3/4 Inch	2710 Pounds
7/8 Inch	3770 Pounds
1 Inch	4960 Pounds

D. Hanger Straps: Galvanized steel, minimum 1" x 22 gauge (except where required by Code to be heavier or noted otherwise), of lock-forming grade conforming to ASTM A924, G90 (minimum) galvanized coating conforming to ASTM A 653. Minimum yield strength

of 30,000 psi. Straps shall be sized so that the total load imposed does not exceed the following:

Strap Size	Maximum Load	
1" x 22 Gauge	230 Pounds	
1" x 20 Gauge	290 Pounds	
1" x 18 Gauge	380 Pounds	
1" x 16 Gauge	630 Pounds	
1-1/2" x 16 Gauge	990 Pounds	

- E. Beam Attachments: Constructed of malleable iron or steel, MSS standard types designed for clamping to building structural support beam. "C" clamp type shall have cup point set screws with locknuts and retaining straps. Center loaded type beam clamps shall have horizontally adjustable clamping bolt (or rod with nuts).
- F. Concrete Anchors: Wedge type expansion anchors, with hex nut and washer, and stainless steel split expansion rings. Tested to ASTM E 488 criteria, UL listed, with exposed anchor head stamped with code to identify anchor length.
- G. General Anchors (Screws, Nuts, Bolts, Fasteners):
 - General: Constructed of materials suitable for the conditions exposed to and materials being joined, with minimum 50 year service life. Stainless steel construction where exposed to corrosive conditions. Configuration, size and grade to suit application, accommodate expected forces, and provide anchoring to structural element (or allow for proper fastening of items). Minimum safety factor of 2.5 (or as required by code, whichever is greater). Comply with ASTM A307, SAE J429, SAE J78, or ASTM A 563; bolts and nuts shall have unified inch screw threads (course, UNC).
 - 2. Test Reports: Provide independent test report indicating fastener strength (pullout and shear) as installed in the materials and applications of this project (when required by the Engineer or AHJ).
 - 3. Finish: In finished areas, the portion of fastener exposed to view shall match the exposed finish of item being fastened.
- H. Manufactured Strut Systems:
 - 1. Channels: Minimum 12 gauge, 1-5/8 x 1-5/8" (unless noted otherwise), with slots/holes to suit application.
 - 2. Accessories: Channel nuts press formed, machined and hardened with gripping slot, fabricated from steel conforming to ASTM A 108 or ASTM A 36. Fittings fabricated from steel in accordance with ASTM A 907.
 - 3. End Caps: Vinyl cap, capable of withstanding high temperatures without degradation, manufactured specifically for use with manufactured strut. Unistrut Series P2859 or P2860 (or approved).
- I. Steel: Structural steel per ASTM A 36.
- J. Wood: Only allowed to be used where building structural elements are of wood construction same type, grade used for building structural members. Where located

outdoors shall be the pressure treated type; with all cut portions of wood painted with wood preservative.

K. Field Galvanizing Compound: Brush or spray applied galvanizing treatment; consisting of a premixed ready to apply liquid organic zinc compound, with 95% metallic zinc content by weight in dry film. ZRC worldwide "ZRC Cold Galvanizing Compound".

2.03 PIPE HANGERS AND SUPPORTS

- A. Copper Pipe: All hangers used directly on copper pipe shall be copper plated or have a factory applied 1/16-inch thick (minimum) plastic coating on all contact surfaces.
- B. Cushion Clamps: Pipe clamps with a vibration dampening insert between the pipe and clamp, with a nylon inserted lock-nut on clamp. Insert shall be constructed of a thermoplastic elastomer, designed to tightly fit and match pipe size and clamp used with; suitable for system temperatures.
- C. Type: Shall be MSS type selected in accordance with MSS-69; except that MSS type 24, 26, and 34 shall not be used.
- D. Trapeze Hangers: Shall be constructed of carbon steel angles, manufactured strut channels, or other structural shapes with flat surface (or installed saddle) for pipe support. Provide steel washer where hanger rod nuts bear on trapeze hanger. Pipe anchors shall be two piece clamp type designed for use with trapeze style (i.e. inserted into strut channel opening) or one piece type designed for welded or bolted attachment to trapeze; shaped to match pipe size (or pipe size plus insulation thickness on insulated systems). Pipe guides shall comply with paragraph titled "Alignment Guides"; or be steel angles with vertical leg height equal to pipe diameter (or pipe diameter plus insulation thickness on insulated systems); or be two piece clamp type pipe anchors sized and installed to serve as a guide.

E. Insulated Pipe Supports:

- Insulation material at pipe support shall consist of expanded perlite, calcium silicate or high density phenolic. Where located outdoors or used on chilled water piping, insulation material, shall be water resistant. Insert shall have a flame resistant jacket of nylon reinforced kraft paper bonded to aluminum foil cover on insulation, with galvanized steel shield. Insulation material shall have no more than 5% deformation at 100 psi and a thermal conductivity no more than 0.32 Btu/hr-sf-deg F-inch (rated at 75 deg F). Insulation shall be suitable for temperatures and conditions it will be exposed to without degradation over a 30 year life.
- 2. All insulation and materials shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E84.
- 3. Insert shall be same thickness as adjoining pipe insulation, sized to match pipe diameter used on.
- 4. Minimum insulation and shield lengths, and minimum shield gauge:

Nominal Pipe	Insulation	Shield	Minimum**
Diameter	Length	Length	Shield
In Inches	In Inches	In Inches	<u>Gauge</u>

1/2 to 1	*	4	20
1-1/4 to 2	6	4	20
2-1/2 to 6	6	4	18
Larger Sizes	9	6	16

^{*} Insert not required; shield at insulation is acceptable.

2.04 DUCT HANGERS AND SUPPORTS

- A. Hangers: As shown in SMACNA-DCS except that wire shall not be used and all materials used shall comply with these specifications.
- B. Vertical Duct Supports at Floor: 1-1/2" x 1-1/2" x 1/8" (minimum) galvanized steel angle and to support ducts, maximum 12 foot on center, and as shown in SMACNA-DCS. For ducts over 30 inches wide provide riser reinforcing with hanger rods between the riser support and riser reinforcing.
- C. Vertical Duct Supports at Wall: 1-1/2" x 1/8" (minimum) strap or 1-1/2" x 1-1/2" x 1/8" (minimum) angle bracket and as shown in SMACNA-DCS.
- D. Hanger Attachments to Structure: As shown in SMACNA-DCS to suit building construction and as allowed on structural drawings. Provide washers at all fasteners through hanger straps (regardless of SMACNA-DCS allowances). Where C-clamps are provided, retainer clips shall be used. Friction beam clamps shall not be used.
- E. Hanger Attachments to Ducts: As shown in SMACNA-DCS except that wire shall not be used as any form of support or attachment for ducts.
- F. Flexible Duct Strap: Woven polypropylene hanging strap, minimum tensile strength of 400 lbs, minimum 1.75-inches wide, designed and intended for flexible duct support.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

- A. General: Provide all necessary bolts, nuts, washers, fasteners, turnbuckles, hanger rods, rod connectors, stanchions, wall/roof/floor backing and attachments, bridging between structural members, and any other miscellaneous accessories required for the support and anchoring of all pipes, ducts, and mechanical equipment. All supports, whether from floor, walls, or hung from structure, are Contractor's responsibility. Anchors and supports shall be adequate to accommodate forces equipment will be exposed to. Any field cut pieces of galvanized materials shall be hot-dip galvanized after cutting; or be solvent and wire brushed clean and receive field applied galvanizing treatment. This field applied galvanizing (only allowed with prior permission for minor localized cuts) shall use multiple coats to provide as near equal protection as possible to factory (or hot-dip) applied coatings.
- B. Backing: Install steel or wood backing in walls (anchored to studs) and in ceiling (anchored to joists or trusses), as required to provide support for items.
- C. Installation: Install all inserts, anchors, and supports in accordance with manufacturer's instructions, code requirements, and best professional practices. The most restrictive criteria governs.

^{**} Provide with 360° shield where pipe is clamped (or has a 360° anchor).

- D. Welded Assembly Finish: All welded steel support assemblies shall have a power wire brush and primer paint finish where installed indoors and be have factory applied hot-dip galvanized finish where installed outdoors (or subject to moisture); unless another finish is specified.
- E. Attachments: Attach to anchoring element (i.e. building structure, concrete pads, etc.) as shown on drawings (reference structural drawings). Where not detailed on the drawings, the Contractor shall design and submit shop drawings of proposed attachment methods to the Engineer for review.

F. Application:

- Where not detailed on the drawings (or otherwise indicated), the selection and design of supports is the Contractor's responsibility, in compliance with code and Contract Document requirements; subject to submittal review and acceptance by the Engineer.
- 2. Exposed supports in finished areas shall be arranged to minimize their visibility; be free of dents, scratches and labels, and be configured in a manner to match the decorum and finish of the room they are installed in. Exposed supports in finished areas shall be cleaned to allow for field painting (unless a chrome, stainless steel, or similar finish has been indicated).
- 3. HVAC Support wire and flexible duct strap shall only be used for support of ceiling air inlets and outlets, or at flexible duct supports.
- G. Manufactured Strut ("Unistrut"): Provide end caps on all strut ends at the following locations:
 - 1. Where exposed to view in finished areas.
 - 2. Where near maintenance access paths.
 - 3. Where personnel injury could occur if the ends were not covered.
- H. Seismic: Provide hangers, supports, anchors and bracing as required by code and as necessary to accommodate forces in a seismic event. Seismic bracing is not required for piping sized 2-inch and less, or for horizontal piping where the distance from the top of the pipe to the support attachment point to the building structure is less than 12-inches (unless noted otherwise). Seismic bracing is not required for ductwork less than 28-inch in diameter or having across sectional area less than 6 square feet, or for horizontal ductwork where the distance from the top of the duct to the support attachment point to the building structure is less than 12-inches (unless noted otherwise). All equipment shall be seismically anchored.

3.02 INSTALLATION OF PIPE HANGERS AND SUPPORTS

- A. General: Aboveground pipe shall be anchored to the structure to prevent sagging, to keep pipe in alignment, and to resist the forces the pipe will be exposed to; piping shall be supported independent of equipment so that no loads bear on the equipment. Underground pipe shall be evenly supported in trenches with proper bedding materials.
- B. Adjustment: All pipe supports shall be provided with a means of adjustment for the aligning and leveling of the pipe after installation.

- C. Applications: Selection, sizing, and installation of pipe supports and accessories shall be in accordance with the manufacturers recommendations, standards MSS SP-89 and MSS SP-69, UPC, and IMC. Refrigerant piping and similar piping subject to vibration (i.e. high pressure tubing) shall be installed with cushion clamps.
- D. Support Spacing: Provide piping support spacing according to the most restrictive of the following: UPC, IMC, ASME B31.1, B31.9, local codes, manufacturers recommendations or Contract Documents specific requirements. Provide supports at each change in direction of piping and at each side of concentrated loads (such as in-line pumps, valves greater than size 5", and similar items).
- E. Trapeze Hangers: Four or more pipes running parallel may be supported on trapeze hangers provided the slopes of such pipes allow use of common trapeze. Suspend trapeze hanger from the building structure using hanger rods; attach to the building structure using concrete inserts, beam clamps, or other approved methods. Where trapeze width exceeds 30 inches, and where building attachment restrictions require more anchor points, provide three (or more) hanger rod supports. Provide pipe anchors to secure piping to trapeze on minimum 20 foot spacing; size and install pipe anchor to allow longitudinal movement of pipe (unless noted otherwise) with minimal vertical and transverse movement; where pipe is subject to expansion/contraction provide anchoring and alignment guides per paragraph titled "Thermal Expansion/Contraction".
- F. Vertical Piping Supports: Support piping at each floor line with pipe clamps and at intermediate points as required so that hanger spacing does not exceed allowable spacing and as required to prevent excessive pipe movement and so as to comply with the maximum spacings cited above. Support all pipe stacks at their bases with a concrete pier or suitable support. For vertical pipe drops which occur away from a wall or similar anchoring surface, provide angled bracing from nearest structure on two sides of drop to provide rigid anchoring of pipe drop. Provide riser clamps and vertical supports on all vertical vent piping where the vertical pipe length exceeds 5'.
- G. Underground Pipe: Shall be evenly supported on approved bedding materials, as appropriate for the type of piping being used.

3.03 INSTALLATION OF DUCT HANGERS AND SUPPORTS

- A. General: Provide anchors and supports for all ductwork. Supports and hangers shall comply with SMACNA-DCS, except that hanger spacing and hanger maximum loads shall be governed by whichever is more restrictive between these specifications or SMACNA-DCS.
- B. Hanger Spacing -- Rectangular Duct:

Duct AreaMaximum SpacingUp to 4 Square Feet8 Feet4.1 to 10 Square Feet6 Feet10 Square Feet and Up4 Feet

C. Hanger Spacing -- Round Duct:

Duct Area Maximum Spacing

Up to 24 Inch Diameter 8 Feet 25 Inch to 48 Inch Diameter 6 Feet 49 Inch Diameter and Up 4 Feet

- D. Hanger Spacing Flexible Duct: 4 feet, and at changes of direction as needed to maintain duct elevation and smooth airflow.
- E. Vertical Ducts: Support at each floor level, but in no case less than on 12 foot intervals.
- F. Flexible Duct: Support with methods shown in ADC. Metal strap in contact with the flexible duct shall have minimum 1.5-inch width.
- G. Fittings: Provide supports at each change in direction of duct for ducts with 4 square foot area or more, or for ducts larger than 24 inch diameter. Locate hangers at inside and outside corners of elbows--or at each end of fitting on each side.
- H. Concentrated Loads: Provide additional supports at each side concentrated loads such as modulating dampers (24" x 24" and larger), duct heaters (18" x 18" and larger), sound attenuators (all sizes), and similar items.
- I. End of Duct: At end of duct run, hangar shall be located no more than 1/2 the allowed hangar spacing from the end of the run.

3.04 CEILING SERVICES

- A. Less than 20 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing less than 20 pounds shall be positively attached to the ceiling suspension main runners (or ceiling support members) or to cross runners with the same carrying capacity as the main runners (or support members).
- B. 20 to 56 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing 20 pounds but not more than 56 pounds, in addition to the above, shall have two No. 12 gauge wire hangers (or minimum 1" x 22 gauge hangar straps) connected from the terminal or service to the ceiling system hangers or to the structure above. These added hangers may be slack.
- C. Greater Than 56 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing more than 56 pounds shall be supported directly from the building structure by approved hangers.

3.05 MECHANICAL EQUIPMENT ANCHORS AND SUPPORTS

- A. General: Provide anchoring and supports for all mechanical equipment. All equipment shall be anchored to (or supported from) the building structure. In lieu of anchoring to the building, anchor outdoor equipment to the concrete pad serving the equipment.
- B. Suspended Equipment: Support as indicated on the plans. Where not indicated use the methods shown (or consistent with) Mason SRG and SMACNA-DCS; submit shop drawings of the proposed methods to the Engineer for review.
- C. Vibration Isolation: Equipment shall be supported and anchored in such a way so that no equipment vibration is transmitted to the building structure.
- D. Seismic: Provide anchors and bracing to resist seismic forces.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Pipe Sleeves.
- B. Duct Sleeves.
- C. Duct Closure Collars.
- D. Firestop Seals.
- E. Non-Firestop Seals.

1.03 DEFINITIONS

- A. Firestop System: Specific firestop materials or combination of materials installed in a specific way in openings in a specific rated assembly to restore (or maintain) the fire rating and smoke passage resistance properties of the assembly.
- B. Firestop Seal: Same as "Firestop System".
- C. Rated Assembly: Wall, floor, roof, ceiling, roof/ceiling or other construction which is required (by code or the Contract Documents) to have a fire-resistance rating, be a smoke barrier, or to limit the passage of smoke.

1.04 SUBMITTALS

- A. General: Shall comply with Section 20 05 00.
- B. Product Data: Provide product data on all material to be use. Provide MSDS for all sealants, caulks and similar materials.
- C. Shop Drawings General: Shop drawings of proposed sealing/flashing assembly for roof and exterior wall penetrations.
- D. Shop Drawings Firestop: Provide firestop system shop drawings showing:
 - Listing agency's detailed drawing showing opening, penetrating items, and firestop materials. Drawing shall be identified with listing agency's name and number or designation, fire rating achieved, and date of listing for each firestop system.
 - 2. Identify where each firestop system is to be used on the project.
 - 3. Manufacturer's installation instructions.

- 4. For proposed systems that do not conform strictly to the listing, submit listing agency's drawing marked to show modifications and stamped approval by the firestop system manufacturer's fire protection engineer.
- 5. Other data as required by the AHJ.

1.05 REFERENCES

- A. ASTM A 36: Standard Specification for Carbon Structural Steel.
- B. ASTM C534: Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- C. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- E. UL 1479: Standard for Fire Tests of Through-Penetration Firestops.
- F. UL 723: Surface Burning Characteristics of Building Materials.
- G. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.
- H. SMACNA-ARCH: SMACNA Architectural Sheet Metal Manual, 7th Edition.

1.06 GENERAL REQUIREMENTS

A. Corrosion Protection: All sleeves exposed to water, moisture, chemicals, or subject to corrosion shall be constructed of corrosion resistant materials suitable for the exposure. Steel sleeves shall be hot dip galvanized after assembly. Provide additional coatings as noted or as required to resist corrosion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.
- B. Firestop Seal Materials: 3M, Dow Corning.
- C. Non-Firestop Seal Materials: 3M, GE, Dow Corning, Tremco, Pecora, Sonneborn, Pipeline Seal & Insulator.

2.02 PIPE SLEEVES

A. Diameter:

1. Belowground: Inside diameter of belowground pipe sleeves shall be at least 2 inch larger than the outside diameter of the pipe or pipe covering (for covered piping systems), so as to allow free movement of piping.

- 2. Aboveground: Inside diameter of aboveground pipe sleeves shall be at least 1-inch larger than the outside diameter of the pipe or pipe covering (for covered piping systems), so as to allow free movement of piping.
- 3. Large Movement: Provide larger sleeves where a larger space around pipe exterior is required by code, where specifically noted, where expansive soils or other unusual conditions are present and where required to accommodate large piping movement.
- B. Length: Horizontal sleeves through finished areas (where sleeve is exposed to view) shall be sized to be flush with finished surfaces; other horizontal sleeves may terminate flush to 2-inches past the element being penetrated. Vertical sleeves shall be sized to extend one inch above the final floor elevation.
- C. Structural Type: Fabricated from schedule 40 steel pipe. Waterstop shall consist of fully welded 2-inch larger diameter collar, minimum 1/4 inch thick steel, located on sleeve so as to be centered within the element being penetrated. Provide waterstop on sleeves where sleeves are installed in the following locations: in cast-in-place concrete, where any part of the sleeve ends are exposed to water, where installed in floors with water-proofing or water stopping membranes, in rooms with floor drains, and where needed for anchoring/support purposes. Prime paint all surfaces with rust-inhibiting paint.

D. Non-Structural Type:

- 1. Belowground Type:
 - a. Non-Waterstop Type: Fabricated from any of the following: 18 gauge galvanized sheet metal, 22 gauge spiral seam galvanized steel duct, schedule 40 PVC, HDPE thermoplastic or Schedule 40 galvanized steel pipe.
 - b. Waterstop Type: Constructed of HDPE thermoplastic or Schedule 40 steel pipe, with waterstop. Waterstop shall consist of 2-inch larger diameter collar, minimum 1/4 inch thick, located on sleeve so as to be centered within the element being penetrated, fully welded (for steel) or bonded/formed (for HDPE) to sleeve. Sleeve shall be suitable for use with "Link-Seal" type seal. Prime paint all surfaces with rust-inhibiting paint.
- 2. Aboveground Type: Fabricated from 18 gauge galvanized sheet metal or 22 gauge spiral seam galvanized steel duct. Provide with galvanized steel angle tabs, collars, or similar to allow for anchoring where sleeve cannot be retained in place by element being penetrated.

2.03 FIRESTOP SEALS

- A. General: Commercially manufactured through-penetration and membrane-penetration firestop systems to prevent the passage of fire, smoke and gases, and to restore the original fire-resistance rating of the barrier penetrated.
- B. Listing: Firestopping shall be listed by UL in "Fire Resistance Directory" (category to match the application), or be qualified by another independent agency acceptable to the AHJ.

- C. Rating: Firestop system and devices shall be tested in accordance with ASTM E 814 or UL 1479, with "F" and "T" ratings as required to maintain the fire-resistance rating of the barrier penetrated, and as required by code.
- D. Fire Hazard: Materials shall have a flame spread of 25 or less, and a smoke development rating of 50 or less; when tested in accordance with ASTM E 84 or UL 723.
- E. Cabling Applications: Firestop systems used with loose electrical cabling shall be the type that allows for removal of the cable or installation of new cables without damage to the firestop system, or the need to replace or repair firestop materials.
- F. Insulation: Firestop system shall be applicable to insulated systems to allow the insulation to run continuous through the firestop system (unless noted otherwise).

2.04 NON-FIRESTOP SEALS

A. Indoor Sealants:

- Smoke or Sound Sealant Applications: For use where a firestop seal is not required, but smoke or sound seal is required. Single component, elastomeric or acrylic latex type sealant with STC ratings per ASTM E90. Sealants shall be of the following types, or approved equal:
 - a. 3M "Smoke and Sound Sealant SS100".
 - b. Tremco "Tremstop".
- 2. Other Areas Dry (Not Normally Exposed to Water/Moisture): Single component, latex sealant complying with requirements of ASTM C834. Sealants shall be of the following types, or approved equal:
 - a. Tremco Corporation "Tremflex 834".
 - b. Pecora Corporation "AC-20 Arylic Latex".
 - c. Sonneborn Building Products "Sonolac".
- Other Areas Wet (Exposed to Water/Moisture): Single component, mildew resistant silicone sealant complying with requirements of ASTM C920, Type S, Grade NS, Class 25. Color white. Sealants shall be of the following types, or approved equal:
 - a. Dow Corning "786 Mildew Resistant Silicone".
 - b. Pecora Corporation "898 Silicone Sanitary Sealant".
 - c. Tremco "Tremsil 200".

B. Outdoor Sealants:

1. General: Single component, non-sag, low modulus, silicone elastomeric sealant conforming to requirements of ASTM C920, Type S, Grade NS, Class 100/50. Sealant shall be of the following types, or approved equal:

- a. Dow Corning "790 Silicone Building Sealant".
- b. Pecora Corporation "890 Silicone".
- c. Tremco "Spectrem 1".
- Adjacent to Aluminum: Single component, non-sag, medium modulus, silicone elastomeric sealant conforming to requirements of ASTM C920, Type S, Grade NS, Class 50. Sealant shall be primer-less type for use in joints adjacent to fluoropolymer coatings. Sealants shall be of the following types, or approved equal:
 - a. Dow Corning "795 Silicone Building Sealant".
 - b. GE Silicones, Momentive, SCS2000 and SCS7000.
 - c. Pecora "895 Silicone".
 - d. Tremco "Spectrem 2".

C. Expanding Foam Sealant:

- 1. General: Single component, polyurethane insulating sealant with flame spread index of 25 or less and smoke development rating of 50 or less. Shall expand and fully cure within 24 hours to a semi-rigid, closed cell, water and air resistant foam. Sealant shall be of the following types, or approved equal.
 - a. DAP "Kwik Foam".
 - b. Fomo Products "Handi-Foam".
 - c. Todol Products "EZ Flo Gun Foam".
- D. Link Seal: Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. The seal assembly shall expand when mechanically tightened to provide an absolute water-tight seal between the pipe and wall opening. Sizing shall be per manufacturer's recommendations. Seal shall be Pipeline Seal and Insulator, "Link-Seal" (or approved).
- E. Specialty: Packed fiberglass or wool insulation; with silicone sealant rated for use with temperatures and other conditions encountered.

PART 3 - EXECUTION

3.01 PIPE SLEEVES

A. General: Provide sleeves for all piping passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements. Except that sleeves are not required at core drilled penetrations through solid concrete or where formed openings equivalent to a core drilled opening are provided. Sleeves shall be type as specified.

3.02 FIRESTOP SEALS

- A. General: At each through-penetration and membrane-penetration in rated assemblies, where required to limit the passage of smoke, and as required by code or in the Contract Documents, provide a firestop system. Firestop system shall be installed in accordance with the manufacturer's instructions and listing.
- B System Selection: Contractor is responsible to select the firestop systems to be utilized, corresponding to the construction of the assembly penetrated, and types of penetrations. Contractor shall submit proposed firestop systems to be utilized, shall also review such systems with the AHJ and obtain AHJ approval.
- C. Preparation: Prepare surfaces as recommended by firestop material manufacturer. Examine and confirm that conditions are acceptable to proceed with the installation. Provide maskings and temporary coverings to prevent contamination or defacement of adjacent surfaces.

D. Installation Review:

- 1. Notify Architect/Engineer when firestopping work is complete and ready for review. Provide minimum 7 days notice to allow scheduling of review. An independent testing agency may be utilized to perform an inspection.
- 2. Notify AHJ when firestopping work is complete and ready for inspection. Provide sufficient advance notice to allow scheduling of the inspection without adversely impacting project schedule.
- 3. Do not cover or conceal firestopping until all inspections have been satisfactorily completed.

3.03 NON-FIRESTOP SEALS

A. General: Provide seals around all ducts, conduit, and piping passing through sleeves, walls, floors, roofs, foundations, footings, partitions, and similar elements. Seals shall be watertight where the penetration may be exposed to water or moisture. Provide type of sealant to suit the application. Provide smoke and sound type at all penetrations of rooms which contain mechanical equipment on both side of element penetrated to a depth of 5/8-inch (unless noted otherwise).

B. At Sleeves:

- Between Sleeve and Penetrated Element: Fill openings around outside of pipe sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating and properties that allow a tight seal between the sleeve and the surrounding construction. Seal full depth of sleeve for vertical penetrations.
- 2. Between Pipe and Inside of Sleeve: Provide sealant between outside of pipe or pipe covering (for covered piping systems) and inside of sleeve. Seal depth shall be minimum 1-inch each side. Provide Link Seal type for belowground penetrations, vault wall penetrations, and slab-on-grade penetrations (not required where flexible type sleeves are used).
- C. No Sleeves: Provide "Link-Seal" type for belowground penetrations, vault wall penetrations, and slab-on-grade penetrations. Provide sealant at other areas, type to suit

the application. Fully seal between outside of pipe or pipe covering (for covered piping systems) and surrounding construction. Seal depth shall be minimum 1-inch each side.

- D. Preparation: Remove loose materials and foreign matter impairing adhesion of seal. Perform preparation in accordance with recognized standards and sealant manufacturers recommendations. Protect elements surrounding area of work from damage or disfiguration due.
- E. Installation: Install sealants immediately after joint preparation. Install sealants free of air pockets, foreign embedded matter, ridges, and sags. Tool exposed joint surface concave and with a neat finished appearance.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. Vibration Isolation.

1.03 DEFINITIONS

- A. "Equipment" is defined to mean any item with power connections (fans, HV units, AHU units, etc.), and also to include all hoods; but does not include pumps less than 3 hp.
- B. "Equipment Requiring Vibration Isolation" is defined to be any equipment (as defined above) with rotating components (e.g. pumps, fans, etc.).

1.04 SUBMITTALS

A. General: Submittals shall comply with Section 20 05 00.

B. Product Data:

- 1. Submit product data on all items to be used.
- 2. Submit calculations showing vibration isolation selection for all isolation devices provided under this specification section (i.e. where isolation is not furnished integral with the equipment or by the manufacturer of the equipment).
- C. Shop Drawings: Submit shop drawings for all fabricated support assemblies.

1.05 GENERAL REQUIREMENTS - VIBRATION ISOLATION

A. General:

- 1. Select and provide all vibration isolation devices for all equipment requiring vibration isolation so as to provide complete installed mechanical systems free of the transmission of vibration and vibration generated noise to the structure.
- 2. Vibration isolation is shown on the drawings for various items but is not shown for all items requiring isolation. Provide all isolation as indicated and specified herein.
- B. Supplier: Where not provided by the equipment manufacturer, all vibration isolation devices and support assemblies shall be supplied as a coordinated package by a single vibration isolation manufacturer, under this specification section.
- C. Equipment Manufacturer Items: Isolation devices furnished by equipment manufacturer shall comply with this specification section and be selected by the manufacturer to suit, and provide satisfactory performance, for the applications of this project.

1.06 REFERENCES

A. IBC: International Building Code.

B. IMC: International Mechanical Code.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.
- B. Products: Mason, Peabody, Kinetics Noise Control, Vibration Eliminators, VMC Group.

2.02 NEOPRENE ISOLATORS

- A. Isolation Pads: Oil resistant bridge bearing neoprene pads, minimum 3/4-inch thick, with cross-ribbed or waffle design. Size pads for not more than 50 psi or as recommended by vibration isolator manufacturer. Provide load distribution plates (minimum 3/8" plate steel) to evenly load pads. Mason Type SW (or approved).
- B. Floor Mounted Isolators: Double deflection neoprene mounts, sized for minimum deflection of 0.30-inch. All metal surfaces shall be neoprene covered, base plate shall have mounting holes, and top shall have threaded steel plate or threaded steel insert. Element shall be color coded or labeled with molded symbols to identify capacity. Neoprene shall be bridge bearing type. Mason Series ND (or approved).
- C. Suspension Isolators: Double deflection neoprene type, with isolator encased in open steel bracket, and sized for minimum 0.30-inch deflection. Hanger rod shall be isolated from steel bracket with neoprene grommets. Mason Series HD (or approved).
- D. Washer Bushings: Bridge bearing neoprene washer insert to provide isolation between anchor bolt and washer from support member/equipment. Mason Series HG (or approved).

2.03 SPRING ISOLATORS

- A. General: The load carried by each isolator shall be carefully calculated and isolators selected so that the static deflection will be the same and the supported equipment will remain level. Isolators shall be so designed that the ends of the springs will remain parallel during and after deflection to operating height. At operating height, springs shall have additional travel to complete (solid) compression equal to at least 50 percent of the operating deflection. Suspension isolator springs shall have a static deflection not less than 1-inch (unless noted otherwise), except that for units with components rotating at 1000 rpm and less, the static deflection shall be not less than 2-inches (unless noted otherwise). Floor isolator springs shall have deflection of not less than 1-inch. All isolators shall provide at least 95% isolation efficiency. Deflections other than these may be used where circumstances warrant and more optimum isolation results can be achieved; provided that a written explanation is submitted for Engineer review and approval.
- B. Floor Type Spring Isolators: Open spring type with ratio between spring diameter divided by compressed spring height no less than 0.8. A ribbed neoprene acoustical friction pad

shall be bonded to the underside of the isolator. Shall have bolted connections for rigid attachment to equipment, configured to allow for equipment leveling by bolt adjustment. Provide with height saving bracket. Mason Series SLF (or approved).

C. Floor Housed Type:

- Ductile Iron: Housed spring isolator with ductile iron housing, base plate with mounting holes, spring inspection ports, neoprene cushion, adjustable upward rebound plate. OSHPD pre-approved. Provide with mounting brackets to suit equipment connected to. Mason Series SSLFH (or approved).
- Welded Steel: Housed spring isolator with welded steel housing, steel base plate with mounting holes, number of springs to suit application, neoprene vertical limit stops, spring bottom neoprene acoustical cups, bottom non-skid neoprene friction pad, and equipment attachment configuration to suit equipment served. OSHPD pre-approved. Provide with mounting brackets to suit equipment connected to. Mason Series SLR or SLRSO (or approved).
- D. Suspension Type Spring Isolators: Shall consist of a rigid steel frame with a stable steel spring in the bottom part of the frame, and double deflection neoprene (or rubber) isolating pad at the top of the frame. Where supporting rods pass through the frame, a clearance of not less than one-half rod diameter shall be provided all around the rod and neoprene bushings provided to prevent steel to steel contact. Mason Series DNHS or Series 30N (or approved).

PART 3 - EXECUTION

3.01 VIBRATION ISOLATION

- A. General: Provide vibration isolators for all rotating equipment so that no vibration is transmitted to the structure. Isolators shall be the type indicated; except where not shown, type shall be as selected by vibration isolation manufacturer (or equipment manufacturer) to provide adequate isolation.
- B. Installation: Install all vibration isolators in accordance with isolator manufacturer's instructions and isolated equipment manufacturer's recommendations.
- C. Inadequate Isolation: Should vibration isolators prove inadequate to prevent transmission of vibrations to the building structure or limit equipment vibration generated noise, such isolators shall be replaced with isolators having the largest deflection that can be practically installed or otherwise modified/replaced to produce satisfactory isolation. Such replacement shall be at no additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Air Balancing.
- B. Hydronic Balancing.
- C. Report.

1.03 SUBMITTALS

- A. General: Comply with Section 20 05 00.
- B. Company: Submit name of Company proposed to do the balancing and sample balancing forms. Where the Company has not been pre-qualified, and substitutions are allowed after bidding (see Division 00 and 01), submit information regarding firm qualifications.
- C. Personnel: Submit list of personnel that will be assigned to the project and their qualifications, and list of past projects.
- D. Reports: Preliminary and final balancing reports.

1.04 REFERENCES

- A. AABC-NS: Associated Air Balance Council, National Standards for Field Measurements and Instrumentation.
- B. ASHRAE: Handbook of Fundamentals.
- C. ACGIH-IV: American Conference of Governmental Industrial Hygienists, Industrial Ventilation, A Manual of Recommended Practice.
- D. NEEB-PS: National Environmental Balancing Bureau Procedural Standard for Testing, Adjusting and Balancing Environmental Systems.

1.05 GENERAL REQUIREMENTS

- A. General: Balancing shall be done by a company which specializes in this type of work and is totally independent and separate from the Company which has installed the systems to be balanced.
- B. Balancers Qualifications:
 - 1. General: Work of this Section shall be performed by balancing firms meeting the following and having prior approval from the Engineer:

- a. Professional Affiliation: Firm shall be an Associated Air Balance Council (AABC) member balancer or National Environmental Balancing Bureau (NEBB) certified balancer.
- b. Experience: Firm shall have satisfactorily completed the balancing work for at least 5 similar projects in the last 3 years. Similar is defined to mean: within 10% of the same quantity of units and air inlets/outlets, involve same type of systems, be the same type of facility (i.e. school, hospital, etc.). The lead field balancer (i.e. the individual who will be on site directing and participating in the balancing efforts) shall have at least 5 years of experience performing balancing work on similar projects.
- c. References: Have five references for similar projects which have been completed in the last three years that will give a good or better performance rating. References shall be engineers, architects, or building owners. As part of the qualification process at least three of these references will be contacted and a rating obtained for the following: timeliness of work (i.e. able to complete work on schedule), cooperative nature of balancer's staff (i.e. ability to work well as a team with other project trades and professionals), overall quality of balancing work, quality of balancing report. Each item will be rated on a scale of 1 to 5 (5 being excellent), with the result averaged, score must be of 4 or better.
- 2. Pre-Qualified Balancers: As a convenience to the Contractor, the following balancing firms have been pre-qualified. This is not in any way intended to limit competition or prevent other firms from submitting qualifications, but is intended as an aid to Contractors by identifying firms that have been confirmed as meeting the qualification requirements.
 - a. Neudorfer Engineers.
 - b. Hardin and Sons.
 - c. Airtest.
- 3. Qualification Process: Firms not pre-qualified who desire to perform the balancing work shall submit a substitution request form in accordance with Contract Document requirements (reference Division 00 and 01). In addition to the information required on the substitution request form, submit: Company information, resumes of staff to be assigned, lists of projects, and references (with name of project, staff assigned to project, and contact name and phone number).
- C. Balancing Issues: Notify the Engineer in writing of all problems or discrepancies between actual conditions and what design documents show as work proceeds.
- D. Engineer's Authority: The Balancer shall be directly responsible to the Engineer and shall perform this work and make system adjustments as directed by the Engineer.
- E. Lead Balancer: The Balancer shall assign an individual as "lead balancer" to work in the field to directly supervise the balancing work and field technicians. This lead field balancer shall have at least 5 years of experience performing balancing work on similar projects.

F. Added Site Visit: The Balancer shall include in his bid three extra site visits and associated time to access system readiness for balancing and resolution of balancing Include added site visit and 8 hours of field balancing time, plus report amendment time to provide added balancing as directed by the Engineer. Such work may occur during the project's construction period or during the warranty period.

PART 2 - PRODUCTS

2.01 **GENERAL INSTRUMENTATION**

- Α. General: Balancing equipment shall comply with Associated Air Balance Council recommendations for field measurement instrumentation.
- B. Calibration: All measuring instruments shall be accurately calibrated and maintained in good working order. Calibration dates and certifications shall be available at Engineer's request.
- C. Instruments: Shall be capable of:
 - 1. Air velocity instruments, direct reading in feet per minute with 2% accuracy.
 - 2. Static pressure instruments, direct reading in inches water gauge with 2% accuracy.
 - 3. Tachometers, direct reading in revolutions per minute with 1/2% accuracy; or revolution counter accurate with 2 counts per 1,000.
 - Thermometers, direct reading in degrees Fahrenheit with 1/10 of a degree 4. accuracy.
 - 5. Pressure gauges, direct reading in feet of water or psig with 1/2% accuracy.
 - 6. Water flow instruments, direct reading in feet of water or psig with 1/2% accuracy suitable for readout of balancing valve provided.

PART 3 - EXECUTION

3.01 **GENERAL**

A. Workmanship: All measurements and adjustments shall be in accordance with AABC-NS. NEEB-PS, and ACGIH-IV and recognized best balancing procedures. Measurements and adjustments of equipment shall be executed in a manner consistent with the manufacturer's recommendations.

B. Flow Rates:

- 1. General: All air and water systems shall be completely balanced and adjusted to provide the flow rates indicated (within tolerances indicated in this specification Section), and to produce an even heating and cooling effect and control response and to produce even water circulation.
- Balancer Determined: Where flow rates have not been indicated the balancer 2.

TESTING, ADJUSTING, BALANCING FOR MECHANICAL

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

shall determine such flow rates using acceptable practices in accordance with AABC-NS, NEEB-PS, and ASHRAE standards and submit the proposed flow rates to the Engineer for review.

- Confirmation: Prior to beginning balancing confirm any flow rate changes since design with the submittals and flow rates indicated therein, and with the Engineer to confirm changes made since design. Assume that new flow rates will be issued.
- C. Controls: Consult and coordinate with the Control Contractor for the adjustment and setting of all control devices to allow for the balancing work, and for proper system operation and proper flow rates. Set all controls and valves as required to maintain design flow rates and temperatures as shown on the drawings. Make measurements and provide data to the Control Contractor to allow for proper control of items.
- D. Comfort Adjustments: Make final adjustments for flow rates in order to optimize each space's comfort, including such considerations as temperature, drafts, noise, pressurization, and air changes. Where variances are made from design values, state reasons in report (e.g., "too noisy", "too drafty," etc.). All such variances are subject to approval by the Architect/Engineer.
- E. Deficiency Reports: Submit deficiency reports where the work does not allow balancing to occur or balancing issues develop. Indicate date, system and equipment involved, location, description of deficiency, and related information to allow for diagnosing the problem. Provide suggestions for resolution where possible.

3.02 AIR BALANCING

- A. Pre-check of System: Prior to beginning balancing, perform, as a minimum, the following:
 - 1. Verify that clean filters have been installed, that system is free from debris, and that all inlets/outlets are not obstructed.
 - 2. Check all fans and equipment to verify that proper start-up and system preparation has been done by the installing contractor.
 - 3. Check all door/window and similar building opening status to insure building is ready and proper pressurization can be obtained.
 - 4. Open all dampers to full flow position, check positions and operation of all motorized dampers to allow full system flows.
 - 5. Review controls and sequences of operation.
- B. Tolerances: All air flow rates (supply, return, and exhaust) shall be adjusted to within plus 5 percent and minus 5 percent of the values shown in the contract documents, except that relative space-to-space pressure relationships shall always be maintained (e.g., restrooms shall be negative relative to other areas, general offices shall be positive, etc.).
- C. Draft and Noise Adjustments: All diffusers, grilles, and registers shall be adjusted to minimize drafts and to eliminate objectionable noise.

D. Filters: Air balancing shall be done with new, clean air filters installed. Adjust air deliveries so that design quantities will be obtained when filters are half dirty. This condition shall be simulated by covering a portion of the filter area.

E. Fan Speeds and Drives:

- 1. Adjust fan speeds and fan drives (adjustable sheaves) as required to produce design flow rates.
- 2. Where new sheaves are required, calculate sizing of new sheave and coordinate requirements with the Division 23 Contractor for Division 23 Contractor to furnish the new sheave. Replace existing sheave with new one furnished by the Division 23 Contractor; include bid costs for sheave replacements on all belt driven fans.
- 3. Adjust belts for proper tension.
- F. Marking: Upon completion of flow readings and adjustments permanently mark the balanced position of all balancing valves by stamping the indicator plate of the valve.
- G. Duct Traverse: Rectangular duct traverses shall measure the center of equal areas in the air flow stream, with centers not more than 6 inches apart. Round duct traverses shall measure at least 20 locations, with locations being the centers of equal annular area. Reference ACGIH Industrial Ventilation Manual.
- H. One Open Run: Balance each branch run so that there is at least one wide open run; balance branches relative to one another so that at least one branch damper is wide open (except that where unique conditions exist, and the Engineer gives prior approval, one open damper on runs or branches is not required).
- I. Data: Data to be measured/recorded and provided in report for all air handling systems and equipment:
 - 1. Floor plans clearly showing and identifying all diffusers, grilles, OA louvers, ducts and all other items where air flow rates were measured.
 - 2. Identify manufacturer, model number, size, and type of all air inlets/outlets.
 - 3. Initial, trial, and final air flow measurements for all diffusers, grilles, OA louvers, ducts, and all other items where air flow rates were measured.
 - 4. Design air flow rates and percentage final air flow rates are of design values.
 - 5. Final damper (or other balance device) final position (as a percentage of full open).
 - 6. The connected voltage and corresponding nameplate full load amps, and the initial and final amperages of all fan motors.
 - 7. Initial and final RPMs of all fans.
 - 8. Static pressures on inlet and outlet of all fans.
 - 9. Fan initial and final CFMs.

TESTING, ADJUSTING, BALANCING FOR MECHANICAL

- 10. Outdoor air CFMs (record minimum and maximum values).
- 11. Entering and leaving air temperatures across coils with coils operating at 100% capacity.
- 12. Static pressure drop across each filter bank and coil.
- 13. Final position of any speed controls (as percent of full).
- 14. In addition to data noted elsewhere, provide the following for all equipment which are part of balanced systems:
 - a. Equipment name and number (as used on drawings).
 - b. Service.
 - c. Equipment manufacturer and model number.
 - d. Sheave and belt sizes (where applicable).
 - e. Filters sizes and quantities (where applicable).
 - f. Motor manufacturer and complete nameplate data.
 - g. Design operating conditions.
 - h. Actual operating conditions (flows, pressure drops, rpm, etc.).

3.03 HYDRONIC BALANCING

- A. Pre-check of System: Prior to beginning balancing, perform, as a minimum, the following:
 - 1. Verify that all strainers have been cleaned.
 - 2. Examine fluid in system to verify system treatment and cleaning.
 - 3. Check for proper rotation and operation of all pumps.
 - 4. Verify that expansion tanks are not air bound and properly charged and that system is full of fluid.
 - 5. Verify that all air vents at high points in the fluid system are properly installed and are operating freely. Verify that all air has been removed from the circulating system.
 - 6. Open all valves to full flow position, close any bypass valves, and open fully balancing valves. Set temperature controls so that automatic valves are open to full flow.
 - 7. Check operation of automatic bypass valves and similar flow/pressure controls.
 - 8. Check and set operating temperature of equipment to design requirements when balancing by temperature drop.

- 9. Check equipment for proper start-up and system preparation by installing contractor.
- 10. Review controls and sequences of operation.
- B. Tolerances: All water flow rates shall be adjusted to within plus 5 percent and minus 5 percent of the values shown in the contract documents.
- C. Control Valve Bypass: Adjust control valve bypass valves so that pressure drop is the same for full flow-through bypass valve as for full flow-through control valve and controlled equipment.
- D. Marking: Upon completion of flow readings and adjustments permanently mark the balanced position of all balancing valves by stamping the indicator plate of the valve.
- E. Requirements for All Hydronic Systems: Data to be measured/recorded and provided in report:
 - 1. Floor plans or schematics showing and identifying all valves, coils, pumps and other items where temperatures, pressure drops, or water flow rates were measured.
 - 2. Identify manufacturer, model number, size and type for all balancing devices.
 - 3. Initial, trial, and final water flow measurements (pressure drops, temperatures, and GPMs) for all items where measurements were made.
 - 4. Design water flow rates, and percentage final water flows are of design values.
 - 5. The connected voltage and corresponding nameplate full load amps, and the initial and final amperages of all pump motors.
 - 6. Pump operating suction and discharge pressures and final total developed head.
 - 7. Pump initial and final GPMs.
 - 8. Entering and leaving fluid temperatures at coils and major equipment.
 - 9. GPM flow of each coil and major equipment.
 - 10. Pressure drop across each coil and major equipment.
 - 11. Pressure drop across bypass valve.
 - 12. Final position of all valves (percent open or setting position on valve).
 - 13. Final position of any speed controls (as percent of full).
 - 14. In addition to data noted elsewhere, provide the following for all equipment which are part of balanced systems:
 - a. Equipment name and number (as used on drawings).
 - b. Service.

- c. Equipment manufacturers and model number.
- d. Equipment capacities.
- e. Motor manufacturer and complete nameplate data.
- f. Design operating conditions.
- g. Actual operating conditions (flows, pressure drops, etc.).

3.04 BALANCING REPORT

- A. General: A balancing report shall be submitted as specified herein, documenting all balancing procedures and measurements.
- B. Report Organization: The report shall be divided into logical sections consistent with the building or system layout (i.e. by floors, building wings, air handling units, or other convenient way). Tabulate data separately for each system. Describe balancing method used for each system.
- C. Preliminary Report: Two preliminary review copies of the balancing report shall be submitted to the Architect/Engineer when the balancing work is 90% complete (or as near 90% complete as possible due to uncompleted work of other trades). In addition to containing all the information required of the final report, the preliminary report shall contain a list of all the work required of other trades in order to allow the balancing work to be completed. The Architect/Engineer will review the preliminary report and inform the Contractor of any additional items or revisions required for the final report. Preliminary reports may be omitted where the Architect/Engineer grants approval.
- D. Final Report: Shall be included in the Operation and Maintenance Manual. Submit reports to Contractor for inclusion in Manuals (or, when manuals have been already sent to Engineer, send report to Engineer who will insert report into Manual). Provide number of reports as required to match quantity of O&M Manuals, but in no case less than five.
- E. Format: 8-1/2" x 11" size, neat, clean copies, drawings accordion folded. Report shall be typed, shall have a title page, table of contents, and divider sheets with identification tabs between sections. Information shall be placed in a three hole notebook, with the front cover labeled with the name of the Job, Owner, Architect/Engineer, Balancing Contractor, and Report Date.
- F. Electronic Copy: Provide copy of reports in *.pdf format; submit final report with closeout documents per Divisions 00 and 01.
- G. General Balancing Information Required:
 - 1. At the beginning of the report, include a summary of problems encountered, deviations from design, remaining problems, recommendations, and comments.
 - 2. List of instruments used in making the measurements and instrument calibration data.
 - 3. Names of personnel performing measurements.
 - 4. Explanation of procedures used in making measurements and balancing each

system.

- 5. List of all correction factors used for all diffusers, grilles, valves, venturi meters, and any other correction factors used.
- 6. Areas where difficulties were encountered in obtaining design flow rates, or where unstable operating conditions may exist.
- 7. Note any parts of the system where objectionable drafts or noises may be present and efforts made to eliminate same and why they may still be present.
- 8. Note where variances from design values occur; explain why.
- 9. All specified measurements, balancing data, any additional recorded data, and observations.

END OF SECTION

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Duct Insulation.
- B. Pipe Insulation.
- C. Equipment and Specialties Insulation.

1.03 DEFINITIONS

- A. R: Thermal resistance of insulation, in units of hr-sf-deg F/Btu.
- B. Rainleader Piping: Any piping or conduit that is used to carry rain water, including overflow drain piping, that is located within the building or enclosed by any building construction.
- C. Subject to Damage: Items installed exposed less than 8 feet above the walking surface (i.e. floor, platform, roof, grade, etc.) adjacent to the item.
- D. Cold Surfaces: Surfaces that will have operating temperatures below the temperature of the surrounding air by at least 5 deg F or more; includes chilled water piping, cooling condensate piping, air conditioning ductwork, outdoor air ductwork, and similar systems. Surfaces shall be considered a cold surface unless specifically indicated otherwise.

1.04 QUALITY ASSURANCE

A. All insulation and materials shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E 84, NFPA 255, and UL 723.

1.05 SUBMITTALS

- A. General: Comply with Section 20 05 00.
- B. Product Data: Provide product data on all insulation materials to be used. Indicate thicknesses to be used.

1.06 GENERAL REQUIREMENTS

A. Code Compliance: Contractor shall insulate all systems with the materials and thicknesses as required by code, but in no case shall the insulation be less than that specified herein. In some cases the specified insulation exceeds code, and shall be provided as specified. Not all systems requiring insulation by code are specified, but shall be provided with insulation where required by code.

B. Insulation at Hangers: Insulation shall be continuous through hangers on all insulated systems (except ductwork). Inserts at hangers are specified in Section 20 05 29 and are considered as part of the hanger and support system. Inserts are required to be installed at the time of pipe installation and are intended to be installed by the Contractor installing the pipe hangers/supports. See Section 20 05 29.

1.07 REFERENCES

- A. ASTM A 653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
- B. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- C. ASTM C 411: Standard Test method for Hot-Surface Performance of High Temperature Thermal Insulation.
- D. ASTM C 547: Standard Specification for Mineral Fiber Pipe Insulation.
- E. ASTM C 1136: Standard Specifications for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- F. ASTM C 1290: Standard Specification For Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
- G. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. NCIIS: National Commercial & Industrial Insulation Standards, published by Midwest Insulation Contractors Association, 5th Edition.
- NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials.
- J. UL 723: Tests for Surface Burning of Building Materials.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph Part 2.01, Acceptable Manufacturers.
- B. Insulation: Johns Manville, Armacell, Owens-Corning, Knauf, Rubatex, Aeroflex, Pittsburgh Corning, GLT, Halstead, Gilsulate, Manson.
- C. Accessories: Johns Manville, Armacell, Owens-Corning, Knauf, Rubatex, Aeroflex, Pittsburgh Corning, GLT, Halstead, Duro Dyne, Gustin Bacon, Childers, RPR, Tee Cee, Lewco Specialty Products, JPS, Buckaroos, Manson.

2.02 DUCT INSULATION

A. Flexible Glass Fiber:

- 1. Type: Flexible blanket type, constructed of inorganic glass fibers bonded by a thermosetting resin, complying with ASTM C 1290, Type III. Johns Manville "Microlite" (or approved).
- 2. Jacket: FSK type, vapor proof, consisting of an aluminum foil cover reinforced with glass fiber mesh, and laminated to kraft. Water vapor permeance shall not exceed 0.05 perms. Provide with joint sealing tape, minimum 2 inches wide, constructed of jacket material with adhesive to seal all joints.
- 3. Thermal Conductivity: Shall not exceed 0.27 Btu-in/hr-sq ft-deg F at 75 deg F.
- 4. Operating Limits: 40 degrees F to 250 deg F.

B. Duct Insulation Thickness:

- 1. General: Provide insulation densities and thicknesses to achieve the R values cited below. R values are for the insulation only, in their installed thickness, considering installed duct wrap stretch and in accordance with code.
- Lining: Where ducts have internal lining, the insulating properties of the lining may be credited toward meeting the required insulation R value; use R-3.65 per inch of installed liner.
- 3. Supply Air Ductwork:
 - a. Inside Building and Within Building's Thermal Envelope: R-3.3 (except where ran exposed in conditioned spaces, no insulation is required).
 - b. Inside Building But Not Within Building's Thermal Envelope: R-7.3.

4. Return Air Ductwork:

- a. Inside Building and Within Building's Thermal Envelope: No insulation required; except where duct contains air that may vary by 10 deg F or more from the space the duct passes through, R-3.3 insulation shall be provided.
- b. Inside Building But Not Within Building's Thermal Envelope: R-7.3.
- 5. Outside Air Ductwork: Shall be insulated same as required for the building envelope; except where allowed by code to be insulated less than the building envelope, shall be R-8; insulation is not required where duct run outside the building.

2.03 PIPE INSULATION

A. Glass Fiber:

- 1. Type: Rigid molded type, constructed of glass fibers bonded by a thermosetting resin, complying with ASTM C 547 Type I. Insulation factory molded to match pipe size applied to. Johns Manville "Micro-Lok" (or approved).
- 2. Jacket: ASJ type, vapor proof, consisting of a white kraft paper cover reinforced with glass fiber and bonded to aluminum foil, with longitudinal self sealing closure

system. Provide with butt strips constructed of jacket material with adhesive to seal all joints. Water vapor permeance shall not exceed 0.02 perms.

- 3. Thermal Conductivity: Shall not exceed 0.24 Btu-in/ hr-sq ft-deg F at 75 deg F.
- 4. Operating Temperatures: 0 deg F to 850 deg F.

B. Elastomeric Insulation:

- 1. Type: Flexible cellular elastomeric insulation, factory formed to match pipe sizes applied to, complying with ASTM C 534, Type 1. Armacell "AP/Armaflex SS" (or approved).
- 2. Thermal Conductivity: Shall not exceed 0.27 Btu-in/ hr-sq ft-deg F at 75 deg F.
- 3. Water Vapor Transmission: Water vapor permeance shall not exceed 0.08 perms.
- 4. Operating Temperatures: -200 deg F to 220 deg F; shall be able to withstand 250 deg F temperatures for 96 hours per ASTM C 411 without damage or deformation.
- 5. Weather Protection: Where installed outdoors provide with metal jacketing to protect from UV and weather exposure.

C. Cellular Glass Insulation:

- 1. Type: Rigid closed-cell glass insulation, factory formed to match pipe size applied to. Pittsburgh Corning "Foamglas" (or approved).
- 2. Jacket: Field applied heat sealable water-proof jacketing, consisting of 3 layers of a polyer modified bituminous compound separated by glass fiber reinforcement and aluminum foil. Water vapor permeance shall not exceed 0.00 perms. Pittsburgh Corning "Pittwrap" (or approved).
- 3. Thermal Conductivity: Shall not exceed 0.29 Btu-in/ hr-sq ft-deg F at 75 deg F.
- 4. Operating Temperatures: -450 deg F to 900 deg F.
- 5. Compressive Strength: 90 psi.
- D. Pipe Fittings: Shall be covered using any one of the following methods of the Contractor's choice:
 - 1. Prefabricated segments of pipe insulation of same materials and thickness as the adjoining pipe insulation, formed to match pipe fitting.
 - 2. Pre-cut fiberglass insulation and pre-molded high impact, gloss white, UV resistant, minimum 20 mil thick, PVC covers suitable for the pipe size and insulation thickness application, PVC cover shall be Johns Manville "Zeston 2000 PVC" (or approved).
 - 3. Insulating plastic cement brought up the full height of the adjacent covering.

- 4. Except, where colored PVC jacketing is applied to piping, fittings shall use PVC covers of the same thickness and color as the PVC jacketing specified for the piping.
- E. Metal Jacket: Aluminum roll jacketing, factory formed to match pipe size and insulation application, with smooth surface, manufactured from 3003 or 5005 aluminum alloy, H-14 temper, conforming to ASTM B 209. Shall be minimum 0.020 inches thick, with an integrally bonded interior 1 mil thick heat bonded polyethylene moisture barrier over the entire surface in contact with the insulation. Fitting covers shall be fabricated of same material as pipe runs, factory formed to match fitting.
- F. Pipe Insulation Types:
 - 1. Aboveground-Inside Building:
 - a. Hydronic Systems: Glass fiber.
 - b. Cooling Coil Condensate: Glass fiber or elastomeric.
 - c. Refrigerant Piping: Elastomeric.
 - d. Other Systems: Glass fiber.
 - 2. Aboveground-Outside Building: Same as specified above, with metal jacket.
 - 3. Underground: Cellular glass or elastomeric.
 - 4. Metal and PVC Jacketing: See "Part 3 Execution".
- G. Pipe Insulation Thickness:
 - 1. General: Provide minimum piping insulation thickness indicated, in inches.

INSULATION THICKNESS (INCHES)

micos (montes)					
Nominal Pipe Diameter (Inches)					
Fluid Design Operating		1<	>1-1/2	4	
Range, deg F	<u><1</u>	to 1-1/2	<u>to <4</u>	<u>to <8</u>	<u>≥8</u>
Above 350	4.5	5.0	5.0	5.0	5.0
251 - 350	3.0	4.0	4.5	4.5	4.5
201 - 250	2.5	2.5	2.5	3.0	3.0
141 - 200	1.5	1.5	2.0	2.0	2.0
61 - 140	1.0	1.0	1.5	1.5	1.5
40 - 60	0.5	0.5	1.0	1.0	1.0
Below 40	0.5	1.0	1.0	1.0	1.5

- 2. Varying Temperatures: Where a system operates over temperature ranges calling for different insulation thicknesses, the thicker insulation requirements shall be met.
- 3. Condensate: Cooling system condensate piping (i.e. from a cooling coil) shall be considered to operate at 50 deg F.

TACOMA PUBLIC LIBRARY
HVAC REPLACEMENT
BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

4. Refrigerant Piping: Refrigerant piping (RG or RS piping) returning from an evaporator (i.e. cooling coil) to a compressor shall be considered to operate at 40 deg F. Refrigerant piping (RL piping) from a condenser to an evaporator does not require insulation (unless noted otherwise).

2.04 ACCESSORIES

- A. Adhesive, Caulks, Mastics, and Coatings: As recommended by insulation material manufacturer and suited for the application.
- B. Bands: 1/2-inch wide, of stainless steel, galvanized steel, or aluminum construction, to match with materials used with.
- C. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length shall be as required for insulation thickness used with. Welded pin holding capacity 100 lb, for direct pull perpendicular to the attached surface. Style and type to suit application.
- D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness used with. Adhesive as recommended by the anchor pin manufacturer as appropriate for surface temperatures and materials used with, and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface. Style and type to suit application.

PART 3 - EXECUTION

3.01 GENERAL

- A. Pre-Insulation Review: No covering materials shall be applied until systems to be covered have had all tests satisfactorily completed, have had all required inspections, and have been satisfactorily reviewed by the Architect-Engineer. All systems shall be examined by the Contractor to confirm cleanliness and other conditions are appropriate to allow for insulation installation.
- B. Insulation Work Review: No insulated items shall be concealed in the building structure or buried until the insulation work has been satisfactorily reviewed by the Architect-Engineer, and has had all required inspections.
- C. Standards: Materials shall be installed in accordance with manufacturer's written instructions, NCIIS, and shall comply with materials and methods specified herein. The more stringent requirements govern.
- D. Joints/Seams: Joints shall be staggered on multi layer insulation. Locate seams and joints in least visible location.
- E. Insulation Protection: Insulation shall be kept clean and dry and shall be protected from dirt, damage, and moisture. Insulation that becomes dirty, damaged, or wet and cannot be restored to like new condition will be rejected, and shall immediately be removed from the jobsite.
- F. Insulation Interruptions: Insulation shall be neatly finished at all supports, protrusions and interruptions. Provide adhesive and tape seal to maintain vapor barrier integrity.

- G. Equipment and Floor Protection: Cover existing equipment and finished floors to protect such items from insulation fiber and dust. Keep all such existing areas in a "broom clean" condition at the end of each day. Take precautions in these areas to prevent glass fiber and insulation dust from entering ventilation systems or areas adjacent to the work.
- H. Glass Fiber Insulation General:
 - 1. Finish all insulation ends with joint sealing tape or vapor barrier mastic, no raw edges allowed.
 - 2. Joints: Tightly butt adjacent insulation sections together without any voids. Provide overlap of jacket material over all joints.
- I. Items To Be Insulated: Provide insulation on all ductwork, all piping, all items installed in these duct and piping systems, all air and liquid energy conveying systems and components, all air and liquid energy storage, all equipment, and all energy consuming devices, except where such insulation has been specifically excluded.

3.02 DUCT INSULATION INSTALLATION

- A. Types and Thickness: Insulate all ducts with insulation type and thickness (to provide the required R value) as specified in "Part 2 Products".
- B. General: Insulation shall be firmly butted at all joints. All longitudinal seams for flexible insulation shall overlap a minimum of 2 inches. All joints and seams shall be finished with appropriate joint sealing tape. Installation shall provide a continuous sealed vapor barrier over all surfaces; seal all jacket penetrations with vapor barrier mastic or vapor barrier jacket tape.
- C. Attachment: For rectangular ducts over 24 inches wide, duct insulation shall be additionally secured to the bottom of the ductwork with mechanical fasteners on 18 inch centers to reduce sagging. Washers shall be applied without compressing the insulation. Protruding ends or fasteners shall be cut off flush after washers are installed. All seams, joints, penetrations, and damage to the facing shall be sealed with joint sealing tape or vapor retardant mastic or appropriate joint sealing tape.

3.03 PIPE INSULATION INSTALLATION

- A. Types and Thickness: Insulate all piping with insulation type and thickness as specified in "Part 2 Products". All piping shall be insulated except where specifically excluded. Refrigerant gas piping does not require insulation.
- B. General: All ends shall be firmly butted together and secured with joint sealing tape. All jacket laps and joint sealing tape shall be secured with outward clinch staples at 4 inch spacing, or by use of a suitable adhesive. Installation shall provide a continuous sealed vapor barrier over all surfaces; seal all jacket penetrations with vapor barrier mastic or vapor barrier jacket tape.
- C. Elastomeric Pipe Insulation: Install with seams and joints sealed with rubberized contact adhesive. Insulation with pre-applied adhesive is not permitted. A brush coating of adhesive shall be applied to both butt ends to be joined and to both split surfaces to be sealed. Adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Provide added tape wrap around insulation

to ensure seam and joint closure. Insulation that can be pulled apart one hour (or more) after adhesive installation shall be replaced. Provide metal jacketing over outdoor exposed insulation.

- D. Pipe Hangers: Provide insulation tight up to pre-insulated pipe supports at pipe hangers, seal all joints with joint sealing tape. Pre-insulated pipe supports are specified in Section 20 05 29.
- E. Pipe Sleeves: Run insulation continuous full size through sleeve. Coordinate work with fire seals and confirm fire seal system is approved for use with insulated pipes; see Section 20 05 30.

F. Metal Jacketing:

- 1. Applications: Provide metal jacket over piping insulation for outdoor exposed piping.
- 2. Outdoor Installation: Where installed on outdoor piping locate seams on bottom side of horizontal piping. Seal all jacket seams to provide a completely weatherproof enclosure; water tight.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Thermowells.
- B. Control Tubing.
- C. Control Damper Installation.
- D. Control Valve Installation.

1.03 SUBMITTALS

- A. General: Comply with Section 20 05 00.
- B. Product Data: Submit product data for all items to be used.

1.04 GENERAL REQUIREMENTS

- A. General: The control system is specified in Division 25. The Division 23 contractor is required to coordinate the work with the control systems work to allow installation of items required for the HVAC control system, and to install the control items indicated.
- B. Control Dampers: Furnished under Division 25 and installed under this specification section.
- C. HVAC Control Valves: Furnished under Division 25 and installed under this specification section.

1.05 REFERENCES

A. ASTM B88: Standard Specification for Seamless Copper Water Tube.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.
- B. Thermowells: Trerice, Ashcroft, IPS, RTD, Texas Thermowell, Thermometrics.

2.02 THERMOWELLS

A. Series 300 stainless steel or brass construction, with 2 inch lagging neck and extension type well. Diameter and insertion length to suit application.

2.03 TUBING

A. Soft Copper tubing, per ASTM B 88; with soldered or flared/screwed type fittings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install items in accordance with manufacturer's instructions and control system requirements. Coordinate all work requirements with Division 25.
- B. Thermowells: Provide all HVAC system piping thermowells required for Division 23 work and by the control system. Install thermowells in accessible locations, to allow for visual observation of control devices, and to allow for proper control system operation.
- C. Tubing: Provide all control tubing necessary to properly connect all control devices (e.g. differential pressure sensors, gauges, etc.).
- D. Control Dampers: Install all control dampers furnished by Division 25 and as necessary for proper functioning HVAC systems. Verify damper sizes, locations, orientation, accessibility, and other installation requirements.
- E. Control Valves: Install all control valves furnished by Division 25 and as necessary for proper functioning HVAC systems. Verify valve sizes, locations, porting arrangements, and other installation requirements. Provide unions at connections to valves (except not required on flanged valves).

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Natural Gas Piping.
- B. Natural Gas Valves.
- C. Natural Gas Regulators.
- D. Natural Gas Accessories.
- E. Coordination with Gas Utility.

1.03 SUBMITTALS

- A. General: Provide submittals in accordance with Section 20 05 00.
- B. Product Data: Submit manufacturer's product data for all items to be used.

1.04 REFERENCES

- A. ASME B 6.5: Steel Pipe Flanges and Flanged Fittings.
- B. ASME B16.9: Steel Butt Welding Fittings.
- C. ASME B16.11: Forged Steel Fittings, Socket Welding and Threaded.
- D. ASTM A53: Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
- E. ASTM A105: Carbon Steel Forgings for Piping Applications.
- F. ASTM A234: Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- G. ASTM B88: Seamless Copper Water Tube.
- H. ASTM B280: Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- I. ASTM D2513: Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
- J. IFGC: International Fuel Gas Code.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General: Products shall comply with Section 20 05 00. See Section 20 05 00, paragraph 2.01 for Acceptable Manufacturer requirements.
- B. Pipe and Fittings: US Steel, Anvil International, Wheatland Tube, Weldbend, Exltube.
- C. Valves: Milwaukee, Flowserve (Nordstrom), Stockham, Conbraco/Apollo, Nibco, Resun, ASCO.
- D. Regulators: Fisher, American Meter, Equimeter.

2.02 PIPE AND FITTINGS - ABOVEGROUND

- A. Pipe: Black steel pipe conforming to ASTM A 53, Grade A or B, Type E or S. Schedule 40 unless indicated otherwise.
- B. Fittings:
 - 2 Inches and Smaller Exposed: Black malleable iron threaded type, Class 150 conforming to ASME B 16.3 and ASTM A 234.
 - Inches and Smaller Concealed: Steel butt weld type, conforming to ASTM A 234, ASME B 16.9; or steel socket weld type, conforming to ASTM A 105 and ASME B 16.11.
 - 2-1/2 Inches and Larger: Steel butt weld type, conforming to ASTM A 234, ASME B 16.9; or steel socket weld type, conforming to ASTM A 105 and ASME B 16.11
 - 4. Flanges: Steel socket or welding neck type, Class 150, conforming to ASME B 16.5.
- C. Vent Pipe: Same as gas piping; except where routed exposed in mechanical rooms, may be hand drawn or annealed seamless copper conforming to ASTM B 280 or UNS number C12200 copper conforming to ASTM B 88, with wrought copper fittings, bronze fittings, and soldered joints.

2.03 VALVES

- A. General: Valves shall be designed for use on natural gas system and suitable for the pressures and temperatures to be encountered. Valves shall be UL listed (or CSA certified) for fuel gas use.
- B. Ball Valves: Bronze body, two piece body, blowout proof stem, full port, reinforced TFE seats, chrome plated brass ball, threaded connections, UL listed for LP gas and natural gas shut-off, 250 psi non-shock LP or natural gas working pressure. Nibco T-585-70-UL (or approved).
- C. Plug Valves: Lubricated, wrench operated, regular pattern full port type plug valve. Gray iron body and plug per ASTM A 126, Class B. Rated for minimum 175 psi wog. Valves shall have a sealing and lubrication system for maintaining valve seals and operation. Valve shall be factory serviced with manufacturers recommended sealant suitable for the valve application. Valves 2 inch and smaller shall have threaded end connections; larger valves shall have flanged connections. Provide one standard lever type hand wrench for each valve. Resun Figure D-125, D-126 (or approved).

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

2.04 ACCESSORIES

A. Piping Specialties: See Section 20 05 19.

- B. Pressure Regulator: Cast iron body, die cast aluminum alloy diaphragm case, Buna-N diaphragm disc, 125 psi maximum pressure rating with over pressure positive tight lock-up, internal relief valve, and gray polyester paint finish. Regulator shall be sized by manufacturer based on inlet pressure, desired outlet pressure, and flow requirements. Regulators with vent openings located within 20 feet of ventilation air intakes or where the venting of gas would be unsafe shall be equipped (and labeled for use with) a vent limiting device.
- C. Vent Cap: T-style, constructed of aluminum or zinc coated cast iron, 30 mesh stainless steel screen. Morrison No. 155.
- D. Flexible Connectors: See Section 20 05 19. Size flexible connectors to match pipe size shown on plan, with reducer after the flexible connector to match the equipment connection size.

PART 3 - EXECUTION

3.01 GENERAL

- A. General: Comply with Section 20 05 00. Install in accordance with manufacturer's written installation instructions, code, applicable standards and best construction practices.
- B Complete System: Provide all piping as indicated and as required to allow connections to all equipment requiring gas connections, and to provide complete and operational gas piping systems.
- C. Coordination: Coordinate installation of items with all trades that are affected by the work to avoid conflicts. Review all drawings for location of pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

3.02 PIPE AND FITTINGS

A. General:

- 1. All piping in finished areas shall be installed concealed unless specifically noted otherwise.
- 2. Install piping at such heights and in such a manner so as not to obstruct any portion of windows doorways, passageways, or access to any items requiring routine service, maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur.
- 3. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal exposed straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

- B. Escutcheons: Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.
- C. Electrical Items: Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offsets are typically not shown on the plans, and are required per this paragraph.
- D. Joints: Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by pipe and fitting manufacturer.
- E. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).
- F. Welding: Shall conform to ASME B31.1 and ASME B31.9. Welders and welding operators shall be qualified as required by ASME B31.1, ASME B31.9, and governing code. Welded joints on piping system shall be continuous, without backing rings, and pipe ends beveled for butt weld connections. Gas cuts shall be square and free from burned material. Before welding, surfaces shall be thoroughly cleaned. Piping shall be carefully aligned, with no weld material projecting inside the pipe.
- G. Unions: Install unions in pipe connections to equipment and other items where it may be necessary to disconnect the item from piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise.
- H. Equipment Drip Legs: Provide drip legs in pipe connections to all equipment. Drip legs shall be located downstream of equipment isolation valves, and upstream of unit flexible connectors or unions. Provide adequate clearance for removal of drip leg cap.
- I. Regulators: Provide drip legs with removable caps upstream of all regulators; provide test tee with capped valve 10 pipe diameter downstream of all regulators.
- J. Flexible Connectors: Provide flexible connectors in piping at connections to all equipment. Size flexible connectors to match pipe size shown on plan, with reducer after the flexible connector to match the equipment connection size.
- K Vents: Pipe regulator vent lines and all equipment gas train vents full size to outside of building.
- L. Outdoor Piping Painting: All aboveground piping outside of building shall be cleaned and prime painted with one coat of a rust-inhibiting paint and a final coat of finish paint (see Section 09 00 00 for paint and color).

3.03 GAS SERVICE

- A. Service Application: Coordinate with gas utility for gas service to building. Contact gas utility and complete all required service application forms and documentation. Coordinate with Owner for any required signatures or service agreement authority. Coordinate scheduling with the utility for timely service to allow proper equipment start-up and to comply with overall project schedule.
- B. Gas Meter: Coordinate proper gas meter location with gas utility; location shown on plans is preliminary. Provide connection to outside utility gas meter, and gas piping from meter,

up to and completely connected, to all equipment.

- C. Gas Service Line: Provide all trenching, excavation, bedding, backfill, compaction, and grade restoration for gas service to the building. Trench depth and width shall be as required per gas utility requirements; coordinate with gas utility. Provide minimum 6-inch pea gravel bedding and minimum 6-inch pea gravel fill over gas utility piping.
- D. Service Charges: Owner will pay direct to the utility all utility charges for gas service to the building.

3.04 TESTING AND INSPECTION

- A. General: All piping shall be tested, inspected, and approved by the AHJ prior to being concealed or covered.
- B. Witnessing: Testing shall be witnessed by the AHJ and the Architect/Engineer (at his option). Notify Architect/Engineer minimum 72 hours prior to date of testing, and mutually agree upon times arranged.

C. Testing:

- 1. Piping shall be inspected, purged and pressure tested in accordance with IFGC (except where more restrictive requirements are specified herein, the most restrictive shall prevail).
- 2. Test pressure shall be not less than 150 percent of the maximum to which the pipe will ordinarily be subjected; but in no case less than 50 psig.
- 3. Components that may be damaged by the test pressure shall be removed or isolated from the piping system during testing.
- 4. Portions of the system that are reconnected after system testing that could not be tested (e.g. low pressure equipment connections, separate portions of the system, etc.) shall be specifically tested with a non-corrosive leak detection fluid acceptable to the AHJ.
- 5. Any leaks or defective piping disclosed by testing and inspection shall be repaired with new materials and the system re-tested.
- D. Documentation: Provide documentation to the Architect/Engineer indicating that the system has been completely pressure tested, and all portions inspected and accepted by the AHJ.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Water-Source Heat Pump System Piping.
- B. Valves.
- C. Balancing Valves.
- D. Expansion Tanks.
- E. Air Separator.
- F. Chemical Addition Tank.
- G. Air Vents.
- H. Flow Measuring Devices.
- I. Flushing and Initial Testing.
- J. Chemical Cleaning, Treatment and Final Testing.

1.03 SUBMITTALS

- A. General: Comply with Section 20 05 00.
- B. Product Data: Submit product information data for all items.
- C. Shop Drawings: Submit shop drawings of underground piping system.
- D. System Flushing, Cleaning and Testing: Submit documentation of work performed.
- E. Water Treatment:
 - 1. Submit name and qualifications of Water Treatment Specialist and chemical product data.
 - 2. MSDS sheets for all chemicals.
 - 3. Submit Water Treatment Specialist report.
- F. Operation and Maintenance: Submit operation and maintenance data, submittal data, and Water Treatment Specialist report for inclusion in project O&M Manuals.

1.04 QUALITY ASSURANCE

A. Water Treatment Specialists (WTS): Shall be a company regularly engaging in this work, having local representation and staff with at least 5 years experience, separate and independent from the system installers. WTS shall have staff trained and experienced in hydronic system chemistry and water treatment. WTS shall have water treatment research and laboratory services available for analyzing hydronic water systems and prescribing proven treatment systems.

1.05 REFERENCES

- A. ASME B16.3: Malleable Iron Threaded Fittings.
- B. ASME B16.15: Cast Bronze Threaded Fittings: Classes 125 and 250.
- C. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.
- D. ASME B18.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- E. ASME B18.24: Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500, and 2500.
- F. ASTM A 53: Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
- G. ASTM A 530: General Requirements for Specialized Carbon and Alloy Steel Pipe.
- H. ASTM B 16.18: Seamless Copper Water Tube.
- I. ASTM B 32: Solder Metal.
- J. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
- K. AWS A5.8: Filler Metals for Brazing and Braze Welding.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.
- B. Pipe and Fittings: US Steel, Anvil International, Wheatland Tube, Weldbend, Exltube, Elkhart, CTS, Mueller, Cerro, Cambridge-Lee.
- C. Valves: Milwaukee, Nibco, Watts, Conbraco/Apollo, Stockham, Kitz, Red-White.
- D. Balancing Valves: Bell & Gossett, Armstrong, Taco, Nibco, Red-White.
- E. Air Vents Automatic: Bell & Gossett.
- F. Expansion Tanks: Amtrol, Bell & Gossett, Armstrong, Taco.
- G. Air Separator: Bell & Gossett, Armstrong, Taco, Spirotherm.

- H. Chemical Addition Tanks: J.L. Wingert, Vector Industries, Neptune.
- I. Flow Measuring Devices: Bell & Gossett.
- J. Glycol Feed Systems: J.L. Wingert, Wessels.
- K. Chemicals: Hydrochem, Dow Chemical, Hercules Chemical Company, Rhomar Water Management, U.S. Water.

2.02 PIPE AND FITTINGS - MATERIALS

- A. Steel Pipe and Fittings:
 - 1. Pipe: Black steel pipe, per ASTM A 53, Type E or S, Grade A or B, Schedule 40 unless indicated otherwise.
 - 2. Fittings:
 - a. Threaded: Malleable iron fittings per ASME B16.3 or threaded cast iron fittings per ASME B16.1 or ASME B16.4.
 - b. Welded: Steel weld fittings per ASTM A 234; butt weld type per ASME B16.9; socket weld type per ASME B16.11.
 - c. Flanged: Fittings, bolts, nuts, and bolt patterns per ASME B16.5, Class 150. Flanges shall comply with ASTM A105. Bolts shall be high strength or intermediate strength, with material conforming to ASTM A193.
 - 3. Threads: Shall conform to ASME B1.20.1
 - 4. Coupled Piping Systems: See Section 23 21 15.
- B. Copper Pipe and Fittings:
 - 1. Pipe: Seamless copper water tube, hard temper (unless noted otherwise), type K or L as indicated, per ASTM B88.
 - 2. Fittings:
 - a. Solder Joint: Wrought copper and bronze fittings per ASME B16.22 and cast copper alloy fittings per ASME B16.18, cast bronze threaded fittings per ASME B16.15.
 - b. Flanged: Cast bronze fittings per ASME B16.24.
 - c. Solder Material: 95/5 tin-antimony solder per ASTM B32 or "Silvabrite 100" (95.5 tin/4 copper/0.5 silver) solder; lead free.
 - d. Brazing Material: AWS A5.8, BCuP-5.
 - Coupled Piping Systems: See Section 23 21 15.

2.03 VALVES

A. Ball Valves:

1. 2 Inches and Smaller: 125 psi-swp bronze body, full port, 2 piece construction, anti-blowout stem, reinforced TFE seats, stainless steel or chrome plated brass ball, extended stem, cadmium plated steel lever handle with vinyl covering, solder or threaded connections as required. Provide with extension stem for handle where valve is installed in systems with insulation thickness greater than 0.5 inch. Nibco S-585, T-585 (or approved).

2. 2-1/2 Inches and Larger:

- a. Stainless: Class 150 stainless steel body, split-body full bore design, anti-blowout stem, carbon filled TFE seats, stainless steel ball, stainless steel trim. Nibco F-515-S6-F-66-FS (or approved).
- b. Cast Iron: Class 125 cast iron body, split-body full port, anti-blowout stem, PTFE seats, stainless steel ball. Conbraco/Apollo IBV-125 Series (or approved).

B. Butterfly Valves:

- 1. 2 Inches and Smaller: 125 psi-swp bronze body, stainless steel disc and extended stem, with solder or threaded connections as required. Milwaukee "Butterball" Model No. BB2 (or approved).
- 2. 2-1/2 Inches and Larger: 200 psi non-shock cold water, ductile iron body, extended neck, molded-in seat EPDM liner, stainless steel stem, and aluminum bronze disc. Provided with lugs for dead-end service. Nibco LD-2000, WD-2000 (or approved).

C. Check Valves:

- 1. 2 Inches and Smaller:
 - a. Horizontal: 125 psi-swp bronze body horizontal swing check valve, regarding type, y-pattern, renewable seat and disc, solder or threaded connection. Nibco S-413 or T-413 (or approved).
 - b. Vertical: 125 psi-swp bronze body vertical inline check valve, stainless steel or bronze disk holder, Buna-N disk, stainless steel spring actuated, solder or threaded connection. Nibco S-480 or T-480 (or approved).

2. 2-1/2 Inches and Larger:

- a. Horizontal: 125 psi-swp iron body vertical inline "silent" check valve, wafer or flanged style, renewable seat and disk, stainless spring actuated, bronze disk. Nibco W-910 (or approved).
- b. Vertical: 125 psi-swp iron body vertical inline "silent" check valve, wafer or flanged style, renewable seat and disk, stainless spring actuated, bronze disk. Nibco W-910, F-910 (or approved).
- D. Drain Valves: Bronze ball valve, minimum 125 psi-swp, anti-blowout stem, stainless steel or chrome plated brass ball, reinforced TFE seat, solder or threaded inlet connection,

male 3/4 inch hose thread outlet connection, with brass cap and chain. Nibco S-585-70-HC, T-585-70-HC (or approved).

E. Pressure Reducing Valves: Bronze body construction, renewable nickel alloy or stainless steel seat, lead free, with integral strainer and union inlet connections. Adjustable range 25 to 75 lbs, suitable for inlet pressures up to 300 psi. Watts Series U5-Z3 (or approved).

2.04 BALANCING VALVES

- A. General: Valve shall have, as an integral factory manufactured part of the valve, a means to measure the pressure drop across the valve to determine the flow rate, using factory calibrated pressure drop versus flow charts. Valve shall have a means to adjust the flow rate through the valve. Bell & Gossett "Circuit Setter" (or approved).
- B. Balancing Valves: Calibrated balance valve, ball or globe type, bronze construction, with brass readout valves with integral EPT insert and check valve to minimize fluid loss during balancing. Valve shall have calibrated nameplate and memory stop. Rated for 200 psig working pressure at 250 degrees F. Valve shall be same size as pipe installed in, except where required for proper flow measuring, valve may be one pipe size smaller.

2.05 COIL CONNECTION HOSES

- A. Construction: Flexible braided stainless steel over a synthetic polymer liner, with brass threaded end connectors, stainless steel ferrules, and swivel end connections at coil connection ends.
- B. Length: Minimum 18 inches, maximum 30 inches.
- C. Pressure Temperature Rating: Minimum 150 psi at 230 deg F, all sizes.
- D. Fire Hazard Rating: Shall not exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E 84.
- E. Insulation: Hoses shall be factory insulated with minimum 1/2 inch thick polyethylene or cellular elastomeric insulation.

2.06 AIR VENTS

- A. Automatic Air Vent - High Capacity: Float type, with stainless steel float and float mechanism, cast iron body, rated for 250 psig maximum operating pressure, 300 degrees F. maximum temperature and 10 cfm capacity at 100 psig water pressure. Hoffman No. 792 (or approved).
- B. Automatic Air Vent: Float type, with stainless steel float and float mechanism, semi-steel or cast brass body, ball check preventing re-entry of air, rated for 150 psig maximum pressure and 250 degrees F. maximum temperature. Hoffman No. 78 (or approved).
- C. Manual Air Vent: 1/4-inch, 125 psi bronze ball valve (Nibco S-589, T-580 or equal), with nipple connecting to pipe and discharge nipple and 1/4-inch diameter soft copper tubing, 24-inch long, provided.

2.07 EXPANSION TANKS

A. Type: Pre-pressurized, ASME labeled diaphragm expansion tanks.

- B. Capacity: Tank volume shall be as indicated on the drawings, factory pressurized to the pressure indicated, and shall be rated for 125 psig maximum working pressure and 240 degrees F. maximum temperature and shall be constructed in accordance with ASME code.
- C. Data Sheet: Furnish each expansion tank with manufacturer's Data Report for Pressure Vessels, per ASME Boiler and Pressure Vessel Code.

2.08 AIR SEPARATOR

- A. Type: Coalescing type combination air eliminator and dirt separator. Spirotherm "Spirovent" VHN (or approved).
- B. Construction: Shall be of cast iron or welded steel construction, with copper or stainless steel coalescing medium, brass air venting components, bottom connection for blowdown. Rated for 150 psig (minimum) at 270 degrees F (minimum) in accordance with the ASME Boiler and Pressure Vessel Code. Unit shall have a removable lower head for internal inspection.
- C. Size and Capacity: Air separator shall have flanged connections, size as shown on plans, and be rated for the gpm shown on the drawings (i.e., the gpm for the pump(s) which flow through the unit) with 100% free air elimination, 99.6% dissolved air removal, and dirt separation efficiency of 80% (of all particles 30 microns and smaller). Pressure drop shall be no greater than indicated (where not indicated, maximum pressure drop shall be 4 feet of water).

2.09 CHEMICAL ADDITION TANK

- A. Type: Welded steel or cast iron construction, with side top and side bottom threaded connections (minimum 3/4 inch), bottom drain 3/4 inch threaded connection, top fill opening with cap (minimum 3-1/2 inch diameter), dished out bottom, and vertical support legs. Fill cap shall be of steel or ductile iron construction, with Buna-N O-ring seal.
- B. Capacity: As indicated on the drawings (where not indicated shall be 5 gallon capacity). Tank shall be suitable for up to 300 psig working pressure, at 200 deg F.

2.10 FLOW MEASURING DEVICES

- A. Venturi: Venturi type flow measuring device, with calibrated flow versus pressure drop characteristics. Shall be of cast steel or bronze construction with weld or mechanical coupled ends, and have built-in sensing taps having shutoff valves and quick connect couplings. Venturi shall have identification tag on chain, giving pipe size, venturi model, pressure drop at specified flow rate, and flow versus differential curve. Same size as pipe installed in (unless noted otherwise).
- B. Orifice Meter: Cast iron, wafer-type orifice flow meter, with readout valves having integral EPT check valve to minimize fluid loss during measuring and calibrated nameplate indicating flow versus pressure drop. Bell and Gossett "Circuit Sensor" or approved.

2.11 CHEMICALS

A. General: Chemicals shall be compatible with system materials and suitable for system operating conditions. Chemical shall be acceptable by local utility for discharge to

sanitary sewer. Chemicals shall be delivered to the site in manufacturer's original sealed and labeled containers.

- B. Cleaner: Single liquid chemical product formulated for use as a cleaner in hot water heating and chilled water piping systems. Product shall have detergents, dispersants, alkaline emulsifiers, and additional agents to effectively remove grease, oil, dirt, mill scale and other contaminants from the piping systems. Cleaner shall be biodegradable. Rhomar "Hydro-Solv 9100" (or approved).
- C. Biocide: Broad spectrum microbiocide for use in hydronic piping systems.
- D. Corrosion Inhibitor: Nitrate/borate or molybdate based inhibitor, single liquid chemical product formulated for use in hot water heating and chilled water cooling systems to provide protection from corrosion. Product shall be compatible with antifreeze, and all materials in the hydronic system that the product may come in contact with. Product shall be formulated from a combination of sodium nitrate, sodium borate, and other ingredients. For work on existing systems where portions of the existing system water will remain in the system use the same corrosion inhibitor type as currently in the system and compatible with the existing chemicals.
- E. Antifreeze: Industrially inhibited propylene glycol, formulated for use in hot water heating and chilled water cooling systems. Shall have operating range from -28 deg F to 325 deg F. Antifreeze shall contain corrosion inhibitors to prevent system corrosion. Product shall be dyed a bright color for easy leak identification. Reserve alkalinity shall be at least 15 to provide long term resistance to acidic pH. Dow "Dowfrost HD" (or approved).

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation: Installation of all items shall comply with code, best professional practices, and manufacturers written installation instructions.
- B. Complete System: Provide all piping as indicated and as required to allow complete supply and return connections to each item requiring hydronic service. Provide piping connections to equipment furnished by others in accordance with Section 20 05 00.
- C. Coordination: Coordinate installation of items with all trades that are affected by the work to avoid conflicts. Review all drawings for location of pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

3.02 PIPE AND FITTINGS

A. General:

- All piping in finished areas shall be installed concealed unless specifically noted otherwise.
- 2. Install piping at such heights and in such a manner so as not to obstruct any portion of windows doorways, passageways, or access to any items requiring routine service, maintenance, or inspection. Offset of reroute piping as required to clear any interferences which may occur.

- 3. Install return piping graded up in the direction of flow. Piping pitch shall be 1/4-inch per 10 feet. Supply piping may be installed with slope parallel to return.
- 4. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal exposed straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.
- 5. Use eccentric reducers for changes in pipe sizing, keeping the top of pipes in line.
- B. Insulation: Allow sufficient clearances for installation of pipe insulation in thickness specified. If interferences occur, reroute piping to accommodate insulation.
- C. Escutcheons: Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.
- D. Electrical Items: Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offsets are typically not shown on the plans, and are required per this paragraph.
- E. Joints: Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by pipe and fitting manufacturer.
- F. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).
- G. Soldered and Brazed Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.
- H. Welding: Shall conform to ASME B31.1 and ASME B31.9. Welders and welding operators shall be qualified as required by ASME B31.1, ASME B31.9, and governing code. Welded joints on piping system shall be continuous, without backing rings, and pipe ends beveled for butt weld connections. Gas cuts shall be square and free from burned material. Before welding, surfaces shall be thoroughly cleaned. Piping shall be carefully aligned, with no weld material projecting inside the pipe.
- I. Unions: Install unions in pipe connections to valves, coils, and any other equipment where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise.
- J. Insulating Unions: Install dielectric insulating unions or insulating type flexible connectors between all connections of copper piping and steel piping of steel equipment. Where flanged connections occur use insulating type flanges.

K. Automatic Air Vents:

 Provide automatic air vents installed at each high point in the system, where air may become trapped, and where system is separated from other air vents by vertical drops or rises. Provide added automatic air vents where shown on drawings.

- 2. All automatic air vents shall be connected to the system through a ball valve.
- 3. All automatic air vents shall be provided with drain piping to the nearest funnel or floor drain. Multiple vents may be plumbed to a common drain line which then runs to the nearest funnel or floor drain. Such a drain system is not shown on the drawings (due to its incidental nature) but is a project requirement. Such drain line shall pitch toward nearest drain at a minimum 1% slope down and shall be the same size as the air vent connection size where serving 1 AAV, minimum 1/2-inch for serving up to 4 AAV's, 3/4-inch for serving up to 12 AAV's, and 1-inch where more are served.
- L. Manual Air Vents: Provide manual air vents where shown on the drawings and at each coil, except that automatic air vents shall be used where specifically called for on the drawings or where it is a high point in the system or where air may become trapped.
- M. Drains: Install drain valves at the low points in the piping system and at the base of each system riser. Provide additional drains as required to allow for complete draining of the system. These drain valves shall take off of the bottom of any horizontal pipe that they are connected to. Identify system drains on record drawings.
- N. Accessories: Install flow measuring devices, balancing valves, and related items per manufacturer's instructions; with the proper distances upstream and downstream to any pipe fittings.

3.03 VALVES

- A. General: Provide isolation valves as shown on the drawings. In addition to those shown, provide added valves to allow for the isolation of all individual equipment items.
- B. Type: Valves 2 inches and less shall be the ball or butterfly type; larger valves may be ball or butterfly type at Contractor's option; except that valves indicated to be a specific type shall be the type as noted.
- C. Installation: Install valves so as to be easily accessible and oriented to permit ease of operation. Valve stem shall be directed toward operator in either the vertical or horizontal direction. Provide access doors for valves not otherwise accessible.
- D. Pressure Reducing Valves: Provide pressure reducing valves as shown on drawings, complete with by-pass line, isolation valves, unions, and pressure gauges. Set initial pressure and adjust as required so that system receives adequate fill and has sufficient pressure at the top of the system to vent system of air.
- E. Balancing Valves: Provide balancing valves in piping where indicated and where required to allow for equal distribution of water flows. Install in full open position unless noted otherwise.
- F. Check Valves: Check valves used on the discharge of pumps shall be the non-slam type (except for pumps 3/4 hp and less).

3.04 FLUSHING, TESTING, AND CHEMICAL TREATMENT

A. General:

- 1. All new work and portions of the existing system affected by the work are to be flushed and pressure tested. The entire system is to be chemically treated to restore proper chemical levels. It is not the intent to flush or test existing portions of the system not affected by the work.
- 2. Due to limited ability to isolate portions of the system, it may be required to flush, fill, and test larger portions of the system than those worked on, or the entire system. Contractor shall review and make his own determination of the extent of the work and include all costs in his bid.
- 3. The activities specified herein represent the minimum work required; Provide additional work as necessary to suit unique aspects of the project (e.g. phased construction, long pipe runs, etc.) and as recommended by the Water Treatment Specialist (WTS) in order to provide clean, pressure tested, and chemically treated hydronic systems ready for service.
- Prior to beginning work have WTS confirm existing system treatment levels, conditions, and chemicals being used. Submit written report of condition and any adverse conditions discovered.
- 5. System shall not be allowed to remain in a condition that is deleterious or aggravates corrosion. After being filled with water systems may not remain without chemical treatment for more than 48 hours; after having been filled and drained, systems may not remain empty for more than 24 hours. Provide added chemical treatment cycles during initial fill periods as needed to suit project phasing or extended testing/flushing periods.
- 6. Provide clear, accurate, and readable pressure gauges to ensure accurate pressure testing. Make a written record of the gauge readings, time, date, and where connected to the system and mark this information on site as-builts.
- B. Witnessing: Notify in writing the Architect/Engineer in advance (minimum three days notice) of when flushing, strainer blow-down and final testing will occur. Flushing and testing work may be witnessed by the Architect/Engineer and Owner's representative (at their option). Failure to provide proper notification and allowing an opportunity for witnessing may require the work to be repeated so that witnessing can occur.
- C. Sequence: Work shall occur in the following order:
 - 1. Prepare system for work.
 - 2. Initial fill and initial leak testing.
 - 3. Flushing (includes initial strainer blow-down).
 - 4. Final leak testing.
 - Chemical treatment.
- D. Preparation: Prepare system for flushing and testing. Isolate from the piping any parts of the system or equipment that may be damaged by the test pressure or entrapment of debris during the flushing process, or that are not part of the flushing process. Install any required (or recommended) start-up strainer screens or related items to protect components or to aid the flushing process.

E. Initial Fill and Leak Test: Fill portions of the system to be flushed with clean water or existing system hydronic water. Open local air vents and valves to allow filling. Maintain isolation from systems not worked on. Check system for leaks during filling. Pressurize system to at least 20% above what system will experience during flushing process (but not less than 75 psig) and check for leaks. Any leaks shall be repaired and the system re-filled and re-checked until system proves tight. Provide temporary hose and piping as necessary.

F. Flushing and Cleaning:

- 1. Flush all new work and portions of system affected by the work to remove system of debris. Use clean water or existing system hydronic water. Blow-down all strainers that are part of system being flushed. Protect existing systems to prevent contamination. Existing systems are not intended to be flushed unless they have not been sufficiently protected from contamination (in which case flushing will be required), or it is not possible to isolate them from the areas worked on. Open system valves (where possible) and other components to ensure full flushing. Provide temporary fill and drain piping as necessary. Provide sufficient number of drain points to ensure that all parts of the new piping are flushed.
- 2. Clean new portions of work by circulating through the system a cleaning chemical. Use concentration, flow rates, and duration as recommended by the chemical supplier and WTS.
- G. Final Testing: After flushing, drain the initial fill water from the portions undergoing flushing. Apply hydrostatic test to the portions of the system worked on. Where new portions cannot be isolated from existing, then test both. Test pressure on systems with all new components only, shall be 125 psig; test pressure on portions with new and existing shall be 75 psig (unless noted otherwise). Confirm all test pressures with Engineer prior to test. System shall hold the test pressure for a minimum of 2 hours with no drop in pressure. Any leaks shall be repaired and the system re-tested until system proves tight.
- H. Documentation: Document all flushing, testing, and strainer cleaning. Documentation shall indicate when these tasks were conducted, description of the extent/scope of work, who did the work, and be signed by the person performing the work or the person supervising the work.
- I. Supervision: All work shall be performed under the direct supervision of the Water Treatment Specialist (WTS) subject to approval by the Architect/Engineer.
- J. Chemical Treatment: After successfully proven free of leaks, add corrosion inhibitor to the system to achieve pre-project chemical levels, or to a concentration of 100-150 ppm for molybdate inhibitors and 800-1200 ppm for nitrite inhibitors where pre-project chemical levels are not documented. Provide anti-freeze to 20% concentration by volume (unless noted otherwise). Existing chemically treated water drained from the system may be re-introduced into the system provided the water is filtered through a 20 mesh strainer and shows no signs of degradation and is acceptable to the WTS.
- K. Final Chemical Testing: Test system as recommended by the WTS to confirm proper system cleaning and stability. Test as a minimum for: total dissolved solids, pH, soluble iron, soluble copper, antifreeze percentage (as applicable), and concentration of corrosion inhibitor.

SECTION 23 21 13 HYDRONIC PIPING

L. Report: The WTS shall submit a report describing the initial system condition, final chemical test results, and the final condition of the system. Report shall include when testing work was performed, and name of individuals doing the testing work or supervising the work.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Mechanically Coupled Pipe.
- B. Mechanically Coupled Pipe Fittings.
- C. Mechanical Couplings.
- D. Mechanically Coupled Valves.
- E. Mechanically Coupled Piping Specialties.

1.03 SUBMITTALS

- A. General: Submittals shall comply with Section 20 05 00.
- B. Product Data: Submit product information on all pipe, pipe fittings, valves, and specialty products proposed to be used. Indicate gasket materials and coupling types to be used for each system and pressure/temperature limitations of all products.
- C. System Expansion/Contraction: Submit information indicating how system expansion/contraction will be accommodated. Provide plans with locations and details of all expansion joints, loops, anchors, guides, and other system features.

1.04 GENERAL REQUIREMENTS

- A. Contractor Option: The Contractor, at his option, may use mechanically coupled pipe, pipe fittings, valves and piping specialties in lieu of those materials otherwise specified. Only the valve and specialty items specifically called out in this specification section may be used.
- B. Systems: Mechanically coupled piping products are approved for use on the following only: Hydronic Heat Pump Water Piping System.
- C. Standardization: All mechanically coupled piping products shall be of one manufacturer.
- D. Quality: All mechanically coupled piping products shall be equal to or superior than the otherwise specified product (i.e. if standard threaded, welded or flanged items were used). Mechanically coupled piping products shall only be used where the operating conditions do not exceed the design parameters of the gasket and product, and where system operation/performance is not adversely affected. The use of mechanically coupled piping products does not eliminate the requirement to provide other components indicated on the plans (i.e. flex connectors, expansion devices, etc.). Product manufacturer shall be ISO-9001 certified.

- E. Costs: Contractor shall bear all added costs of using mechanically coupled piping products in lieu of otherwise specified products.
- F. Tools: Tools used in grooving pipes and in assembling mechanically coupled system components shall be approved for such use by the mechanical coupled product manufacturer.

1.05 REFERENCES

- A. ASTM A53: Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- B. ASTM A183: Carbon Steel Track Bolts and Nuts.
- C. ASTM A234: Standard Specification for Piping Fittings or Wrought Carbon Steel and Alloy Steel.
- D. ASTM A449: Quenched and Tempered Steel Bolts and Studs.
- E. ASTM A536: Ductile Iron Castings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.
- B. Pipe: See system specification sections.
- C. Mechanically Coupled Piping Products: Victaulic Company of America, Anvil International, ("Gruvlock").

2.02 PIPE AND FITTINGS

- A. Pipe: See system specification sections.
 - 1. Pipe shall be roll/cut grooved in accordance with the latest manufacturer's recommendations.
 - 2. Pipe ends shall be free from indentations, projections, and roll marks.

B. Fittings:

- General: Fittings shall be full flow type, with grooves, shoulders and other provisions for use with mechanical couplings by the same manufacturer as the fitting. Shall be products as indicated in the manufacturer's latest catalog literature.
- Steel Piping Systems: Fittings shall be constructed of malleable iron conforming to ASTM A47, ductile iron conforming to ASTM A536, segmentally welded schedule 40 steel pipe conforming to ASTM A53 (type F, E or S, Grade B), or forged steel conforming to ASTM A234, (Grade WPB). Fittings shall be factory coated with an orange colored alkyd enamel paint; except where piping system is galvanized the fitting shall be hot dipped galvanized (conforming to ASTM A153).

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

3. Copper Piping Systems: Fittings shall be constructed of copper, conforming to ASTM B-75 alloy C12200 or ASTM B-152 alloy C11000, up through 4 inch size; or conforming to ASTM B-584, copper alloy CDA 836, 5 inch and larger. Fittings shall be factory coated with a copper colored alkyd enamel paint.

2.03 MECHANICAL COUPLINGS

A. Coupling Components:

- 1. Coupling housings shall be malleable iron conforming to ASTM A47 or ductile iron conforming to ASTM A536; hot dip galvanized per ASTM A153 where the connecting piping or fittings are galvanized.
- 2. Couplings shall be factory coated with an alkyd enamel paint; copper colored for fittings used on copper piping systems and orange colored for other systems.
- 3. Bolts shall be carbon steel track type conforming to ASTM A183 Grade 2, or ASTM A449; minimum tensile 110,000 psi. Nuts shall be hex style, conforming to ASTM A183 Grade 2, or ASTM A563 Grade A. Bolts and nuts shall be zinc electroplated to ASTM B633.
- 4. Gaskets shall be grade "E" EPDM conforming to ASTM D2000 Grade 2, with temperature range from -30 degrees F to +230 degrees F. Gasket selection for each system shall be in accordance with latest manufacturer's recommendations and so as to suit system pressures, temperatures and chemicals.

B. Couplings:

- 1. Steel Piping Systems: Couplings shall be equal to those manufactured by Victaulic, Styles 77, 177, 72, 750, and 107, or approved.
 - a. Victaulic Style 77, 177, 72, W77 and 750 coupling (or approved) shall be used to provide allowance for controlled pipe movement expansion/contraction/deflection to absorb movement for thermal changes, settling or seismic action.
 - b. Victaulic Style 107 "Zero Flex" W07 rigid coupling (or approved) with angular bolt pads shall be used for all pipe joint connections where joint flexibility is not desired.
- 2. Copper Piping Systems: Couplings shall be equal to those manufactured by Victaulic, Style 607. Coupling housings shall be cast with angular bolt pads.

2.04 VALVES

A. Butterfly Valves:

Shall have housing cast of ductile iron conforming to ASTM A-536, or malleable iron conforming to ASTM A-47, with grooved ends and shall be coated with a black alkyd enamel or epoxy coating or polyphenylene sulfide (PPS). Disc shall be of ductile iron construction, conforming to ASTM A-536, with electroless nickel coating conforming to ASTM B-733, or with grade "E" EPDM coating. Disc seat shall be pressure responsive elastomer, "E" EPDM. Stem shall be Type 416 stainless steel. Valve shall be rated for bubble-tight shut-off service up to 300 psi;

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

vacuum service up to 29.9 inches of mercury; and for dead-end service. Provide valves with extended necks where used on insulated piping to allow for insulation without inhibiting valve operation. Victaulic "Vic-300, MasterSeal-W761" (or approved).

- 2. Operator: Manual lever lock/infinitely variable handle with memory stop. Shall be fabricated of ductile iron, with painted enamel finish, and steel zinc plated fasteners. On valves 5-inch and larger, provide with manual gear operator with round handwheel.
- 3. Alternative Valves: Other valves having equal pressure capabilities and of like construction to the above may be used with the Engineer's approval prior to bidding.
- B. Check Valves: Body shall be constructed of ductile iron conforming to ASTM A-536 and ASTM A-395, with grooved ends. Disc shall be aluminum bronze conforming to ASTM B-148 or ductile iron conforming to A-536, or Type 304 stainless steel; with spring assist. Body shall be coated with a black alkyd enamel or epoxy coating or polyphenylene sulfide (PPS). Spring shall be constructed of Type 316 stainless steel. Seal shall be grade "E" EPDM with temperature range -30 degrees F to +230 degrees F continuous service, and be rated for up to 300 psi working pressure. Valve shall be operational when installed in horizontal or vertical positions, and shall close off tight with as low as 5' of head on discharge side. Victaulic Series 716/779 W716 (or approved).

C. Balancing Valves:

- General: Valve shall have, as an integral factory manufactured part of the valve, ports which allow measurement of the pressure drop across the valve to determine the flow rate using factory calibrated pressure drop versus flow charts. Valve shall have a means to adjust the flow rate through the valve and shall have a numerical readout indicating valve position. Valve shall have a concealed locking memory stop feature which prevents opening the valve beyond its balanced setting. Locking position may be unlocked by use of a standard size Allen wrench. Victaulic/TA Hydronics Series 786, 787, 788, or 789 (or approved).
- 2. Construction: Rated 300 psig at 250 deg F, Y-pattern, globe type, constructed of brass copper alloy or ASTM A536 ductile iron, with EPDM O-ring seals. Handwheel controlling valve position shall be of plastic construction, containing readout of valve position.
- 3. Connections: Valves 2-1/2 inch and smaller shall have solder or threaded end connections; larger valves shall have flanged or grooved ends.
- 4. Sizing: Valve shall be same size as pipe installed in, except where required for proper flow measuring, valve may be one pipe size smaller.

2.05 PIPING SPECIALTIES

A. Suction Diffuser: Body shall be constructed of ductile iron conforming to ASTM A536 or malleable iron conforming to ASTM A47. The combination diffuser-strainer-orifice cylinder shall be of Type 304 stainless steel with 5/32-inch or 3/16-inch diameter holes. Start-up pre-filter shall be stainless steel (or bronze), 20 or 16 mesh screen. Rated for 300 psi working pressure at 250 deg F. Provide with 1-1/4-inch pipe support boss, bottom drain plug and side gauge tap. Victaulic 731-D/W731 (or approved).

- B. Strainer: "T" or "Y" type configuration. Body shall be constructed of ductile iron conforming to ASTM A536 and ASTM A395 or malleable iron conforming to ASTM A47. Body shall be coated with an alkyd enamel or epoxy coating or polyphenylene sulfide (PPS). Screen shall be removable by removing end cap coupling. Screen shall be basket type, constructed of Type 304 stainless steel, 6 mesh. End cap shall have NPT blow-down connection, minimum 1/2-inch, and utilize manufacturers standard coupling style and gasket matching other couplings used in the system. Strainer Cv shall be no less than the nominal strainer diameter squared times 26. Rated for 300 psi working pressure at 250 deg F. Victaulic style 730/W730 (or approved).
- C. Branch Outlets: Victaulic Style 923 "Vic-Let", Style 924 "Vic-O-Well", Victaulic Style 920 and 920N "Mechanical-T" outlets (or approved); rated for 300 psi working pressure at 230 deg F.
- D. Dielectric Connection: Victaulic Style 47 "Clearflow Dielectric Waterway" fitting (or approved). Constructed of steel or ductile iron pipe, with zinc electroplating and internal thermoplastic lining. Rated for 300 psi working pressure at 230 deg F.
- E. Adapter Connection: Conversion of flanged outlets to mechanically coupled system connection shall be accomplished by Victaulic Styles 741 Flange Adapter (or approved), conforming to ANSI Class 125/150 bolt pattern, or Style 743 Flange Adapter (or approved), conforming to ANSI Class 250/300 bolt pattern.
- F. Flanged Adapter Nipples: Victaulic Style 41, 45, 46 (or approved) for connecting ANSI class 125, 150, and 300 flanged components to mechanically coupled piping system connection. Nipples shall be constructed of carbon steel pipe (same schedule as the piping system being connected); flanges of cast iron or carbon steel construction.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install all components according to the manufacturer's written installation instructions and applicable codes and standards. See piping system specification section for piping and system installation requirements.
- B. Pipe Preparation: Piping shall be prepared in strict accordance with the coupling manufacturer's instructions and ANSI/AWWA C-606.
- C. Coupling Fasteners: Torque as required by manufacturer. Demonstrate equipment used upon Engineer's request.
- D. Dielectric Connection: Provide dielectric at all piping connections between dissimilar metals and equipment to protect from local cell corrosion.
- E. Coupling Types: Couplings that allow for system flexibility and expansion/contraction shall be used except where a rigid coupled system is specifically required. Three (3) Victaulic 177 or 77 Flexible Couplings in close proximity to pump or equipment connection may be used in lieu of flex connectors.
- F. System Expansion/Contraction:
 - 1. "Flexible" Coupled Systems: Install piping ends with proper clearances ("pre-

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

gap") to allow for system expansion (or contraction), as appropriate to temperatures at the time of installation and system operating temperatures and pressures. Provide pipe anchors at the end of pipe runs and intermediate guides to allow the gap between piping ends to take up piping expansion/contraction. Provide additional couplings (or expansion joints) to accommodate all pipe movement without excessive pipe stress or angular deflection in piping mains and branch connections.

- 2. "Rigid" Coupled Systems: Provide expansions joints and expansion loops (or changes in piping direction) to accommodate system expansion and contraction. Provide pipe anchors at the end of pipe runs and intermediate guides to allow piping to expand/contract into the installed expansion device/system.
- 3. The system features to accommodate all system expansion and contraction shall be Contractor selected, subject to review by the Engineer. Contractor's methods shall be based on guidance from the coupling manufacturer and engineering principles.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

A. In-Line Pumps.

1.03 SUBMITTALS

- A. Product Data: Provide product information and performance data for all pumps. Performance data shall include pump curves, showing pump performance as head vs. GPM, BHP and NPSH vs. GPM, with system operating point clearly marked. (NPSH vs. GPM not required for pumps 1 HP and less.)
- B. Installation: Submit manufacturers installation instructions for pumps.

1.04 QUALITY ASSURANCE

- A. Factory Testing: All pumps shall be factory tested per the Hydraulic Institute Standards and be thoroughly cleaned.
- B. Electrical: Coordinate pump electrical voltage/phase with Division 26 prior to ordering.

1.05 REFERENCES

A. Hydraulic Institute Standards: ANSI/HI Pump Standards, Version 3.1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00. See Section 20 05 00, paragraph 2.01 for Acceptable Manufacturer requirements.
- B. In-Line Pumps: Bell & Gossett, Armstrong, Grundfos, Taco.

2.02 GENERAL

- A. Balancing: All rotating parts shall have been statically and dynamically balanced at the factory.
- B. Alignment: Pump and motors shall be factory aligned, and have alignment checked and reset once installed in place.
- C. RPM: Pumps and motors shall operate at 1750 rpm unless indicated otherwise.
- D. Pump Capacity: Shall be no less than the values listed on the Mechanical Equipment

Schedule on the drawings.

- E. Pump Types: The type of each pump is indicated on the Mechanical Equipment Schedule under the "Type" column, and corresponds to the types specified herein.
- F. Motors: Shall comply with Section 20 05 00. Motors shall be of sufficient size so as to be non-overloading at any point on the operating curve and shall be no smaller than the size shown on the drawings. Motors shall be of drip-proof construction (unless indicated otherwise), resilient mounted with oil lubricated journal or ball bearings, and have built-in thermal overload protectors. Motors shall be for use with the voltage and phase as indicated on the drawings.
- G. Finish: Pumps shall have minimum one coat high grade machinery enamel finish, factory applied, manufacturer's standard color.
- H. Nameplate: Pumps shall have nameplates identifying: manufacturer, model number, capacity (gpm and head), and date of manufacturer.
- I. Variable Speed Application: Pumps used with variable speed drives shall have motors that are compatible with the variable frequency drive unit and shall have suitable couplings and accessories to suit variable speed duty.
- J. Coupling Guards: Provide pumps with coupling guards complying with OSHA requirements.

2.03 VERTICAL IN-LINE PUMPS

- A. Type: Centrifugal, single stage, split coupled, in-line pump with vertical shaft. Bell & Gossett Series 80 (or approved).
- B. Operating Range: Pump shall be rated for continuous operation at a minimum 175 psi and 250°F.
- C. Volute: Cast iron or ductile iron construction (except shall be of bronze construction where pump is noted as "all bronze"), with plugged gauge tappings at inlet and outlet, and plugged vent and drain tappings at top and bottom. Shall have flanged suction and discharge connections, pressure class to match piping system connected to.
- D. Impeller: Cast bronze, fully enclosed, keyed to shaft and secured with stainless steel locknut. Impeller key and hardware shall be of stainless steel construction.
- E. Shaft: Type 416 stainless steel, guided by a carbon graphite throttle bushing. Shaft shall be coupled to motor with a split rigid spacer type coupling, with slotted coupler guard.
- F. Seal: Internally self-flushing mechanical seal; with EPR or EPDM or Viton elastomer, carbon rotating face, tungsten carbide (or silicon carbide) stationary face, stainless steel spring, and metal parts of stainless steel or brass construction.
- G. Service: Pump seal shall be replaceable without removing pump motor or disturbing piping connections.
- H. Support: Provide all floor supported vertical shaft pumps with a cast iron pump stand designed for attachment to pump to provide substantial support off the floor.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Comply with Section 20 05 00. Install in accordance with manufacturer's written installation instructions, code, applicable standards and best construction practices. Install pumps at locations indicated and in accordance with Contract Documents. Set base mounted pumps on concrete housekeeping pads; provide vibration isolation bases as indicated.
- B. Piping: Decrease from line size to pump inlet size with long radius reducing elbows and minimum 5-pipe diameter straight pipe into pump (except where suction diffusers are used) and out of pump. Where reducers in the horizontal are used on pumps, they shall be the eccentric type installed with taper on the bottom.
- C. Flexible Connectors: Provide flexible connectors in piping to base mounted pumps and where indicated.
- D. Owner Instruction: Instruct Owner on equipment operation, including: system start-up, shut-down, emergency shut-down, normal control operation, safety aspects, maintenance and repair instructions. Comply with Section 20 05 00.

3.02 START-UP

- A. Pre Start-Up Inspection: Inspect equipment and connecting systems to confirm equipment and connecting systems, and to confirm equipment has been installed properly and is ready for start-up. As a minimum, check for: proper voltage and phases, correct electrical connections, correct pump rotation, and other items as listed by the manufacturer are properly provided/connected and operating to ensure safe and proper start-up. Install in accordance with manufacturer's written instructions, code, applicable standards and best construction practices. Care shall be taken when moving and setting units not to damage roof, curb, units, or other items.
- B. Start-Up: Perform start-up in accordance with manufacturers written start-up procedures. Arrange other trades needed to be present (i.e. balancer, control technician, etc.). Check pump operation to ensure that specified flows are provided, without motor unloading or pump cavitation. Notify the Architect/Engineer of any unusual conditions or performance other than as specified.
- C. Adjustments: Adjust and set unit components to allow for proper operation (i.e. adjust fan sheaves, adjust fan speeds, unit settings, etc.). Observe unit to detect any unusual vibration, leakage, loose wiring, or other situations that could affect unit operation.
- D. Written Report: When all start-up work has been satisfactorily completed, a written report shall be provided. This report shall list all units checked, items checked, check results, date and time of the work, any items which may impair proper unit operation, and the Company name, contact information, and name and phone number of the actual individual(s) doing the start-up work. The report shall include a statement stating whether or not all units are operating as specified. Separate inspection and start-up sheets shall be provided for each unit.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Cooling Coil Condensate Drains.
- B. Overflow, Miscellaneous Drains.
- C. Drain Pans.
- D. Fabricated P-Traps.
- E. Condensate Pumps.
- F. Testing and Inspection.

1.03 SUBMITTALS

- A. Submittals shall comply with Section 20 05 00.
- B. Submit product information on all items to be used.

1.04 REFERENCES

- A. ASME B 16.15: Cast Bronze Threaded Fitting Classes 125 and 250.
- B. ASME B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings.
- C. ASME B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. ASME B 16.23: Cast Copper Alloy Solder Drainage Fittings.
- E. ASME B 16.29: Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV).
- F. ASTM B 32: Solder Metal.
- G. ASTM B 88: Seamless Copper Water Tube.
- H. ASTM B 306: Copper Drainage Tube (DWV).
- I. ASTM D 1785: Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- J. ASTM D 2466: Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- K. ASTM D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

L. ASTM D 2665: Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, 2.01, Acceptable Manufacturers.
- B. Pipe and Fittings: Mueller, Cerro, Tyler, US Pipe, Charlotte Pipe and Foundry, Pacific States Pipe, Atlantic States, Spears Manufacturing, Cresline Northwest.
- C. Fabricated P-Trap: Rectorseal.
- D. Condensate Pumps: Little Giant.

2.02 PIPE AND FITTINGS - MATERIALS

- A. Copper DWV Pipe and Fittings: Copper drainage tube per ASTM B 306. Wrought copper and wrought copper alloy solder joint fittings per ASME B 16.29; or cast copper alloy solder joint fittings per ASME B 16.23.
- B. Copper Pipe and Fittings: Seamless copper water tube, tube L or M, per ASTM B 88. Solder joint wrought copper and bronze fittings per ASME B 16.22 cast copper alloy fittings per ASME B 16.18, and cast bronze threaded fittings per ASME B 16.15 with 95/5 tin-antimony solder per ASTM B 32.
- C. PVC DWV Pipe and Fittings: Polyvinyl chloride drain waste and vent pipe and fittings per ASTM D 2665, with solvent cement joints. Solvent cement shall comply with ASTM D 2564.
- D. PVC Pipe and Fittings: Polyvinyl chloride pipe, schedule 40, per ASTM D 1785. Solvent cement socket type fittings per ASTM D 2466. Solvent cement shall comply with ASTM D 2564.

2.03 PIPE AND FITTINGS - APPLICATION

- A. Cooling Condensate Drains: Copper DWV, copper, PVC DWV, or PVC.
- B. Miscellaneous Drains: Copper DWV, copper, PVC DWV, or PVC. Except that handling acidic or corrosive fluids shall be PVC.

2.04 DRAIN PANS

A. Fabricate of G90 galvanized steel complying with Section 23 31 00; minimum 22 gauge. Pans shall be welded, with welds power wire brush cleaned and cold-galvanizing compound applied at areas where galvanized coating has been disturbed area. Seal liquid tight all seams. Provide with watertight drain connection, located low in pan; 3/4-inch or sized to match drain line indicated on plans (whichever is larger). Overflow drain pans shall be sized to be 3-inches larger in all directions than item served.

2.05 FABRICATED P-TRAPS

- A. Type: Factory fabricated p-trap with dual cleanouts and clear trap, for cooling coil condensate. Rectorseal "EZ Trap" (or approved).
- B. Construction: Fabricated of schedule 40 PVC, with transparent plastic trap portion. Portion connection to HVAC unit (or coil) drain shall consist of a PVC cross, with top and side cleanouts having caps with integral retaining strap and ring. Outlet portion shall consist of PVC tee fitting, with top portion able to serve as vent.
- C. Size: 3/4-inch unless indicated otherwise. Trap heights shall be sized to suit HVAC unit static pressures, unit configuration (i.e. blow through or draw through), and be consistent with HVAC unit manufacturers installation recommendations.
- D. Cleaning Brush: Provide with bristled flexible shaft cleaning brush, sized for cleaning of p-trap.

2.06 CONDENSATE PUMP

- A. Type: Automatic condensate pump with integral tank; for pumping cooling coil condensate, combustion condensate and similar fluids. Little Giant VCMA, VCMX or VCL series (or approved).
- B. Capacity: Pump shall be rated to pump minimum of 1.4 gallons per hour per ton of unit cooling capacity served (e.g. 10 ton unit shall have a 1.4 x 10 = 14 gph capacity) at 15 feet of head (unless a different capacity is indicated). Pumps serving combustion condensate shall have a capacity of 25 gph per 1000 MBH of equipment capacity at 15 feet of head (unless a different capacity is indicated). Tank shall be 1/2 gallon capacity (unless indicated otherwise). Unit shall be rated for continuous operation.
- C. Construction: Tank body and pump shall be constructed of oil resistant polypropylene or ABS, with discharge check valve, and float for pump on/off control, factory wired.
- D. Accessories: Provide with overflow safety switch for wiring to low voltage controls to stop HVAC unit on high condensate (or to indicate an alarm).
- E. Electrical: Provide with integral electric motor, having thermal overload protection, for use with 115 volt or 230 volt (as required to suit available power) AC single phase power, with minimum 6-foot 3-prong grounded plug.

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation of all items shall comply with code, best professional practices, and manufacturers written installation instructions.
- B. Provide all piping as indicated and as required for all drip pans, unit condensate drains, unit p-traps, and miscellaneous drains and vent connections to all items requiring such drains (i.e. HVAC units, furnaces, boilers, AC units, etc.).
- C. Coordinate installation of items with all trades that are affected by the work to avoid conflicts.
- D. Consult manufacturers data and drawings for information on equipment before beginning

drain rough-in.

- E. Verify points of connection, elevations, and grade requirements before beginning installation or ordering materials.
- F. Trap all equipment items as required by code; provide proper venting for each trap as indicated and as required by code.
- G. Run piping to nearest point of drainage, or as shown on drawings. Where routing is not shown, route to nearest point of proper drainage.

3.02 PIPE AND FITTINGS

- A. All piping in finished areas shall be installed concealed unless specifically noted otherwise.
- B. Install piping so as not to obstruct access to any items requiring routine service, maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur. Prior to running any exposed piping, confirm with Architect/Engineer (unless is clearly noted to be ran exposed). Install exposed piping so as not to obstruct any portion of windows, doors, doorways, passageways, or items requiring service or access.
- C. Consult all drawings for location or pipe spaces, ducts, electrical equipment, structural elements, ceiling heights, door items requiring access, openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.
- D. Install all drain lines with a slope of 1/4-inch per foot unless noted otherwise. Coordinate with AHJ if written approval is required for exceptions to 1/4-inch per foot slope.
- E. Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.
- F. Install all piping parallel to equipment and nearby walls and in a neat, workmanlike manner. Horizontal straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.
- G. Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offsets are typically not shown on the plans, but are required per this paragraph.
- H. Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by piping and fitting manufacturer.
- I. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).
- J. Soldered Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.
- K. PVC Pipe:

- 1. Solvent Joints: The outside of the PVC pipe shall be chamfered to a minimum of 1/16 inch at approximately 22 degrees. Chemicals used must penetrate the surface of both pipe and fitting which will result in complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.
- 2. Plastic to Metal Connections: Work the metal connection first. Use a non-hardening compound on threaded connections. Use only light wrench pressure. Connections between metal and plastic are to be threaded utilizing female threaded adapters only, not male adapters.

3.03 TESTING AND INSPECTION

- A. All piping shall be inspected and approved prior to being concealed or covered.
- B. Provide testing as required by code. Testing shall be by water and shall comply with governing code. Testing shall be witnessed by the plumbing inspector and the Engineer's representative (at his option).
- C. All leaks shall be eliminated and the system re-tested before proceeding with additional work or concealing pipe.
- D. All repairs to piping shall be with new pipe and fitting material's; no caulking of screwed joints or holes is allowed.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Combustion Condensate Drains.
- B. Testing and Inspection.

1.03 SUBMITTALS

- A. Submittals shall comply with Section 20 05 00.
- B. Submit product information on all items to be used.

1.04 REFERENCES

- A. ASTM A312: Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- B. ASTM A403: Wrought Austenitic Stainless Steel Piping Fittings.
- C. ASTM A530: General Requirements for Specialized Carbon and Alloy Steel Pipe.
- D. ASTM A774: As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
- E. ASTM A 778: Welded, Un-annealed Austenitic Stainless Steel Tubular Products.
- F. ASTM D1785: Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- G. ASTM D2466: Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- H. ASTM D2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- I. ASTM D2665: Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- J. ASTM F437: Threaded Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe Fittings, Schedule 80.
- K. ASTM F439: Socket-Type Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe Fitting.
- L. ASTM F441: Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe.
- M. ASTM F493: Solvent Cement for Chlorinated Poly (Vinyl Chloride) CPVC Pipe and Fittings.

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, 2.01, Acceptable Manufacturers.
- B. Pipe and Fittings: Pacific Plastics, Charlotte Pipe, Spears Manufacturing, Cresline Northwest, Mueller, Cambridge-Lee, US Steel, Anvil International, Wheatland Tube, Weldbend, Exltube.

2.02 PIPE AND FITTINGS - MATERIALS

- A. CPVC Pipe and Fittings: Chlorinated poly vinyl chloride pipe, schedule 80, per ASTM F441. Socket-type fittings per ASTM F439 or threaded fittings per ASTM F437 Solvent cement shall comply with ASTM F493.
- B. PVC DWV Pipe and Fittings: Polyvinyl chloride drain waste and vent pipe and fittings per ASTM D2665 or ASTM F891, with solvent cement joints. Solvent cement shall comply with ASTM D2564.
- C. PVC Pipe and Fittings: Polyvinyl chloride pipe, schedule 40, per ASTM D1785. Solvent cement socket type fittings per ASTM D2466. Solvent cement shall comply with ASTM D2564.
- D. Flexible PVC Tubing: Clear flexible polyvinyl chloride tubing, tensile strength 1980 psi, conforming to USP Class VI requirements. Fittings shall be plastic multi-barbed type fabricated of natural nylon or polypropylene, suitable for temperatures equal to tubing rating; with stainless steel worm gear clams, 5/16 inches wide, having 1/4-inch hex head slotted stainless steel screw.
- E. Stainless Steel Pipe and Fittings:
 - 1. Pipe: Seamless or welded stainless steel per ASTM A778 or A312, type 304L or 316L, tolerances per ASTM A530. Schedule 40 unless indicated otherwise.
 - 2. Fittings: Threaded, constructed of same material as piping, per ASTM A774 or A403, suitable for 150 psi swp.

2.03 CONDENSATE NEUTRALIZER

- A. Type: Double compartment neutralizer, with primary chamber holding water and float valve assembly, secondary neutralizing chemical filled container for neutralizing acidic condensate from boilers and boiler flues. Cleaver Brooks "neutralizer", Fulton "pH Neutralizer" (or approved equal).
- B. Construction: Container shall be fabricated of materials suitable for exposure to boiler condensate, with a removable lid accessing both compartments. Ends shall have fittings suitable for connection to drains from boilers/flues served.
- C. Capacity: Neutralizer serving boilers shall be rated for the full boiler condensate capacity (when operating at a HWR temperature of 100 deg F, HWS temperature of 120 deg F and 60 deg F ambient) and be able to increase the condensate pH to at least 6.5. Neutralizer serving flues shall have the same capacity as the unit serving the boiler that the flue is connected to.

D. Chemical: pH neutralizing chemical as recommended by boiler manufacturer (i.e. magnesium oxide, limestone, etc.). Provide sufficient quantity for 2 years worth of boiler operation.

PART 3 - EXECUTION

GENERAL 3.01

- A. Installation of all items shall comply with code, best professional practices, and manufacturers written installation instructions.
- B. Provide all piping as indicated and as required for combustion equipment condensate drainage; including accessory items (i.e. flues, heat exchangers, etc.). Provide p-traps and vents as required by code, recommended by equipment manufacturer, and where required for proper operation.
- C. Coordinate installation of items with all trades that are affected by the work to avoid conflicts.
- D. Consult manufacturers data and drawings for information on equipment before beginning drain rough-in. Verify points of connection, elevations, and grade requirements before beginning installation or ordering materials.
- E. Route combustion condensate drains through acid neutralizer and to nearest point of drainage, or as shown on drawings.
- F. Fill equipment and drain p-traps with water and condensate neutralizers with neutralizing chemical (type and quantity as recommended by manufacturer) before operating systems.

3.02 PIPE AND FITTINGS

- Piping shall be stainless steel except where other materials are specifically approved by A. combustion equipment manufacturer. Use flexible pipe only at connections to acid neutralizer where needed to allow for unit removal and where recommended by unit manufacturer.
- B. Install piping so as not to obstruct access to any items requiring routine service, Offset or reroute piping as required to clear any maintenance, or inspection. interferences which may occur.
- C. Install all drain lines with minimum slope of 1/4-inch per foot unless noted otherwise. Coordinate with AHJ if written approval is required for exceptions to 1/4-inch per foot slope.
- D. Install all piping parallel to equipment or nearby walls and in a neat, workmanlike manner.
- E. Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by piping and fitting manufacturer.
- F. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

- G. Solvent Joints: The outside of the PVC pipe shall be chamfered to a minimum of 1/16 inch at approximately 22 degrees. Chemicals used must penetrate the surface of both pipe and fitting which will result in complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.
- H. Plastic to Metal Connections: Work the metal connection first. Use a non-hardening compound on threaded connections. Use only light wrench pressure. Connections between metal and plastic are to be threaded utilizing female threaded adapters only, not male adapters.

3.03 TESTING AND INSPECTION

- All piping shall be inspected and approved prior to being concealed or being placed in service.
- B. Provide testing as required by code. Testing shall be by water and shall comply with governing code. Testing shall be witnessed by the plumbing inspector (if required) and the Engineer's representative (at his option).
- C. All leaks shall be eliminated and the system re-tested before proceeding with additional work or concealing pipe.
- D. All repairs to piping shall be with new pipe and fitting material's; no caulking of screwed joints or holes is allowed.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Ductwork Systems.
- B. Flexible Duct.
- C. Acoustical Duct Lining.
- D. Preparation of Duct for Service.

1.03 DEFINITIONS

A. Duct Sizes: All duct dimensions shown are inside clear dimensions. Where inside duct lining is specified or indicated, duct dimensions are to the inside face of lining.

1.04 QUALITY ASSURANCE

- A. All work and materials shall comply with SMACNA-DCS, NAIMA-DLS, ASHRAE-F, IBC, IMC, NFPA-90A, NFPA-90B, and code. The most restrictive criteria governs.
- B. Leakage Criteria: Duct system shall be constructed and sealed so that leakage does not exceed the following:
 - 1. Supply Duct: 5%.
 - 2. Return Duct: 5%.
- C. Fabrication Proximity: The Contractor performing the work of this section shall have fabricating facilities located within 100 miles of the project site.
- D. Drawing Review: Prior to beginning any work review all drawings, duct routing, duct connections, equipment configuration, equipment connection locations, and other work details to discover conflicts in anticipated duct arrangement and improper or incomplete connections. Review shall include the following: supply ducts not connected into return (or exhaust) ducts, ducts not crossed and improperly connected in shafts, air outlets/inlets connected to ducts, unit configuration compatible with planned duct connections, louver locations match architectural plans. Submit resolutions of such possible conflicts as submittals with shop drawings of proposed solutions; written description in lieu of shop drawings is acceptable for minor issues.

1.05 SUBMITTALS

- A. General: Comply with Section 20 05 00.
- B. Product Data: Submit product data for duct lining, flexible duct, and factory fabricated

items.

C. Conflict Resolution: Submit additional shop drawings showing proposed resolution of conflicts after review of documents and again after review of actual field conditions.

1.06 DUCT PRESSURE CLASS

A. Constant Volume Systems: Ductwork shall be constructed to the pressure class corresponding to the static pressure indicated for the fan which serves the duct system or 2-inch pressure class (plus or minus as appropriate), whichever is higher; unless noted otherwise.

1.07 REFERENCES

- A. ADC-FLEX: Air Diffusion Council Flexible Duct Performance and Installation Standards.
- B. ASHRAE-F: ASHRAE Handbook of Fundamentals.
- C. ASTM A 653: Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
- D. ASTM A 924: General Requirements for Steel Sheet Metallic-Coated by the Hot-Dip Process.
- E. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. IMC: International Mechanical Code.
- G. NAIMA-DLS: North American Insulation Manufacturers Association Fibrous Duct Liner Standards, 1st Edition.
- H. NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems.
- I. NFPA 90B: Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- J. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.
- K. UL 181: Underwriter Laboratories Factory-Made Air Ducts and Air Connectors.
- L. UL 181A: Underwriter Laboratories Closure Systems for Use with Rigid Air Ducts.
- M. UL 181B: Underwriter Laboratories Closure Systems for Use with Flexible Air Ducts and Air Connectors.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.
- B. Sheet Metal: All domestic manufacturers.

- C. Spin-in Fittings and ATTO: Sheet Metal Connectors Inc., United McGill, Royal Metal Products, Airflow Products Inc.
- D. Gasketing: Preson, Insulfab, Duraco.
- E. Duct Sealant and Tape: Carlisle (Hardcast), Ductmate, Benjamin Foster, Grace Construction Products, United McGill, Polymer Adhesives Sealant Systems, RCD Corporation, Nashua, 3M.
- F. Flexible Duct: Flexible Technology Inc., JP Lamborn Co.; Hart & Cooley, Thermaflex.
- G. Acoustical Duct Lining: Johns-Manville.

2.02 GENERAL MATERIALS

- A. Ducts: Construct of galvanized sheet steel, suitable for lock forming without flaking or cracking, conforming to ASTM A653 and A924, having a zinc coating of 0.90 ounces total per square foot for both sides of a sheet, corresponding to coating G90.
- B. Fasteners: Steel construction, electroplated zinc coated, having strength properties adequate for the application, compatible with materials being joined, and in accordance with SMACNA-DCS. Where exposed to corrosive conditions shall be of Type 304 or 316 stainless steel. Type to meet duct pressure class and duct leakage requirements. Where used for the support and anchorage of ducts shall comply with Section 20 05 29, with independent test reports regarding strength.
- C. Spin-in Fittings: Factory fabricated of galvanized steel with die-formed mounting groove and damper with raised damper quadrant where ducts are to be insulated. Collar length for flexible duct attachment shall be at least 2" long.
- D. Air-Tight Take-Off Fittings (ATTO): Factory fabricated branch duct connector, of galvanized steel. Flange shall be 1-1/2" wide with 1/8" self-adhesive gasket and predrilled fastener holes. Collar length for flexible duct attachment shall be at least 2" long. Where used on round duct mains, shall be saddle type appropriately sized for main duct diameter.

E. Draw Bands:

- 1. Metal: Worm gear type clamp, constructed of galvanized steel, stainless steel, or aluminum; minimum 1/2-inch wide band; suitable for 200 pound loading.
- 2. Non-Metal: Nylon "zip-tie" with self-locking ability, designed for flexible duct usage, minimum 1/4-inch wide, rated for 175 pound load, suitable for temperatures from 0 to 185 deg F; listed per UL181B and labeled "UL181B-C".
- F. Gasketing: Vinyl nitrile, vinyl neoprene, or neoprene nitrile PVC blend; designed for HVAC use with size to suit the application having minimum 1.5-inch width at equipment roof curb applications. Fire hazard rating not to exceed 25 for flame spread and 50 for smoke development per ASTM E 84.
- G. Duct Sealant/Mastic: Water based duct sealant, listed per UL 181B-M and UL 181A-M, suitable for indoor and outdoor use. Fire resistant with a flame spread rating of 5 or less, and a smoke developed rating of 0. Sealant shall be resistant to ultraviolet radiation and ozone. Fiberglass mesh shall be minimum 0.006-inches thick, with minimum 9 x 9

weaves per inch, and 2-inch width; for use with mastic in sealing ductwork. Sealant system shall be suitable for duct system pressure class and materials used with. Carlisle Hardcast "Versa-Grip 181".

H. Foil Tape: Foil back adhesive tape, listed per UL181A-P and UL181B-FX, with listing labeled on tape outer foil face. Minimum 3-inch width for metal-to-metal applications; minimum 2-inch width for flexible duct applications. 3M No. 3340 or Nashua No. 324A.

2.03 DUCT FABRICATION

- A. Duct Gauge and Reinforcement: Shall be as shown in SMACNA-DCS according to the pressure classification of the system and the duct dimensions; with heavier gauge duct used as required to minimize duct reinforcement to suit space available and other project constraints.
- B. Joints and Seams: Construct in accordance with SMACNA -DCS, code requirements, and these specifications (more stringent governs). Ducts shall be constructed and sealed so that the leakage criteria is not exceeded. Round ducts shall be the spiral seam type; except that branch ducts to individual air inlets/outlets less than 16" diameter may be of other types as allowed by SMACNA-DCS. Coordinate joint spacing with duct reinforcement requirements so that transverse joints having the required stiffness may be incorporated in the reinforcement spacing schedule. Round duct transverse joints shall be made with beaded sleeve joints or flanged connections in accordance with SMACNA-DCS; except that branch ducts to individual air inlets/outlets less than 16" diameter may use other joining methods as a allowed by SMACNA-DCS.
- C. Elbows and Tees: Shall be long-radius type with a center-line radius not less than 1-1/2 times the width or diameter of the duct. Where space does not permit the use of long-radius elbows, short-radius or square elbows with turning vanes may be used. Elbows in round duct systems with duct pressure class above 2-inches shall be stamped type, welded segmented type, or standing seam segmented type.
- D. Transitions: Increase duct sizes gradually. Transitions for diverging air flow shall be made with each side pitched out not more than 22.5 degrees. Transitions for converging air flow shall be made with each side pitched in not more than 30 degrees. Except that eccentric transitions for round to flat oval may have up to a 45 degree pitch.
- E. Branch Connections: Shall comply with SMACNA-DCS, and as required herein.
 - 1. Rectangular-to-Rectangular: Rectangular take-off with 45 degree angle on "inside" of take-off, minimum 4" length. Reference SMANCA-DCS Figure 4-6. Close corner openings.
 - 2. Rectangular-to-Round:
 - a. Serving Individual Air Inlet/Outlet: Spin-in type connector or air-tight take-off (unless a different fitting type is specifically noted).
 - b. Serving Branch Duct: Rectangular to round transition, with maximum degree pitch as specified for transitions. Rectangular end size shall have free area no less than round end. Rectangular connection to rectangular main shall be made as specified for "Rectangular-to-Rectangular" connections.

c. Serving Individual VAV Terminal Unit: Conical type connector, with connector 2" larger on one end and maximum 15 degree pitch on sides.

3. Round-to-Round:

- a. Serving Individual VAV Terminal Unit: Conical type connector (or conical tee fitting), with connection at the main duct 2" larger than the end serving the VAV terminal unit, and a maximum 15 degree pitch on sides; or "Lo-Loss" tee fitting, equivalent to that manufactured by United McGill.
- b. Other Connections: Air-tight take-off or constructed in accordance with SMACNA-DCS and recognized professional practices.
- 4. Other Connections: In accordance with SMACNA-DCS and recognized professional practices.

F. Ductmate Systems:

- 1. Rectangular Duct: Transverse duct joints may be made with Ductmate System, or approved equal. System shall consist of companion flanges of 20 gauge galvanized steel with an integral polymer mastic seal; corner pieces of 12 gauge G90 galvanized steel; 20 gauge G90 galvanized cleats; closed cell, high density gasket type; and galvanized carriage bolts with hex nuts. The flanges shall be securely fastened to the duct walls using self-drilling screws, rivets or spot welding. Fastener spacing shall be as recommended by the manufacturer for the size of duct and the pressure class. The raw duct ends shall be properly seated in the integral mastic seal. A continuous strip of gasket tape, size 1/4" x 3/4", shall be installed between the mating flanges of the companion angles at each transverse joint; and the joint shall be made up using 3/8-inch diameter x 1-inch long plated bolts and nuts. Galvanized drive-on or snap-on cleats shall be used at spacing recommended by the manufacturer.
- 2. Round Duct: Transverse duct joints may be made with Ductmate "Spiralmate" system, or approved equal. System shall consist of galvanized steel round connector flanges (fitting inside each duct section to be joined) and an exterior galvanized steel closure ring with tightening bolt to form an airtight duct connection and join flanges together. Duct connector flanges shall have non-hardening integral mastic to seal between flanges and duct, and a neoprene gasket to seal flange faces.

G. Lined Ductwork:

- Rectangular Ducts: Contractor Fabricated ductwork with interior duct lining. Duct fabrication and liner installation shall comply with NAIMA-DLS. Lining material shall comply with paragraph titled "Duct Lining" in this specification section.
- 2. Round and Oval Ducts: Shall consist of acoustic insulation in between a perforated interior duct liner and solid exterior duct. Acoustic insulation shall be 1-inch thick, except where noted to be greater. Duct sections shall connect by mechanical means to maintain positive concentricity of liner with duct. All fittings and transitions shall have perforated inner liner (except where noted otherwise). Lining material shall comply with paragraph titled "Duct Lining" in this specification section. United McGill "Acousti-k27" (or approved).

2.04 FLEXIBLE DUCT

- A. Type: Factory insulated fully lined flexible duct.
- B. Construction: Double-ply neoprene coated polyester fabric hose, reinforced with a steel wire helix. Black color. Fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E84.
- C. Thermal Characteristics: Certified thermal resistance "R" of 4.2 Hr-SF-deg F/Btu, rated in accordance with ADC-FLEX. Except where duct is installed in an unconditioned area (and where required by code) provide certified thermal resistance "R" of 8 Hr-SF-deg F/Btu, rated in accordance with ADC-FLEX.
- D. Working Pressure: As required to suit maximum pressure to be encountered on system, but no less than 4-inch wc positive, 0.5-inch wc negative.
- E. Length: Shall not exceed 8 feet where used on duct systems with a pressure class of 2-inches and less; maximum 5 feet length on higher pressure class systems.
- F. Code Compliance: Comply with code and applicable standards; including NFPA 90A, NFPA 90. Shall be UL listed and labeled as a Class 1 connector per UL 181.

2.05 DUCT LINING

- A. Material: Flexible, inorganic glass fiber material, bonded with thermosetting resin, maximum thermal conductivity of 0.24 Btu-inch/hr-sq. ft.-degree F at 75 degrees F, coated to prevent erosion, conforming to NAIMA-DLS and exceeding that standard as specified herein. Suitable for air temperatures to 250 degrees F, and duct velocities to 6000 feet per minute. Surface shall be coated with an acrylic coating having antimicrobial agents and factory applied edge coating. Johns-Manville "Permacote Linacoustic" (or approved).
- B. Thickness: Lining shall be 1-inch thick except where noted otherwise.
- C. Adhesives and Fasteners: Shall conform to NAIMA-DLS, and as suitable for the duct liner material and ductwork.
- D. Fungi and Bacteria Resistance: Conform to ASTM C 1338 and ASTM G21 for fungi resistance and ASTM G 22 for bacteria resistance.

PART 3 - EXECUTION

3.01 DUCTWORK INSTALLATION

A. General: Install all ductwork with all accessories and connections to provide complete and operable duct systems, in accordance with plans and specifications. See Section 20 05 29 for hangers and supports. Provide quality assurance review of all drawings prior to beginning work (see paragraph titled Quality Assurance, this specification Section and see Section 20 05 00). Provide duct and plenum sizes and locations as shown on the drawings; except as adjusted for field conditions and work of other trades, and with prior approval of the Engineer. See Section 20 05 00 for offsets and transitions to be included in project.

- B. Coordination: The Contractor shall fully coordinate the work of all trades to avoid interferences and conflicts. Due to the extremely tight spaces in portions of the building, the Contractor shall coordinate duct reinforcement spacing and supports with other trades as necessary to avoid interferences. In addition, the Contractor shall select duct gauge and reinforcement types to avoid interferences. Changes required due to lack of coordination between trades, improper spacing or selection of hangers, or improper duct gauge and reinforcement selection, shall be done at no additional cost to the owner.
- C. Field Measurements: Prior to fabricating any duct materials, the Contractor shall field measure all areas where ducts will be installed to verify room available and all offsets and fittings required. Field verify connection sizes and locations to equipment, louvers, and similar items.
- D. Workmanship: All work shall comply with code, SMACNA-DCS, and other applicable standards. Ducts shall be installed level (unless noted otherwise) and in neat lines with the building construction using best professional practices.
- E. Exposed Ducts: All ducts are to be installed concealed unless indicated otherwise. Ducts that are exposed shall be carefully fabricated, stored, and installed for best appearance. All dents, dings, scratches and other damage shall be repaired for a high quality finished look; all dirt, debris, labels, stickers, lettering, and marks removed; and the duct completely cleaned. Any sealant shall be cleaned to form a straight and even seam adjacent to joints, have no overlap onto duct areas not needing sealant, and have all excess sealant removed (mask off adjacent areas as necessary).
- F. Flexible Duct: May only be used where specifically shown on the plans. Attach flexible duct inner core to sheet metal duct (or connector) with draw band. For insulated type, pull insulation and outer jacket completely over the inner core (at the connection to the sheet metal duct) with outer jacket covering the inner core and tucked back at its end to provide a continuous vapor barrier cover; install draw band to secure the outer jacket and insulation. Use metal type draw bands on duct systems where duct pressure class exceeds 3-inches or where temperature or other conditions do not allow the non-metal type and where indicated; use type of metal suitable for the conditions without corrosion or other deterioration. Install flexible duct with a centerline turning radius not less than one duct diameter. Where this turning radius cannot be maintained with the flexible duct use sheet metal elbows or (at air inlets/outlets) provide a plenum having a side connection.
- G. Spin-in Fittings/ATTO's: May be used for branch ducts to individual outlets only. Apply a bead of duct sealant to all spin-in fittings where fitting seals against sheet metal duct.

H. Sealing:

- General: Use materials listed and approved for the specific application. Foil tape may only be used at duct connections to air inlets/outlets (unless specifically noted otherwise). Clean surfaces to be sealed of moisture and all contaminants. Seal joints in accordance with SMACNA-DCS, sealant manufacturer's instructions, and UL 181.
- 2. Ductwork: Seal to meet duct leakage criteria as follows: Seal Class B.
- 3. Flexible Duct: Coat connection of flexible duct to metal duct with duct sealant prior to installing the flexible duct.
- 4. Air Inlets/Outlets: Seal duct connections (including "cans" or plenums) at air

inlets and air outlets with duct sealant or foil tape; except at louvers and exposed ducts only sealant shall be used.

- I. Ductmate: All "Ductmate" and similar systems shall be installed in strict accordance with manufacturer's instructions.
- J. Protective Caps: Provide temporary sheetmetal caps or heavy visqueen covers over all open portions of ductwork to prevent debris, dirt, and dust from entering the ductwork. Such covers shall be installed at the end of each work shift, and shall remain in place until all work activities or events that may cause duct contamination will no longer occur.

3.02 ACOUSTICAL DUCT LINING INSTALLATION

- A. General: Install acoustical duct lining in ducts to extent shown on drawings, covering all interior surfaces. Round ducts shall use factory fabricated double-wall ducts as specified.
- B. Installation: Installation shall comply with NAIMA-DLS and these specifications. The liner shall be cut to assure tightly butted joints.
- C. Liner Attachments: The duct liner shall be applied with a 100% coverage of adhesive. Mechanical Fasteners shall be installed flush with the liner surface, and shall be spaced in accordance NAIMA-DLS.
- D. Horizontal Duct Runs: Tops of ducts over 12" wide and sides of duct over 16" high shall have liner additionally secured with mechanical fasteners.
- E. Vertical Duct Runs: Any side of duct over 12" in size shall have liner additionally secured with mechanical fasteners.
- F. Exposed Edges: All joints, exposed edges and any damaged areas of the liner, shall be heavily coated with fire resistant adhesive/mastic.
- G. Metal Nosing: Install metal nosings on the leading edges of the liner in ducts where the velocity exceeds 4000 feet per minute.

3.03 PREPARATION FOR SERVICE

- A. Cleaning: All ducts shall be wiped or blown clean of all dust and debris prior to the installation of grilles or diffusers. Notify the Engineer to allow for an inspection prior to installing grilles or diffusers.
- B. Contaminated Ducts: Where ducts have been contaminated by dirt or debris during the construction process, the affected duct systems shall be cleaned by an independent firm specializing in the vacuum cleaning of ductwork. All costs associated with such cleaning shall be the responsibility of the Contractor.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Manual Dampers.
- B. Backdraft Dampers.
- C. Turning Vanes.
- D. Flexible Connectors.
- E. Duct Access Doors.

1.03 QUALITY ASSURANCE

- A. General: Comply with Section 20 05 00.
- B. Workmanship: Construction and installation of all duct accessories shall comply with applicable SMACNA-DCS, and exceed those standards as noted.
- Fire dampers, combination fire/smoke dampers, and smoke dampers shall be UL listed.

1.04 SUBMITTALS

- A. General: Submittals shall comply with Section 20 05 00.
- B. Product Data: Submit product information on all items to be used.
- C. Sound Attenuators: Submit dynamic insertion loss and pressure drop data for all sound attenuators. Submit listing of all sound attenuators by unit served, airflow application, cfm, size, velocity, and pressure drop.

1.05 REFERENCES

- A. AMCA 500D: Laboratory Methods for Testing Dampers for Rating.
- B. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.
- B. Manual Damper Hardware: Duro-Dyne, Young Regulator Co., Ventfabrics, Krueger,

Rossi.

- C. Turning Vanes: Duro-Dyne, Aero-Dyne, Oil Capital Sheet Metal, Airsan.
- D. Flexible Connections: Ventfabrics, Duro-Dyne Elgen.
- E. Duct Access Doors: National Controlled Air, Ventfabrics, United-McGill, Kees, Ruskin, Vent Products, Duro-Dyne.

2.02 MANUAL DAMPERS

Marin Direct

- A. Type: Manually adjustable volume dampers.
- B. Blades: Damper blades shall be fabricated of galvanized steel or stainless steel (unless a specific material is indicated), two gages heavier than duct in which installed, and in accordance with SMACNA-DCS. Maximum blade width 12 inches; fabricate multi-blade dampers with opposed blade pattern for ducts larger than 12" x 48".
- C. Regulators: Damper regulator sets shall have quadrant dial regulator with locking nut, square end bearing one side, and spring round end bearing other side (small sizes) or open end square bearing (larger sizes), axis of blade the long dimension. Multiple blade dampers shall have individual quadrants for each blade or one quadrant with interconnected blades. Regulator sets shall be Duro-Dyne model numbers (or approved equal) as follows:

Max. Blade		
<u>Dimension</u>	Duro-Dyne Regulator Set	Shaft Size
10" and less	KS-145, 145L	1/4"
11" to 14"	KSR-195, 195L	3/8"
15" to 23"	SRS-388, SB-138, KP105	3/8"
24" and larger	SRS-128, SB-112, KP105	1/2"

- D. Concealed Regulator: For remote damper adjustment with finished ceiling appearance. Shall consist of self-locking regulator of cast alloy construction (with serrated core, spring washer, housing, indicator, lock nut) cast into a cylindrical housing for flush ceiling installation. Housing cover shall be of steel construction, shall telescope into the regulator housing to be flush with the finished ceiling, and be secured to the housing with two screws. Provide with extension rods, linkages, miter gears, and all accessories as needed for proper damper operation. Plain Finish. Ventfabrics No. 666, 667 or Young Regulator Co. No. 301 (or approved equal).
- E. Extractor Fittings: Galvanized steel construction, 24 gauge steel blades on 2-inch centers, with worm gear operator for adjustment through face of grille. Krueger EX-88 (or approved equal).

2.03 TURNING VANES

- A. Type: Galvanized steel turning vanes to guide airflow through duct elbows to minimize pressure drop.
- B. Construction: Turning vanes shall comply with SMACNA-DCS. Vanes shall be fabricated of minimum 26 gauge galvanized steel; rails shall be fabricated of minimum 24 gauge galvanized steel. For duct widths less than 12 inches, vanes may be single wall construction; for widths 12" and greater, vanes shall be double wall "airfoil" type.

- C. Spacing: Turning vanes shall be equally spaced in accordance with SMACNA-DCS, parallel to each other, and securely attached to runners.
- D. Unequal Elbows: For elbows where the inlet and outlet dimensions are not the same, modify vane shape or angle to provide optimum turning.

2.04 FLEXIBLE CONNECTORS

A. Type: Flexible fabric type connectors, to provide vibration isolation at equipment duct connections and to allow for movement in duct systems.

B. Fabric:

- 1. Width: Minimum 3" wide except at equipment 3 hp or larger with external vibration isolators fabric shall be minimum 6" wide.
- 2. Indoor Applications: Flexible woven glass fiber fabric with neoprene coating, minimum 22 oz/sq. yard, 450 lbs x 450 lbs tensile strength.
- 3. Outdoor Applications: Flexible woven glass fiber fabric with hypalon coating, ozone resistant, 24 oz/sq. yard, 225 lbs x 275 lbs tensile strength.
- C. Metal Collars: Minimum 24 gauge galvanized steel 3" wide metal edge connectors, each side of fabric, connected to fabric by folded over metal seam.
- D. Temperature Rating: Suitable for temperatures from -40 to 200 deg F.
- E. Fire/Smoke Rating: Flame spread rating not over 25, and smoke developed rating not higher than 50; complying with IMC requirements and NFPA standards.

2.05 DUCT ACCESS DOORS

A. Construction: Access doors shall be of double wall construction, made with minimum 24 gage galvanized steel, tight fitting, with sealing gasket, and cam locks (or may be hinged type with latches).

B. Size:

- General: Access doors shall be of sufficient size so that items concealed in duct can be serviced and inspected, and shall be adequately sized to allow complete removal of the item being served (where removal cannot be made without disturbing fixed ductwork).
- 2. Minimum size: Doors shall be minimum 14" x 14". Where duct size will not accommodate this size door, the doors shall be made as large as practicable.
- 3. Large Sizes: Doors larger than 14" x 14" shall have a minimum of 4 cam locks (or where hinged type is used, have a minimum of two (2) latches).
- C. Insulation: Doors in insulated ducts shall be insulated type, with minimum 1 inch thick fiberglass insulation.
- D. Round Ducts: Access doors on round ducts shall use either lined rectangular tap off with rectangular access door or curved insulated access door (for insulated duct); or curved

type un-insulated access door (for un-insulated duct).

PART 3 - EXECUTION

3.01 MANUAL DAMPERS

- A. General: Dampers shall be fabricated and installed in accordance with SMACNA-DCS requirements for volume dampers.
- B. Locations: Install dampers at locations shown on the drawings in branch ducts to all air inlets/outlets, and at all other locations as required by the Balancer to allow for the balancing of the system. Locate dampers at a point where the damper is most accessible; orient damper regulator for best access.
- C. Non Accessible Dampers: Provide flush-mounted concealed type damper quadrants for ducts concealed in walls or non-removable ceilings and where a remote damper operator has been indicated.
- D. Initial Setting: Set and lock all dampers in the full open position prior to balancing.
- E. Identification: Provide orange surveyor's tape, approximately 18" long tied to each damper regulator (except not required on dampers in ducts exposed to view in finished areas).

3.02 TURNING VANES

- A. General: Install turning vanes in all duct elbows and "T" fittings, and at locations shown on the drawings.
- B. Attachment: Securely attach turning vane runners to ductwork.

3.03 FLEXIBLE CONNECTORS

- A. General: Provide flexible connectors at all duct connections to all equipment, where ducts of dissimilar metals are connected, and where shown on the drawings. Except that flexible connectors are not required on internally spring isolated fans where the fan is located in a separate mechanical room and a flexible connector has not been shown.
- B. Round: For round ducts, the flexible material may be secured by zinc-coated, iron clinch type draw bands directly to adjoining duct; or with normal duct joining methods and using metal collars furnished with flexible connectors.
- C. Slack: Install flexible connections with sufficient slack to permit 1 inch of horizontal or vertical movement of ducts or equipment at flexible connection point without stretching the flexible material. At building expansion joints install sufficient flexible material to allow for 2 inch movement in any direction; provide two flexible connectors separated by a 12 inch section of duct.

3.04 DUCT ACCESS DOORS

A. General: Provide duct access doors at all automatic control dampers, fire dampers, fire/smoke dampers, smoke dampers, backdraft dampers, all duct coils, thermostats, filters, control devices, and any other components in the duct system that require service

or inspection. Coordinate with Control Contractor to confirm quantity and location of control devices.

- B. Return and Exhaust Ducts: Provide access doors every 20 feet in return and exhaust air ductwork as required by NFPA 90.
- C. Size and Location: Access doors shall be of sufficient size and so located so that the concealed items may be serviced and inspected or completely removed and replaced.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 SECTION INCLUDES

- A. Boilers.
- B. Condensate Neutralizer.
- C. Boiler Flue.
- D. Combustion Air Duct.

1.03 SUBMITTALS

- A. Product Data: Submit product information on boiler, including gas train details, wiring diagram (distinguishing field wiring from unit installed wiring) and point of connection of all utilities.
- B. Installation Instructions: Submit boiler manufacturer's installation instructions.
- C. Certification: Submit certification of boiler's compliance with ASME BPVC.

1.04 REFERENCES

- A. ASME: American Society of Mechanical Engineers Codes and Standards.
- B. ASME BPVC: Boiler and Pressure Vessel Code (BPVC).
- C. ASME CSD-1: Controls and Safety Devices for Automatically Fired Boilers.
- D. ASTM A653: Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
- E. ASTM A924: General Requirements for Steel Sheet Metallic-Coated by the Hot-Dip Process.
- F. SMACNA-DCS: SMACNA HVAC Duct Construction Standards.
- G. UL 1738: Venting Systems for Gas-Burning Appliances, Categories II, III, and IV.

1.05 WARRANTY

A. Extended Warranty - Boiler: The boilers and all accessories (burner, boiler trim, controls, etc.) shall be warranted to be free from defects in material and workmanship for a period of 2 years following date of substantial completion. Items which prove to be defective during this period shall be repaired or replaced by manufacturer's authorized personnel at no cost to the Owner.

B. Extended Warranty - Heat Exchanger: Boiler heat exchanger shall be warranted against failure of any kind for 10 years from date of substantial completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, 2.01, Acceptable Manufacturers.
- B. Boilers: Lochinvar, Weil McLain.
- C. Flue: Schebler, Metalbestos, Metal-Fab, Lennox.

2.02 BOILERS

A. Type: High efficiency, condensing hot water boiler, wall mounted type, for firing natural gas.

B. General:

- Complete Unit: Factory assembled, self-contained readily transported unit complete with all accessories and ready for automatic operation except for connection of water, fuel, electrical and vent services.
- 2. Design Certification: AGA or CGA design certified as condensing boilers, with a thermal efficiency rating up to 97% at minimum input.
- 3. Turndown: Designed for a minimum 5:1 turn down with low NOx and CO discharge levels over the turndown range.
- 4. Gas Pressure: For use with maximum 14" W.C. and minimum 4.5" W.C. natural gas pressure.
- 5. Venting: Boiler shall be able to vent the distance as indicated on the plans, with fittings indicated, using the vent diameter shown.
- C. Capacity: No less than that indicated on the plans. Ratings shall be in accordance with AGA or CGA standards.
- D. Emissions: Shall comply with local requirements with NOx emissions less than 20 ppm at all firing rates.

E. Construction:

- ASME BPVC: Constructed and stamped in accordance with ASME BPVC, and Section IV of the ASME Code for low pressure heating boilers with a working pressure as indicated on the plans. Form H-3 Manufacturers' Data Report for Water Tube Boilers shall be provided.
- 2. Support: Boiler shall be mounted on a steel support frame with drilled provisions to allow for seismic anchoring.
- 3. Jacket: Steel jacket, insulated with minimum 2-inch thick insulation.

- 4. Condensation: Flue gas condensation shall be collected in a corrosion resistant drain assembly with drain fitting for draining condensation from the products of combustion.
- 5. Heat Exchanger: Manufacturer's standard design, suitable for exposure to combustion condensate.
- F. Service Access: Provide with access covers for accessing all serviceable components. All accesses must seal completely as not to disrupt the sealed combustion process.
- G. Electrical: For use with power of voltage and phase as indicated on the plans, and complete with wiring to all unit items requiring power. Wiring shall be color coded with terminals numbered, corresponding to unit wiring diagram furnished.

2.03 BOILER TRIM

- A. Relief Valve: ASME rated pressure relief valve, set at boiler working pressure indicated psi, capacity no less than boiler maximum output.
- B. Pressure/Temperature Indicator: Combination pressure/temperature gauge.
- C. Low Water Cut-Off: Manual reset low water cut-off, manufacturer's standard type, complying with ASME standards and acceptable to AHJ.
- D. High Temperature Cut-off: High temperature cut-out with manual reset to prevent unit operation if boiler water temperature rises to an unsafe level.
- E. Pressure Switch: Differential pressure switch to sense air flow to the burner and to prevent operation in case of inadequate combustion air flow.
- F. Alarm: Visual and audible alarm, factory mounted on control panel with audible silence switch; shall sound audible and visual alarm for boiler alarm condition.

2.04 BURNERS

- A. Type: Manufacturers standard, meeting performance requirements.
- B. Construction: Manufacturer's standard design, allowing high turndown of the fuel-air mixture, with equal distribution of heat through the heat exchanger.
- C. Gas Train: Factory assembled, piped, and wired gas train assembly, complying with ASME CSD-1; with main shut-off valve, motorized gas valve, pilot isolation valve, and pilot solenoid valve (as applicable to boiler manufacturer's design).
- D. Burner Controls: Unit shall be complete with all controls for stand-alone operation of the boiler. Controls shall include:
 - 1. Interrupted-type pilot system with electric spark ignition.
 - 2. Pilot and main flame controlled by UV detection.
 - AGA (or CGA) approved flame safe-guard programmer system controlling burner operation and ignition timing in accordance with ASME CSD-1 and AHJ requirements.

- 4. Safety Controls:
 - a. Flame detector, shutting down the burner in case of pilot or main flame failure.
 - b. Fuel shutoff in case of high or low gas pressure.
 - c. Fuel shutoff in case of draft failure.
 - d. Pre and post combustion purging.
 - e. High temperature limit controls.
 - f. Low water cut-off and flow switch.
 - g. Blocked flue detection switch.
- E. Fuel-Air Ratios: Boiler design shall couple fuel-air ratios such that changes in combustion air flow or fuel flow do not affect combustion quality, with automatic adjustments for altitude and temperature to maintain proper fuel-air ratios for safe and efficient boiler operation over the full range of boiler firing.

2.05 BOILER CONTROLS

- A. General: Boiler shall have controls to allow operation in a stand alone "local" mode or as part of a master boiler control scheme by the building EMCS. When operating in "local" mode, each boiler shall operate to a fixed setpoint.
- B. Controls: Electronic control system, provided integral with each boiler to control firing rate of that boiler, to maintain system water temperature setpoint.
- C. Boiler Display: Operating status shall display in English text, indicating the condition of all interlocks, alarms, firing rate, runtime hours, and operating temperatures. Menu driven calibration and setup menus.
- D. Firing Rate: Advanced PID algorithm optimized for the boilers for most efficient operation.
- E. Four dedicated temperature sensor inputs for: Outside Air Temperature, Supply (Outlet) Temperature, Return Temperature (Inlet), and Header Temperature. Automatically detect the optional temperature sensors on start up (Note: See Division 25 for boiler sequence as to whether or not this feature is being utilized; capability still required).
- F. Auxiliary Contacts: Boiler pump control contacts; contacts for combustion air damper control with proof time; alarm contacts.
- G. OA Reset: Outdoor air reset with programmable ratio for hot water supply temperature (Note: See Division 25 for boiler sequence as to whether or not this feature is being utilized; capability still required).
- H. Failsafe Mode: When a building EMCS is controlling setpoint. If communications is lost, the boiler/system shall run off the Local Setpoint.
- I. EMCS Interface:

- 1. Provide controls to allow enable/disable control of each boiler by the building EMCS system.
- 2. Provide contacts to indicate alarm condition to the EMCS.
- 3. Provide terminal unit controller, with BACnet or LonWorks protocol type to match building EMCS and to allow connection to building EMCS and transmission of boiler operating parameters to EMCS. Coordinate protocol with Division 25 to confirm compatibility.
- J. Emergency Shutdown: Provide boiler with connections and components to allow for remote shut-down of boiler by emergency wall switch in accordance with code.

2.06 BOILER FLUE

- A. Type: Double wall factory fabricated flue, listed to UL 1738, Category IV, for use with positive pressure gas fired condensing boilers of the type connected to.
- B. Size: As shown on drawings or as required to match unit connection, whichever is larger.
- C. Clearance to Combustibles: Listed for minimum 2 inch clearance to combustibles.
- D. Construction: Double-wall construction, with inner pipe constructed of AL29-4C stainless steel and outer pipe of type 430 stainless steel. Sections and fittings shall be joined by a mechanical closure system providing a liquid and pressure tight inner pipe with an outer cover to maintain continuity and protection of the outer pipe. Construction shall allow for thermal expansion and contraction of flue without any operational noises or undue stress.
- E. Fittings: Provide fittings, transitions, caps, collars, thimbles, drain fittings, thermometer wells, flashings and related pieces for a complete assembly allowing continuous venting of boiler to outside the building, and accommodating all system requirements.
- F. Termination: Provide with weather proof cap; type/style as acceptable to the boiler manufacturer and to suit application.

2.07 COMBUSTION AIR DUCT

- A. Type: Galvanized steel duct.
- B. Construction: Galvanized sheet steel, suitable for lock forming without flaking or cracking, conforming to ASTM A653 and A924, having a zinc coating of 0.90 ounces total per square foot for both sides of a sheet, corresponding to coating G90. Construction shall comply with SMACNA-DCS. Round duct shall be the spiral seam type.
- C. Fittings: Elbows shall be long-radius type with a center-line radius not less than 1-1/2 times the width or diameter of the duct. Where space does not permit the use of long-radius elbows, short-radius or square elbows with turning vanes may be used. Elbows in round duct systems shall be stamped type, welded segmented type, or standing seam segmented type. Increase duct sizes gradually. Transitions for diverging air flow shall be made with each side pitched out not more than 22.5 degrees. Transitions for converging air flow shall be made with each side pitched in not more than 30 degrees.
- D. Termination: Provide with screen; type/style as acceptable to boiler manufacturer and of same appearance as flue termination.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install boilers as indicated, in accordance with the boiler manufacturers recommendations and instructions, code requirements, and applicable standards. Furnish boilers disassembled as necessary to accommodate access and installation restrictions. Re-assembly of boilers shall be by boiler manufacturer's authorized service representative.
- B. Connections: Connect all piping and services up to boilers as shown on the drawings and as required to provide complete and operational boiler system. Provide gas manifold vent piping to outside building. Install on boilers any items shipped loose with boilers (i.e. relief valves, gauges, etc.).
- C. Drains: Pipe boiler drains and relief valves full size to proper point of drainage. Pipe combustion condensate through condensate neutralizer and on to proper point of drainage. See Section 23 21 29 for combustion condensate drains. Fill equipment and drain traps with water before operating system.
- D. Condensate Neutralizer: Fill with water and limestone (type/size as recommended by manufacturer) before operating system. See Section 23 21 29.
- E. Filling and Purging: Fill boiler with hydronic system water and purge of air per boiler manufacturers installation instructions.
- F. Anchoring: Anchor boiler to building to resist seismic forces; see Section 20 05 48.

3.02 BOILER VENTING INSTALLATION

- A. General: Install boiler venting as shown on the drawings and in accordance with manufacturer's instructions. Slope flue back toward boiler. Seal flue joints with high temperature sealant; seal combustion air duct per SMACNA-DCS and Seal Class C.
- B. Supports and Accessories: Provide adequate anchoring, supports, expansion devices, flashing and sealing. All penetrations of building exterior shall be flashed and sealed watertight.
- C. Clearances: Comply with Code requirements and flue listing for clearances to combustibles.
- D. Terminations: Terminate venting with proper clearances and distances to building openings, other boiler vents, and building elements (roof, walls, etc.).
- E. Condensate Neutralizers: Where flue arrangement does not allow draining of flue condensate back to boiler (and to boiler condensate neutralizer), provide flue with drain fitting, p-trap, and drain piping to condensate neutralizer and on to drain. Condensate neutralizer shall be separate from boiler neutralizer.

3.03 BOILER CONTROLS

A. General: Provide all boiler control wiring, control components, and connections required for proper operation. Provide all system control components (header temperature sensors, outside air temperature sensors, etc.), connections, thermowells, and

accessories not specified in Division 25 to provide a complete and operational boiler control system.

- B. Building EMCS: Coordinate work with Division 25 to provide specified sequence of operation.
- C. Settings: Set boiler controls and safety devices for proper operation; test to verify all devices operate properly. Coordinate Division 25 outdoor air reset schedule with Engineer. Verify boiler "stand-alone" setpoints; use 160 deg HWS setpoint unless noted otherwise.
- D. Sequence: Boilers shall be controlled by the EMCS to satisfy the HWS setpoint system, with the EMCS activating boilers in a lead/lag fashion. See Division 25.
- E. Wiring: Wiring of items integral with boilers and wiring terminated on the boiler and its panels and sensors shall be provided as part of Division 23 and this specification section, complying with code, manufacturers requirements, Division 25 and Division 26 requirements.
- F. Coordinate with Division 26 for power wiring to the boiler and to system components external to the boiler.
- G. Wiring Diagram: A copy of the wiring diagram for the boiler shall be permanently and prominently displayed with the boiler. Such diagram shall include the coding of the actual wiring by color or by number to permit a ready check of the system.

3.04 CLEANING

- A. Heat Exchanger: Flush and drain water side of boiler heat exchanger on completion of installation; run water until clear. After flushing, clean water side of boiler heat exchanger according to manufacturer's written instructions. Provide temporary fill piping/drain piping and cleaning chemicals.
- B. Boiler Exterior: After completing boiler installation, inspect exposed finishes. Remove burrs, and repair damaged finishes on boiler exterior. Clean boiler of all dirt, dust, overspray, and similar extraneous material.

3.05 START-UP

- A. Inspection: Boilers shall be inspected by the boiler manufacturer's authorized service representative to verify proper unit installation prior to start-up.
- B. Start-Up: Start-up shall be provided by the boiler manufacturer's authorized service representative. Boilers shall be operated in various modes to test for proper operation, including proper ignition sequence, proper operation of all safety devices, proper control setpoints/operation, proper fuel flow, proper fuel/air ratio and proper burner modulation. Boilers shall be adjusted for optimum efficiency, considering system operation and boiler application. All adjustments shall be made in accordance with manufacturer's instructions.
- C. Duration: Start-up services as listed herein shall be for a minimum of four hours (on site time) for each boiler.

- D. Witnessing: Start-up may be witnessed by the Engineer and Owner's representative (at their option). Notify the Engineer when the start-up is proposed to occur, to allow a mutually agreed upon time to be arranged.
- E. Written Report: Submit a written report by the boiler's manufacturer authorized service representative detailing all inspection and start-up procedures and findings.
- F. Code Inspection: Contact and coordinate with State of Washington (and local code inspector) for boiler installation inspection.
- G. Occupancy Adjustments: Within 12 months of date of Substantial Completion, provide on-site assistance to review system operation and system adjustments to suit operating conditions for best efficiency.

3.06 OWNER INSTRUCTION

- A. General: Instruction, notification, and scheduling shall comply with Section 20 05 00. After start-up has been satisfactorily completed, provide Owner with boiler operation and maintenance instructions.
- B. Instruction: Instructions shall include: system start-up, shut-down, emergency shut-down, normal control operation, safety aspects, maintenance and repair instructions. Instruction shall be by the manufacturer's authorized service representative.
- C. Duration: Instruction period shall be for a minimum of four hours for each different boiler type.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 23 05 00 apply to this Section.

1.02 WORK INCLUDED

- Fluid Coolers Refurbishment.
- B. Flexible Piping Connections.
- C. Start-Up.

1.03 SUBMITTALS

- A. Submittals shall comply with Section 20 05 00.
- Submit product data on all items to be used.

1.04 EXISTING SYSTEM INFORMATION

A. Existing Fluid Cooler: Baltimore Aircoil Series V Industrial Fluid Cooler, Model Number F1732-J, serial number 88-200159.

1.05 GENERAL REQUIREMENTS

- A. Experience: Work shall be performed by a Company and individuals experienced in the refurbishment of cooling towers.
- B. General: Provide all work and materials necessary to refurbish all items noted and to provide complete and functioning towers.
- C. Unit Capacity: Work shall be performed such that unit capacity and performance will be no less than the original as submitted unit capacity.
- D. Refurbish Quality: All items being refurbished shall be equal or better than the original unit items. All work materials shall be provided to have complete and functioning units, able to operate without added repairs or refurbishment for a minimum 15 year period.
- E. Refurbish Scope: Refurbishment shall include the following:
 - 1. Replace automatic air vent on piping to unit.
 - 2. Replace fans, fan shafts, bearings and drive assemblies.
 - 3. Replace fan motor with 2 speed (full and 2/3 full type).
 - 4. Replace pan heaters and thermostats.
 - 5. Add fiberglass lining to tower basin.

- 6. Interior metal surfaces not receiving fiberglass lining to have epoxy based paint coating.
- 7. Seal unit seams with sealant.
- 8. Provide new flexible pipe connectors in piping to tower.
- 9. Replace tower nozzles.
- 10. Clean tower in general.
- F. Warranty: All work shall be warranted for a one year period, as described in Division 00 and 01 specifications. Warranty shall cover all refurbished components and all refurbished work.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 20 05 00, Paragraph 2.01, Acceptable Manufacturers.

2.02 FLUID COOLER PARTS

- A. Fans, Shaft and Drive: Forward curved centrifugal fan, same configuration, capacity, and type as existing. Fans shall be statically and dynamically balanced. Fan housings shall have curved inlet rings for efficient air entry, and rectangular discharge cowls to increase fan efficiency and prevent water from entering the fans. Fans shall be mounted on a steel fan shaft supported by heavy-duty, self-aligning, re-lubricatable bearings with cast iron housings. The fan wheels, fan housings, inlet rings and discharge cowls shall be protected with a factory fiberglass or polymer corrosion protection system. The fan shaft shall be protected with a two-part epoxy coating for corrosion protection. Fans shaft shall be V-belt driven. V-belt fan drive shall be designed for not less than 150% of motor nameplate horsepower.
- B. Fan Motors: Motors shall be the same size and type as the existing configuration to suit fans, and for use with electricity of the same voltage/phase as the existing. Motors shall be energy efficient type, and comply with Section 20 05 00. Each motor shall be located in a protective enclosure on an easy adjustable heavy-duty motor base. Motor adjustable base and fasteners shall be of galvanized steel or stainless steel construction.
- C. Pan Heaters and Thermostats: Electric immersion type, located in cooler pan to provide protection from freezing. Capacity and voltage/phase same as existing. Provide with sump thermostat for control of heaters, with sensing bulb, contactors/relays as required to allow for control of heaters and to interlock heaters with spray pump (heater off when pump is on), and with low water level cutout (to prevent heater operation at low water level).
- D. Polymer Corrosion Protection System: All new items designated shall be protected with the polymer corrosion protection system. System shall consist of: G210 hot-dip galvanized steel; electrostatically sprayed thermosetting, hybrid polymer fuse-bonded to the hot-dip galvanized substrate during a thermally activated curing stage; Units (parts) shall be assembled with phenolic-epoxy coated, cadmium-plated, washer head fasteners; The corrosion protection system shall have the following final characteristics:

- When "X" scribed to the base substrate, it shall be able to withstand 6,000 hours
 of 5% salt spray test, according to ASTM Standard B117. No blistering or
 chipping around the intersection of the scribes or any undercutting or creepage
 along the scribes shall occur.
- 2. When "X" scribed to the base substrate, it shall show no signs of chemical attack after 6,000 hours exposure in acidic (pH 4) and alkaline (pH 11) water solutions at 95 degrees F.
- 3. Shall not fracture or delaminate after 160 inch pounds direct impact from a 0.625 inch radius impact tool according to ASTM Method D2794.
- 4. Shall not crack as a result of 6,000 hours of continuous ultra-violet exposure, equivalent to 120,000 hours of normal sunlight radiation.
- 5. Shall not show signs of deterioration after minimum of 200 thermal shock cycles conducted between -25 degrees F and 180 degrees F.
- 6. Shall show no signs of erosion when exposed continuously for 6,000 hours to high pressure (60 pounds) water jet.

E. Fiberglass Lining:

- 1. General: Shall be product specially designed and intended for sealing of cooling tower water basins or water tanks, and be compatible with system chemicals, tower materials, and all other conditions and materials exposed to.
- 2. Primer: Epoxy-polyamide primer, as suitable to prepare surfaces for the fiberglass lining system to be installed.
- 3. Polyester Resin and Catalyst: Chemical resistant polyester or vinyl ester resin. Catalyst and promoter solutions as recommended by resin manufacturer.
- 4. Fiberglass Mat: Type E glass, chopped strand reinforcing mat with a high solubility binder, minimum 1-1/2 ounces per square foot.
- 5. Fiberglass Cloth: Type E glass, plain weave cloth with a Silane finish, minimum 10 ounces per square yard, 16 x 14 thread count, 150-4/2 warp and filling yarn.
- 6. Epoxy Resin Binder: ASTM C881, Type III, Grade 2 or 3, class as suitable for temperatures to be exposed to.
- 7. Acceptable alternative method, Evapco "Evapaliner".
- F. Epoxy Paint: Product designed and intended to protect steel surfaces from corrosion by a protective coating. Shall be compatible with all materials, chemicals, temperatures, and conditions will be exposed to.
- G. Sealant: Suitable for application and intended use, and compatible with chemicals and materials will be exposed to.
- H. Nozzles: Style and type same as existing, and so as to give equal or better performance than new.

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

2.03 FLEXIBLE CONNECTORS

A. Water Pump Flexible Connectors: Twin sphere type, constructed of peroxide cured EPDM with Kevlar tie cords, multilayered. Embedded solid steel rings shall be used at raised face flanged ends. Shall have an external ductile iron reinforcement ring between spheres. Rated minimum 225 psi at 230°F. Control rods shall be used as recommended by the manufacturer for the application; rods shall have 1/2" thick neoprene bushings, washers and accessories sized to accommodate system loads and conditions. Connector shall be same size as pipe installed end, with end connections to suit connecting piping. Mason Industries "SafeFlex" SFDEJ Series, and SFDCR Series.

PART 3 - EXECUTION

3.01 GENERAL

- A. General: Work shall be in accordance with code, manufacturers written instructions and recommendations and best professional practices.
- B. Coordination: Coordinate timing and schedule of all work with Owner's staff. Items to be coordinated include: system draining, disposal of materials (off-site, by Contractor), building/room access, re-filling of system, equipment start-up, etc.
- C. Protection: Protect all portions of building, equipment, piping, and all other systems from damage during the course of performing the work. Mask off and protect areas that may be damaged by pressure washing or cleaning work, by fiberglass, epoxy, or other materials or activities. Provide protective enclosures and other measures as needed to provide a proper environment for all work and to protect adjacent areas from any deleterious effects due to the work.
- D. Repair: Repair all damaged items in the course of performing the work to preconstruction conditions (or better).
- E. Removal/Access: Remove all piping, supports, panels, electrical, controls, etc. as needed to accomplish the work. Re-install all such items when work is complete.
- F. Site Visit: Contractor performing the work of this Section shall visit the site and review the tower prior to bidding, and again prior to beginning any work.

3.02 REFURBISHMENT

- A. General: Refurbish all items as indicated and so as to provide fully functioning as close to "all new" (or better) unit as possible.
- B. Spray Pumps and Motors: Replace existing spray pumps, motors, and accessories with new. Completely connect all items for proper operation. Coordinate electrical work with Division 26.
- C. Fan Shafts, Wheels, and Drive Assemblies: Replace existing fan shafts, bearings, fan wheels, drift eliminators, sheaves, belts and accessories with new. Provide extended lube line to an accessible location. Completely connect all items for proper operation. Adjust belts for proper tension and align assembly for proper operation. Lubricate bearings. Provide vibration analysis and balance fans to same standard as for new tower. Replace fan inlet cowling with new, to match existing.

D. Fan Motors: Replace existing fan motors and adjustable mounting bases with new 2 speed motors (full speed and 2/3 speed). Coordinate electrical work with Division 26.

- E. Pan Heaters, Controls, Electrical: Replace existing pan heaters, associated controls and wiring with new. Coordinate electrical work with Division 26.
- F. Fiberglass Lining to Tower Basin:
 - Scope: Provide fiberglass lining at tower basin that normally contains water, up to at least 3 inches above the high level drain point. Install to form a complete water tight and protective coating over all seams, joints, connections, and surfaces.
 - 2. General: Cleaning and surface preparation shall be in accordance with fiberglass lining manufacturers written instruction, but no less than the cleaning and preparation requirements cited herein.
 - 3. Initial Abrasive Blasting and Cleaning: Provide an initial brush-off abrasive blast cleaning in accordance with SSPC SP 7. Blasting shall remove all scale, rust, and surface debris.
 - 4. Surface Repair: Inspect surfaces to be lined for defects requiring repair. Repair voids, pits and other surface imperfections with epoxy resin mortar, polyester putty, or similar material that is suitable for the application and compatible with the fiberglass lining and tower basin.
 - 5. Final Abrasive Blasting and Cleaning: Following completion of the surface repair and hardening of repaired areas, provide a final abrasive blast in accordance with SSPC SP 5. Provide final cleaning of all areas to remove all loose abrasives or other materials, and to prepare areas for primer and lining installation.
 - 6. Primer: Provide primer coating over all surfaces that will receive lining. Limit elapsed time between final abrasive blasting until application of primer in accordance with manufacturers recommendations. Apply primer to thickness of no less than 2 mils. Allow primer to cure in accordance with manufacturers written instructions.
 - 7. Resin and Fiberglass: Install resin, fiberglass mats, and top coat of resin in multiple layers in accordance with best professional practices to form a cured watertight fiberglass assembly of at least 1/8-inch thick. Roll or knead fiberglass mats to remove all wrinkles, air bubbles, and to wet the mat with the resin. Overlap mat joints at least 3 inches.
- G. Epoxy Coating: All unit interior metal surfaces not receiving fiberglass lining shall be painted with an epoxy coating. Prior to painting, all surfaces shall be thoroughly cleaned and prepared in accordance with epoxy manufacturers guidelines.
- H. Seal Unit Seams: Clean all tower interior joints and seams and prepare surfaces for sealing. Cleaning shall remove all rust, scale, and miscellaneous materials to provide clean solid substrate for sealing. Seal all unit seams.
- I. Flexible Pipe Connectors: Replace existing flexible pipe connectors to tower with new. Confirm size and length required. Revise piping as necessary to accept new connectors.

- J. Nozzles: Remove and replace existing nozzles with new.
- K. General Cleaning: Provide general cleaning of entire tower, inside and outside, tube bundles, and all heat transfer surfaces. Use suitable detergents, mechanical scrubbing (where accessible), and power wash equipment.

3.03 START-UP

- A. Initial Checks: Prior to operating units, checks shall be made to insure that all components are properly installed, aligned and ready to operate. Check that adequate voltage, water flow, electrical connections, control connections, and other items as listed by the manufacturer are properly provided/connected and operating to insure safe and proper unit operation.
- B. Testing and Adjustment: Operate unit in various modes of operation to test for proper operation, including, fan rotation, proper spray pump operation, heater operation, makeup water level, correct interface to other controls (solenoid valve, etc.), purging of air from coils, etc. Make necessary adjustments per manufacturer's direction.
- C. Final Check: When the testing and adjustment is complete, a final check of each unit shall be done by the manufacturer's authorized service representative, or direct employee, to verify proper unit operation. Any defective items shall be repaired or replaced by the contractor until proper operation is confirmed by the manufacturer's authorized service representative.
- D. Owner Review: Notify Owner in advance to allow Owner review of final operation. After all testing and adjustments have been satisfactorily completed, the Owner shall be provided with an overall description of the refurbish work provided.
- E. Written Report: When the final check has been completed, a written report from the manufacturer's authorized service representative shall be provided. This report shall list all units checked, items checked, check results, any items which may impair proper unit operation, and the name and phone number of the actual individual(s) doing the check. The report shall include a statement stating whether or not all units are operating as specified.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Split-System Air-Source Heat Pumps.
- B. Refrigerant Piping and Accessories.

1.03 SUBMITTALS

- A. Product Data: Submit complete product information on all units; include performance data showing cooling and heating capacity (as a function of indoor and outdoor coil db/wb temperatures and indoor coil air flow rates), supplementary heater capacity, fan performance, filter information, unit accessories, wiring diagram, and point of connection of all utilities.
- B. Installation: Submit manufacturers installation instructions for units.

1.04 QUALITY ASSURANCE

- A. Listing: Units shall be UL listed and labeled.
- B. Ratings: Units cooling and heating performance shall be rated in accordance with ANSI/AHRI 210/240.
- C. Codes: Unit and accessories shall conform to applicable codes and standards. Unit efficiency shall comply with code (and exceed code as indicated).
- D. Operating Ability: Outdoor unit and all components shall be able to withstand ambient temperatures from 0 deg F to 125 deg F, plus direct exposure to sun and weather elements without adverse affects. Unit shall be able to operate and produce cooled air between ambient temperatures of 45 deg F and 115 deg F. Unit shall be able to operate and produce heated air between ambient conditions of 0 deg F and 80 deg F. Unit shall be able to operate with supply air temperatures between 50 deg F and 125 deg F; and with room temperature setpoints between 65 deg F to 85 deg F.
- E. Electrical: Coordinate equipment electrical voltage/phase, minimum circuit amps, and overcurrent protection requirements with the Division 26 contractor prior to ordering.

1.05 GENERAL REQUIREMENTS

A. Refrigerant Pipe Sizing: Refrigerant pipe sizes shown on the drawings are preliminary only. Due to the use of proprietary selection criteria by equipment manufacturers verify and finalize all required pipe sizes with the equipment manufacturer (or manufacturer's representative) prior to bidding. Verify with the equipment manufacturer (or manufacturer's representative) the need for any accumulators, solenoid valves, and similar accessories and size/select such devices prior to bidding. Include costs in bid for

required pipe sizes and all accessories.

B. Extended Warranties: Unit compressors shall be warranted by the manufacturer for five years. All labor and materials associated with compressor replacement (or repair) shall be warranted.

C. Spare Parts:

- 1. Belts: Provide two complete sets of spare belts for all belt driven fans.
- 2. Filters: Provide two complete spare sets of filters for each unit.

1.06 REFERENCES

- A. ANSI/AHRI 210/240: Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment.
- B. ANSI/AHRI 270: Sound Rating of Outdoor Unitary Equipment.
- C. ANSI/ASHRAE 52.2: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- D. ASME B16.22: Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- E. ASME B16.26: Standard for Cast Copper Alloy Fittings for Flared Copper Tubes.
- F. ASTM B280: Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products shall comply with Section 20 05 00, See Section 20 05 00, Paragraph 2.01 for Acceptable Manufacturer requirements.
- B. Heat Pumps: Trane, Carrier, York/JCI.
- C. Condensate Safety Switch: Little Giant, Diversitech, Rectorseal.
- D. Refrigerant Piping and Accessories: Mueller, Sporlan, Nibco, Elkhart, Parker, Emerson, Henry.

2.02 SPLIT SYSTEM HEAT PUMP - OUTDOOR UNIT

- A. Type: Split system air-to-air heat pump; outdoor section.
- B. Capacity: Units shall have minimum cooling and heating capacities as scheduled on the drawings at the conditions shown and with the indoor unit (i.e., air handler) indicated; and shall be rated in accordance with ARI standards.

- C. General: Unit shall be fully factory assembled and shall be complete with casing, coils, fans, compressor(s), piping, wiring, controls, and all other accessories required to be ready for field connections and operation. Units shall be UL listed and labeled. Units control wiring shall be 24 volt, and units shall be capable of operating in the cooling mode from 40 to 115 degrees F ambient, and in heating mode from -20 to 65 degrees F ambient.
- D. Factory Test: Units shall be factory run-tested to verify proper heating, cooling, defrost, control, and fan operation.
- E. Refrigerant: Units shall be for use with refrigerant R-410A and shall be fully charged at the factory.
- F. Unit Casing: Shall be constructed of minimum 18 gauge zinc coated steel, with zinc phosphate coating and baked-on polyester powder coating. Access panels shall provide access to unit controls and all major components. All screws or holding devices shall be of cadmium plated construction to resist corrosion. Unit shall have knockouts for piping, electrical and control connections with rubber grommets to insure water-proof connections.
- G. Compressor(s): Hermetically sealed or serviceable hermetic reciprocating type compressor, specifically designed for heat pump service. Compressor shall have internal line break overcurrent and overtemperature protection, low pressure protection (via low pressure switch), high pressure protection (via internal relief valve or pressure switch), and crankcase heaters. Motor shall be suction gas cooled and have a voltage utilization range of plus or minus 10% of nameplate voltage. Compressor(s) shall have internal spring isolation mounting and discharge gas sound muffler to reduce vibration transmission and noise.
- H. Refrigerant Circuit: Shall be fully factory piped and shall include a refrigerant line filter/drier, liquid line and gas line service valves (brass, back seating type) with service ports, reversing valve, accumulator, and thermostatic expansion valve for both heating and cooling operation.
- I. Coils: Shall be constructed of seamless copper tubing with aluminum fins mechanically bonded to tubes.
- J. Fan(s): Shall be statically and dynamically balanced at factory. Shall be propeller type, used in draw-through configuration, direct drive type, with permanently lubricated, totally enclosed weather-proof ball bearing type motor(s) having built-in overload protection.
- K. Defrost: Unit shall have defrost cycle to remove build-up of frost on outdoor coil. Defrost cycle shall be an on-demand time and temperature initiated; i.e., after 90 minutes (adjustable to lower time periods) elapsed run time; if temperature is low enough, defrost cycle shall be activated. Defrost cycle shall be time or temperature terminated; i.e., defrost cycle shall stop after 10 minutes or when refrigerant temperature is high enough indicating defrost is completed. When in defrost mode, unit shall provide an output (normally open dry contacts) to building control system to allow Division 25 controls to activate supplementary electric heaters as needed. Unit shall also have defrost control in case of low evaporator coil temperatures at the indoor coil; unit shall prevent compressor slugging by temporarily interrupting compressor operation.
- L. Electrical Power: Units shall be for use with power of voltage and phase as scheduled on the drawings.

M. Accessories:

- 1. Anti-Short-Cycle-Timer: Solid state 24 volt timing device to prevent rapid on-off compressor cycling; providing an approximate 5 minute delay between compressor starts.
- 2. Low Ambient Accessories: Provide unit with accessories as needed to allow operation to temperatures specified in Paragraph C above. Accessories shall include head pressure control device(s), evaporator freeze thermostat, low ambient isolation relay.
- 3. Compressor Start Assist: Provide capacitor(s) and relay(s) to allow improved compressor starts.
- 4. Mounting Legs: Provide with minimum 4" high non-corroding mounting legs (or base), to allow for proper drainage of unit base and to minimize base corrosion.

2.03 SPLIT SYSTEM HEAT PUMP - INDOOR UNIT

- A. Type: Split system heat pump, indoor section (i.e. air handler). Air flow configuration as indicated on drawings.
- B. Capacity: Units shall have minimum cooling and heating capacities as scheduled at the conditions shown and with the outdoor unit indicated, and shall be rated in accordance with AHRI standards.
- C. General: Units shall be fully factory assembled and shall be complete with casing, coils, fans, piping, wiring, controls, supplementary electrical heaters and all other accessories required to be ready for field connections and operation. Unit shall be compatible with outdoor section as specified so as to provide performance over the temperature range indicated.
- D. Refrigerant Circuit: Shall be fully factory piped and shall include factory installed thermostatic expansion valve (or dual flow metering device) to allow for both heating and cooling operation.
- E. Unit Casing: Shall be constructed of zinc coated steel, with baked-on enamel finish. Access panels shall provide access to unit controls, indoor coil, supply air fan, and filters. Unit shall be completely insulated with minimum 1" thick 1-1/2 lb. per cubic foot neoprene coated fiberglass insulation. Condensate drain pan shall be provided with external connections on either side of unit.
- F. Refrigerant Circuit: Shall be fully factory piped and shall include factory installed thermostatic expansion valve (or dual flow metering device) to allow for both heating and cooling operation.
- G. Coils: Shall be constructed of seamless copper tubing with aluminum fins mechanically bonded to tubes.
- H. Fans: Shall be statically and dynamically balanced at factory. Shall be double width, double inlet, forward curved centrifugal type, with adjustable belt drive or multi-speed direct drive type, as follows:

Fan Scheduled CFM Drive
0-1899 Direct
1900-2200 Direct or Belt

2201 and up Belt

Direct drive fans shall have minimum of three speeds, field changeable by switching wiring connections at unit terminal strip or by operation of switches or equivalent method. Belt drive units shall have adjustable sheaves. Fan and motor bearings shall be permanently lubricated type with built-in overload protection.

I. Air Filters:

- 1. General: Unit shall be provided with filter racks for accommodating filter sizes as scheduled on the plans (except where filters are indicated to be installed at another location).
- 2. Filter Type: Filter shall have MERV efficiency as scheduled on the drawings as evaluated by ASHRAE 52.2.
- J. Defrost: In conjunction with outdoor unit, unit shall have defrost control to prevent compressor slugging by temporarily interrupting compressor operation in case of low evaporator coil temperatures.
- K. Supplementary Electric Heaters: Shall be provided with capacity and stages as scheduled on the drawings at the voltage and phase indicated. Heaters shall have open wire nickel-chrome elements, mercury contactors, stages as indicated, safety overcurrent protection, and secondary and primary overtemperature protection. Heaters shall have airflow switch (or be interlocked to fan starting device) to only allowing heater operation when airflow is proven. Heaters shall be UL listed.
- L. Electrical Power: Units shall be for use with power of voltage and phase as scheduled on the drawings. Units shall have single power entry unless indicated otherwise. Units with single source power entry shall require only one field connection and power source. All necessary terminal block, fuse blocks, fuses, wiring, junction boxes and accessories shall be factory installed within the unit cabinet to provide power to all devices (including the supplementary heater for single source power entry units).
- M. Vibration Isolators: Neoprene-in-shear (or spring suspension) type. All isolators shall be sized by manufacturer for unit weights and so as to provide 95% vibration isolation efficiency.
- N. Condensate Safety Switch: Code compliant safety switch for stopping unit operation at high condensate level. PVC or polymer body, with corrosion resistant mechanical float or reed switch, normally closed contacts, minimum 2.5 amp capacity at 24 vac, and 6 feet 18 gauge wire leads Little Giant ACS-5 (or approved equal).

2.04 REFRIGERANT PIPING AND ACCESSORIES

A. Piping: Hard drawn ACR copper tubing per ASTM B280, Type L, with silver brazed joints and wrought copper fittings per ASME B16.22. Use only long radius elbows. Flared fittings (at equipment connections only) shall comply with ASME B16.26. Soft copper tubing may only be used on runs less than 50-feet or where necessary due to existing construction (i.e. when routing through sleeves, or similar poor access areas).

B. Sight Glass: Sight glass shall allow visual inspection of refrigerant flow and indicate refrigerant moisture content. Shall be double port type, solder end connections, for use with type of refrigerant of system being installed in, same size as tubing installed in. Henry type 3103 or equal.

- C. Isolation Valves: Brass ball valve, full port, rated for 700 psig and -40 deg F to 300 deg F. Compatible with refrigerant used with, UL listed, with rupture proof encapsulated stem, extended copper connections for ease in brazing. Provide in configuration (i.e. angle, straight, with access port) as required to suit application.
- D. Filter/Drier: Sealed cannister type, with molded blended desiccant core, for filtering refrigerant system moisture, debris and acids. Suitable for refrigerant and system type used with. Size for maximum 1 psi pressure drop. Sporlan "Catch-All" (or approved).

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Comply with Section 20 05 00. Install in accordance with Manufacturer's written instructions, code, applicable standards and best construction practices. Indoor Units shall be level (or slightly sloped) to drain and aligned with building walls. All indoor units shall be hung from the building structure (unless noted otherwise). Provide custom fabricated steel support frames as necessary. Install indoor units with vibration isolators.
- B. Location Verification: Install equipment in locations as indicated in accordance with the Contract Documents. Prior to selecting installation locations, confirm that: unit location matches ductwork for the area the unit is intended to serve; installed duct locations match unit; manufacturer's pre-installation checks have been completed; proper unit clearances and access will be provided; no adverse conditions will affect unit operation at the proposed location and arrangement present; and installation has been coordinated with other trades.
- C. Complete Connections: Connect and install all items shipped loose with units; provide and connect all utilities and accessories as required for proper unit operation.
- D. Refrigerant Pipe Sizing: Review selected pipe routing, pipe lengths, elevation changes, and fittings with equipment manufacturer (or manufacturer's representative) prior to installing and confirm final pipe sizing any required accessories. Provide accumulators, solenoid valves, and similar accessories recommended by the equipment manufacturer (or manufacturer's representative) to maintain equipment full capacity.
- E. Refrigerant Piping: Shall be silver brazed. Bleed dry nitrogen through piping during brazing to minimize oxidation. Keep all open ends of piping capped when not being worked. Soft copper shall have long radius bends; install without kinks or excess bends. Piping shall be routed concealed, except where routed outdoors and where noted. Piping shall be ran plumb and square to building walls, and in a neat professional manner. Provide sight glass in refrigerant liquid piping at outdoor unit.
- F. Refrigerant Valves: Provide isolation valves on refrigerant piping connections at the outdoor unit (unless unit has integral service valves). Provide valve with access port on larger volume systems to aid in system vacuum testing (or as required for other purposes).

HVAC REPLACEMENT

- G. Refrigerant Charge: Units shall be checked for proper refrigerant charge and oil level and charged to proper levels after all leak testing and evacuation work has been completed. Refrigerant to be added to the system shall be delivered to the site in factory charged containers and charged into the system through a filter/drier.
- Н. Sheaves: Provide sheave changes for all belt driven fans. Sheave changes shall meet Balancer and Engineer requirements.
- I. Owner Instruction: Instruct Owner on equipment operation, including: system start-up, shut-down, emergency shut-down, normal control operation, safety aspects, maintenance and repair instructions.

3.02 REFRIGERANT LEAK TESTING AND EVACUATION

- Notification/Witnessing: Prior to beginning any testing, notify the Architect/Engineer A. when the testing will occur. The Architect/Engineer will witness (at his discretion) various parts of the test. Failure to notify the Architect/Engineer will be cause to re-test all piping in the presence of a representative of the Architect/Engineer.
- В. Test Preparation: Disconnect and isolate from the system any components that may be damaged by the test pressure.
- C. Testing: Connect oil-pumped, dry nitrogen to the system through a pressure reducing gauge manifold. Charge enough nitrogen into the system to raise the pressure to 50 psig. Let stand for 2 hours and check for signs of leakage. If no leakage is noted, slowly increase pressure to 300 psig (or as required by local code, whichever is higher). Tap all brazed connections with a rubber or rawhide mallet sufficiently hard to start any leak that might subsequently open from thermal expansion/contraction or vibration. Check the manifold gauge for any drop in pressure. Let the system stand pressurized for 24 hours. Re-check the manifold gauge. If no change in pressure is noted (after adjusting for temperature) the system may be considered free of leaks.
- D. Leak Repair: If leakage is suspected or apparent, check joints with a glycerin soap solution or other means to locate the leaks. Repair any leaks found by completely disassembling the connection, cleaning the fitting and remaking the connection. Re-test the system after repairs are made both with pressure (300 psi for 24 hours) and at the leak location with a glycerin soap solution or other means of determining leaks.
- E. System Evacuation: When the system has been proven free of leaks with the above methods, the system shall be completely evacuated of all air and moisture. Connect a vacuum pump to the system and pump the system down to 500 microns and let stand for a minimum of 2 hours. If the vacuum reading remains unchanged, the system may be charged with refrigerant.
- F. System Charging: After satisfactory pressure testing and vacuum evacuation, fully charge the system with refrigerant. Any final connections that were not subject to the full test pressure (e.g. connections at unit, etc.) shall be carefully checked with a halide or electronic leak detector after the system has been charged.

START-UP 3.03

A. Pre Start-Up Inspection: Inspect equipment and connecting systems to confirm equipment and connecting systems to confirm equipment has been installed properly and is ready for start-up. As a minimum, check for: proper voltage and phases, correct

system refrigerant charge, correct electrical connections, complete control connections, all unit safety devices properly set and connected, heaters operational, fans free to rotate and rotating correctly, fans lubricated, belts tightened to proper tension, coils clear of obstructions, and other items as listed by the manufacturer are properly provided/connected and operating to ensure safe and proper start-up.

- B. Start-Up: Perform start-up in accordance with manufacturers written start-up procedures. Arrange other trades needed to be present (i.e. balancer, control technician, etc.). Operate equipment in various modes to confirm proper operation. Observe proper operation of all unit components (heating, cooling, condenser fan, economizer, etc.).
- C. Adjustments: Adjust and set unit components to allow for proper operation (i.e. adjust fan sheaves, adjust fan speeds, unit settings, etc.). Observe unit to detect any unusual vibration, leakage, loose wiring, or other situations that could affect unit operation.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 SECTION INCLUDES

- A. Hydronic Heat Pumps.
- B. Start-Up.
- C. Owner Instruction.

1.03 DEFINITIONS

A. "ESP" is defined to mean external static pressure, measured external to the heat pump unit duct connection collars but including a pressure drop for the units' filters. Filter pressure drop has been estimated in a one-half dirty/one-half clean condition using 0.25 inch.

1.04 QUALITY ASSURANCE

- A. Listing: Units shall be listed by an approved testing laboratory for the use and application intended (reference Section 20 05 00).
- B. Rating and Certification: Unit performances shall be tested and rated in accordance with ARI Standard 320, and units shall be ARI certified.

1.05 SUBMITTALS

- A. Shall comply with Section 20 05 00.
- B. Submit product and performance data on all products to be used. Provide schedule clearly indicating what model numbers are proposed for each unit.

1.06 GENERAL REQUIREMENTS

- A. Standardization: In interests of Owner's standardization, all heat pumps shall be the product of the same manufacturer.
- B. Substituted Equipment: The drawings show design configuration based on a particular manufacturer's equipment. Use of another manufacturer's equipment will require redesign of mechanical ductwork, piping, electrical, structural, unit support systems, and general building construction to accommodate the substituted equipment. Such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. If a different manufacturer than shown on the plans is used, the Contractor shall submit complete shop drawings showing all alternate unit installation plans and details; shop drawings shall comply with Section 20 05 00. The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of maintenance,

duct connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate the substitutional equipment shall be borne by the Contractor.

C. Equipment shall utilize HFC R-410A refrigerant and shall have a maximum charge meeting the requirements of USGBC LEED Credit EA #4, Enhanced Refrigerant Management.

1.07 REFERENCES

- A. ARI 320: Water Source Heat Pumps (ANSI/ARI 320).
- B. ARI 350: Sound Rating of Indoor Air Conditioning Equipment.
- C. ASHRAE 52: Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter, Method of Testing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hydronic Heat Pumps: Florida Heat Pump, Climate Master, Water Furnace.

2.02 GENERAL

- A. Capacity: Units shall have the minimum heating, cooling, and supply air cfm capacities as scheduled on the drawings at the conditions shown. Units shall be capable of meeting or exceeding all the capacities indicated.
- B. Starting Limits: Unit shall be capable of starting in an ambient of 40 degrees F with entering water at 70 degrees F with both air and water flow rates at the ARI rating conditions.
- C. Operating Limits: Units shall be capable of operating satisfactorily within the following limits:

<u>Cooling</u> <u>Heatin</u>	9
Minimum Ambient Air 20 deg F 20 deg	F
Maximum Ambient Air 100 deg F 85 deg	ΙF
Minimum Entering Air 50 deg F 50 deg	ΙF
Maximum Entering Air, db/wb 100/83 deg F 80 deg	ΙF
Minimum Entering Water 20 deg F 20 deg	ΙF
Maximum Entering Water 120 deg F 120 deg	βF

- D. Electrical: Units shall have single point power connection and have an internal power distribution system providing necessary power to all components. Unit shall be for use with the power (voltage and phase) as scheduled on the drawings. Unit shall be nameplated to accept time delay fuses or HACR circuit breaker for branch over-current protection of the power source.
- E. Fan Drives: Shall be sized for not less than 120% of the rated motor horsepower.
- F. Listing: Shall be UL listed and as specified in Section 20 05 00 and shall also comply

with this section.

2.03 HYDRONIC HEAT PUMPS

A. Type: Water source heat pumps with discharge configuration as indicated on plans.

B. Cabinet:

- 1. General: Shall be constructed of heavy-gauge galvanized steel, with a baked-on enamel finish. Cabinet interior shall be lined with minimum 1/2-inch thick, 1-1/2 lb./ft.³ density fiberglass duct liner. Cabinet shall have panels providing access to fan, fan motor, compressor, and control box. An insulated panel shall separate the air handling compartment from the compressor compartment.
- Filter Bracket/Collar: Units shall be provided with a combination return air duct collar/filter bracket, suitable for holding a 2-inch thick filter and allowing return air duct connections directly to the unit. Filter bracket shall be capable of being field modified to allow for bottom or side filter removal. Units shall be factory shipped with side filter access.
- 3. Drain Pan: Units shall have integral condensate drain pan, constructed of stainless steel, insulated, with drain connection extending through unit cabinet. Drain pan shall comply with ASHRAE 62.1-2007.
- 4. Configuration: Unit shall be provided from the factory configured as shown on the drawings in either straight-discharge or side-discharge. For unit ventilator console type provide with top supply grille and bottom front return grille.
- Knockouts/Utility Connections: Cabinet shall have separate holes and knockouts for entrance of line voltage and low voltage control wiring. Supply and return water connections shall be copper FPT fittings and shall protrude through the cabinet.
- C. Acoustic Package: Provide units with additional sound attenuating material factory applied to compressor, cabinet interior and fan scroll to further dampen and attenuate sound transmissions.
- D. Compressors: Shall be hermetic type with external vibration isolators and motor thermal overload protection; compressors shall be specifically designed for heat pump duty.
- E. Air/Refrigerant Coils: Shall be constructed of aluminum fins mechanically bonded to copper tubes; tubes shall be tested to 400 psig.
- F. Water/Refrigerant Coils: Shall be coaxial type with an outer steel tube serving as the shell and inner finned copper tube. Coil shall be rated for 400 psig on the water side and 450 psig on the refrigerant side. Water coils shall be for use with 25% glycol solution.
- G. Refrigerant Circuit Accessories:
 - 1. Reversing Valve: Pilot operated sliding piston type, with replaceable encapsulated magnetic coil; valve shall be energized/de-energized in such a manner to minimize noise of operation.
 - 2. Metering System: Refrigerant metering system for proper heating and cooling

cycle operation.

- 3. Safety Controls:
 - High refrigerant pressure cut-out.
 - b. Low refrigerant Pressure cut-out.
 - c. Low refrigerant pressure bypass time delay (to prevent nuisance trippings at cold start-up).
 - d. Anti short cycle timer (to prevent short cycling of compressor).
 - e. Safety cut-outs shall be reset only by interrupting and then restoring main power supply to the unit. Control system calls for cooling, heating, or fan operation shall not reset safely cut-outs.
- H. Refrigerant: Unit shall be fully charged at the factory with refrigerant. Refrigerant shall be HFC R-410A and shall comply with USGBC LEED Credit EA #4, Enhanced Refrigerant Management.
- Fan/Motor Assembly:
 - 1. Drive Type:

ARI Standard

Cooling CapacityDrive Type50 MBH and LessDirect

51 MBH to 69 MBH Direct or Belt

70 MBH and Higher Belt

- 2. Direct Drive: Fan shall be forward curved centrifugal type. Fan motor shall be multi-speed permanent split capacitor type, with internal thermal overload protection. Fan arrangement shall be field convertible from straight-through to right-angle discharge (and vice-versa) without the use of additional parts.
- 3. Belt Drive: Fan shall be forward curved centrifugal type, with solid steel shaft having heavy duty ball bearing supports, with adjustable pitch motor sheave and fixed fan pulley. Motor shall be open type, permanently lubricated, with internal overload protection. Fan/motor assembly shall be mounted on a heavy steel assembly, isolated from the unit; motor mounting shall be adjustable to allow proper bolt tension.
- J. Duct Collar: Fan housing shall extend through the cabinet to provide a collar for duct connections.
- K. Filters: Unit shall be for use with thickness and MERV rating as indicated on plans; rated in accordance with ASHRAE 52; provide minimum size (or area) noted on plans.
- L. Electrical: Units shall be factory furnished with all necessary motor starters, transformers, relays, etc. to provide for start/stop of all powered equipment and appropriate interlocks to all safety cut-outs and connections to unit control terminal strip.
- M. Controls:

- 1. General: Unit shall be furnished with devices that are compatible with the Division 25 control system. Unit shall have all necessary interconnections, relays, transformers, terminals, and wiring to properly control the unit's compressor, reversing valve, fan, as activated by the Division 25 system. Unit's internal safety controls shall lock-out unit operation; reset shall occur per safety controls. All control devices shall be located in an accessible control box within the unit.
- 2. Condensate Overflow: Units shall have a condensate overflow float switch in the drain pan to shut down compressor operation when the pan is full.
- 3. Alarm Indication: Provide dry contacts for connection to Division 25 system to indicate unit alarmed condition. Alarmed condition to include any safety cut-out and compressor malfunction.
- 4. Division 25 Interface: Provide unit with necessary terminals and accessories to allow sequence of operation as specified in Division 25, and to be compatible with the control system furnished. Unit shall (as a minimum), allow for Division 25 control of fan compressor, heating, and cooling operation.
- N. Unit Ventilator Console Units: Provide with integral return air and outside air dampers, with pipe chase area for unit valving.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install units in locations shown on plans and in accordance with manufacturer's instructions.
- B. Piping: Provide condensate, hydronic loop supply, and hydronic loop return piping connected to unit. No hydronic loop piping connections shall be made to the heat pumps until these lines are thoroughly flushed and cleaned per Section 23 21 13.
- C. Unit Protection: Units shall be protected during construction to prevent mud, dirt, paint overspray, plaster materials, and similar debris from depositing on the unit.

3.02 START-UP

- A. Initial Checks: Prior to operating units, checks shall be made to insure that adequate voltage, water flow, duct connections, electrical connections, control connections, crankcase heaters (where applicable), and other items as listed by the manufacturer are properly provided/connected and operating to insure safe and proper unit operation.
- B. Testing and Adjustment: Operate unit in various modes of operation to test for proper operation, including fan rotation, proper damper travel (where applicable), proper cooling/heating, correct interface to other controls (time clock, fans, etc.), purging of air from coils, etc. Make necessary adjustments per manufacturer's directions. See Section 20 05 93.
- C. Final Check: When the testing and adjustment is complete, a final check of each unit shall be done by the manufacturer's authorized service representative, or direct employee, to verify proper unit operation. Any defective items shall be repaired or

replaced by the Contractor until proper operation is confirmed by the manufacturer's authorized service representative.

3.03 OWNER INSTRUCTION

- A. After all testing and adjustments have been satisfactorily completed, the heat pump owner shall be provided with operator instructions (including start-up, shut-down, emergency, maintenance, and repair instructions) by the manufacturer's authorized service representative.
- B. Instruction and notification shall comply with Section 20 05 00.

END OF SECTION

TACOMA PUBLIC LIBRARY SECTION 25 50 00 HVAC REPLACEMENT INTEGRATED AUTOMATION FACILITY CONTROLS BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 00 and 01 Specification sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 SECTION INCLUDES

- Control System Design.
- B. Complete Mechanical System Controls.
- C. Control Devices, Components, and Wiring.
- D. Control System Commissioning.

1.03 SUBMITTALS

- A. General: Comply with Section 20 05 00.
- B. Product Data: Submit manufacturer's product data for all items to be used. Provide a complete materials list, labeled to match labeling used on shop drawing, with manufacturer and model number.
- C. Shop Drawings: Submit shop drawings of complete control system, including the following information: interconnect drawings showing all wiring and control connections, all control device locations, sequence of operation for all controlled systems, building floor plans with all proposed thermostat and other control device locations shown.

1.04 QUALITY ASSURANCE

A. Skilled Workers: The entire control system shall be installed by skilled electricians, technicians, and programmers, all of whom are experienced, properly trained and qualified for the work they perform. Contractor shall submit evidence of workers' experience and training upon request of the Engineer.

1.05 GENERAL REQUIREMENTS

- A. Single Contractor: One single Company shall be responsible to design, furnish and install the complete Division 25 control system. Any subcontracted installation work shall be done by firms experienced and qualified in the work they perform, and subject to approval by the Engineer.
- B. Local Contractor: System shall be designed, programmed, and commissioned by local office personnel.
- C. Programming Point Names: Custom point naming is required to match the Owner's standard point naming scheme. Coordinate with Owner to confirm standards.
- D. Existing Systems:

- Existing controls: Existing controls are the DDC type, by Alerton. New controls shall be the DDC type and shall be an extension of the existing system, by the same manufacturer, with the same capabilities extended to include new equipment. Revise and add system graphics to reflect all project work and to include new equipment.
- 2. System Demolition and Revisions: Remove existing DDC controls as indicated and revise system as necessary so that existing items that remain continue to operate properly. Revise existing system graphics to reflect demolished system revisions. Revise existing control wiring and control components as necessary to properly reconnect to all relocated and revised equipment so that the equipment operates properly. Revise and relocate existing wring and control component locations to suit revised areas.
- 3. Wiring and Component Reuse: Verify existing system wiring and existing components to be reused, to confirm they will operate properly with the new system. Existing components that are indicated to be reused shall be assumed to be in working condition (i.e. temperature sensors, actuators, etc.); however Contractor shall review their operation and functionality to confirm their condition and notify the Owner of any issues or component failure.
- E. Installing Contractor: Shall be approved by the Owner. Pre-approved installers:
 - 1. ATS Automation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General: Products shall comply with Section 20 05 00.
- B. Control System Manufacturer: Alerton.
- C. Other Control Components and Accessories: Idec, Hoffman, McDonnell, Tridelta, Veris, Kele, Edwards, Mamac, APC, Barksdale, Belimo, Mark-Time, Functional Devices, and control system manufacturer listed.

2.02 BASIC SYSTEM

- A. General: The work involves revising the existing system to accommodate project demolition and revised zoning. The system shall be a distributed processing type direct digital control (DDC) system same type as the existing. System shall provide complete stand-alone temperature control/monitoring and energy management for this project, using a network of various independent controllers, sensors and associated devices interconnected in a communicating network.
- B. System Protocol: Same as existing (Alerton).
- C. Network: All controllers shall be interconnected in a communicating network to provide facility wide access to work stations and sharing of information. A Local Area Network (LAN) shall be provided to interconnect controllers for high speed data transmission. Failure of a single or multiple controllers shall not cause loss of communication between other LAN-connected controllers still active. The control system LAN shall be separate and independent from other building LAN's (except for a single data terminal connection at a

single system workstation).

D. System Performance:

- 1. Graphics: System shall display a graphic with at least 20 dynamic points with all current data within 10 seconds of being initially displayed. System shall refresh a graphic with at least 20 dynamic points with all current data within 8 seconds.
- 2. Object Command: Commands of a binary object entered at local workstations shall be executed at the commanded device within 2 seconds of being entered; analog objects shall start to adjust within 2 seconds.
- 3. Current Data: Any data used or displayed at a controller or local workstation shall be current within the previous 6 seconds.
- 4. Alarm Response: Maximum time between an alarm event at it being annunciated shall be 45 seconds.
- 5. Program Execution Frequency: Applications shall be capable of running as often as every 5 seconds; select execution times that are consistent with the process under control and provide optimum comfort and control of setpoints without excess deviation. Controllers shall be able to execute PI and PID control loops at a selectable frequency of at least once per second; with the process value and algorithm output updated at this same frequency.
- 6. Reporting Accuracy: Control system reporting end-to-end accuracy shall be no less than the following: Temperatures: Plus/minus 1 deg F.
- 7. Stability: System shall provide stable and accurate control operation without excessive variation of controlled variables; variation shall in no case be more than 1.5 the reporting accuracy for temperatures, and the same as the reporting accuracy for other variables.

2.03 HYDRONIC CONTROL VALVES

- A. Valves shall be two position, normally open. The valves shall be sized by the control manufacturer and be provided with actuators of sufficient power for the duty intended. Valve body and actuator selection shall be sufficient to handle system pressure and shall close against the differential pressures liable to be encountered in the system.
- B. Valves shall be constructed with a cast-brass body and screwed ends. Valves shall be selected for a maximum 2 psi pressure drop at design flow unless indicated otherwise.

2.04 ACTUATORS

- A. General: Actuators shall use a brushless DC motor controlled by a microprocessor with protection from overload at all angles of rotation. Run time shall be constant, independent of torque. Actuator shall have manual positioning mechanism and direction of rotation control switch and visual position indicator. Housing shall be NEMA rated to suit the conditions at the actuator location.
- B. Type: Proportional or two position or floating point type, as required for application. Proportional type shall modulate in response to a 2-10 VDC, or 4 to 20mA control input. Provide with auxiliary switches as required for sequence of operation and to allow for safe

operation of items served (and interlocked items), switches shall meet requirements for "double insulation" so an electrical ground is not required.

- C. Automatic Closure: Actuator shall spring return upon power interruption, spring return position shall be fail-safe as dictated by freeze, fire or temperature protection requirements; except that actuators required to be the fast operating type may utilize a capacitor discharge for fail-safe closure in lieu of spring (subject to Engineer's approval). Spring return is not required for air terminal unit dampers or for zone dampers.
- D. Performance: Actuator power and torque shall be sufficient to match dampers or valves being controlled and allow proper damper and valve operation against system pressures liable to be encountered. Actuator shall be capable of driving control devices from full closed to full open in less than 90 seconds (unless indicated otherwise) and where fast operating type are required (i.e. where interlocked with equipment operation). Where actuators serve valves or dampers directly serving equipment (e.g. boiler water flow control valves) or are interlocked with equipment operation (e.g. make-up air equipment dampers) verify required operating time of actuator with equipment manufacturers and timing of other system components to allow for proper system operation without nuisance shutdowns of equipment or creating undesirable effects due to improper actuator response time.
- E. Accessories: Units shall be complete with all brackets, and hardware required for mounting and to allow for the proper control for the application of the regulated damper or valve.

2.05 VARIABLE FREQUENCY DRIVES

- A. Type: Adjustable frequency and voltage variable speed controller, pulse width modulated type.
- B. Controller: Shall be housed in a NEMA 1 (or better) enclosure, and shall provide 6 to 60 Hz adjustable torque output. Standard Features:
 - 1. Start-stop speed selection.
 - 2. Manual speed potentiometer.
 - 3. Input fuses.
 - 4. Insensitive to incoming power phase sequence.
 - 5. Adjustable volts/Hertz.
 - 6. Output frequency stabilized to + 0.5% of set speed for +10% to -5% change in line voltage of 15 degrees C change in ambient temperature.
 - 7. Output voltage regulated to + 1% of rated voltage with +10% to -5% variations in plant power.
 - 8. Standard off-the-shelf, NEMA B and synchronous motors (3600, 1800, 1200 rpm) usable without derating controller.
 - 9. Automatic shutoff under output short circuit conditions or when load current exceeds 150% of maximum output amps (RMS).
 - 10. Input fuses.

- Line transient protection to prevent power line transients from harming the controller.
- 12. Monitor lamps (or LCD display) indicating: power on, zero speed, enabled, unit failure (with type indicated).
- 13. Hand-Off-Auto switch.
- 14. Auto restart after power outage.
- 15. Input Disconnect (meeting NEC requirements for unit power disconnect).
- 16. Output Contactor for positive motor disconnect.
- 17. Output Overloads using individual phase bimetallic thermal sensors.
- 18. Ammeter ampere scale depending upon drive rating.*
- 19. Voltmeter -0 to 500 volt (460 volt drives); 0 to 750 volts (575 volt drives).*
- 20. Frequency Meter 0 to 120 Hz scale.
- C. VFD shall be for use with specified equipment. Unit shall accept appropriate control signal and provide for variable speed operation of unit served.
- D. System shall be fully compatible with motors furnished, and shall be free of audible noise exceeding an NC of 45 in any octave band.

2.06 ACCESSORIES

- A. Wiring and Conduit:
 - 1. Basic Materials: As specified in Division 26.
 - 2. Power Wiring: 18 AWG minimum and rated for 300 VAC service. Wiring for circuits greater than 24 V shall be as specified in Division 26.
 - 3. Analog Signal Wiring: Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.
 - 4. Life Safety Applications: Wiring that performs code required life safety control (e.g. shutdown of equipment), control of engineered smoke systems, fire alarm interface and similar functions shall comply with code and NFPA standards for fire alarm system wiring and the specific application.

B. Labels:

- General: Match existing labeling practices used by control manufacturer and consistent with Owner standard.
- Control Devices: Labels on control devices shall use the same designation that appears on the control shop drawings and an indication as to purpose; except that

devices in finished rooms shall be labeled as to the generic item controlled for better user understanding (i.e. 'Room Exhaust Fan", "Hood Fan").

- 3. Wiring: Wiring labels shall be the self-laminating or heat shrink type with numbering, lettering, or an alpha-numeric identifier indicating the wire signal/power purpose and matching the designation that is used on the control drawings
- C. Control Cabinets: Wall mounted, NEMA rated construction, type and rating to suit location environment, UL listed, minimum 14 gauge sheet metal, hinged front door with latch. Size as required to house controls. Controls/devices shall be logically assembled in cabinet, with all devices and cabinet labeled.
- D. Relays/Contactors: Shall be the single coil electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contacts shall be doubled break silver to silver type protected by arching contact where necessary. Number of contacts and rating shall be selected for the application intended. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage. Relays shall have mechanical switching to allow manual operation of relay and LED light to indicate the energized state.
- E. Miscellaneous Sensors/Transmitters/Switches/Transformers: Shall be manufacturer's standard, designed for application in commercial building HVAC control systems, compatible with other components so as to provide sequence of operation specified.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Provide all computer software and hardware, operator input/output devices, sensors, relays, switches, dampers, actuators, conduit, tubing, wiring, motor starters, transformers, control cabinets, power panel circuit breakers, system design, and all other components required to provide a complete control system with the system features and sequence of operation specified. Select control components with proper characteristics to suit the application, meet specified system performance, provide specified system features, and provide the specified sequence of operation.
- B. Electrical Power and Wiring:
 - 1. General: All work shall comply with code and Division 26 requirements. Run conduit and wiring in neat lines, parallel with building construction and coordinated with other trades. Use wire type and size as required by code and recommended by component manufacturers and to suit the application conditions.
 - Conduit: All wiring shall be installed in conduit and in accordance with Division 26 section of these specifications, except that low voltage wiring within ceiling plenum spaces and in mechanical mezzanine areas may be ran without conduit provided that plenum rated cable is used. Install all conduit and wiring parallel to building lines.
 - 3. Electrical Power:
 - a. Scope: It is the responsibility of the Division 25 Contractor to provide power for all control devices requiring electrical power. Coordinate with the

Division 26 Contractor to confirm which panels and circuits are to be utilized. Provide all electrical wiring, conduit, junction boxes, circuit breakers, grounding, panel circuit breakers (of proper size/type), transformers, enclosures and all other components as needed to power all control devices in accordance with code and Division 26 requirements.

- b. Sources: Power for control devices shall be obtained from electrical panels and not from power serving the equipment (unless noted otherwise or the Engineer gives approval). Utilize panels located closest to the items served to the greatest extent possible. Where the building has a generator, equipment served by the generator shall also have their control power (i.e. power to control devices which allow the item to be controlled and monitored) shall also be served by the generator (this is in addition to any required UPS').
- 4. Service Loop: Provide minimum of 6" extra wiring at all wiring terminations for ease of future maintenance/servicing. Such extra wiring shall be neatly coiled/bundled to allow for uncoiling when the connected equipment is serviced.
- 5. Miscellaneous Control Wiring: Provide all necessary control wiring between equipment to allow for proper operation. This includes AC units, chillers, boilers, kitchen hoods, and items furnished by others or under other Sections of the specifications.
- C. Labeling: All control components, except regular room thermostats, shall be labeled. All control wiring shall be labeled except where color coded wiring is used and the control shop drawings clearly identifier wiring for each color and it is fully consistent through-out the entire project. Submit list of proposed labeling prior to installing.
- D. Complete Functions: Provide complete system totally programmed to provide all specified functions, including but not limited to:
 - 1. Master Menu and Graphics as requested by the Owner.
 - 2. All Controller Setpoints and Operational Values Required.
 - 3. Demand Limiting.
 - 4. Optimum Start/Stop and Warm-up.
- E. Electrical Phase Loss: Provide all necessary wiring, components, software, and accessories to monitor building electrical power quality and 3-phase power; initiate shutdown of 3-phase powered mechanical equipment on loss of a phase.
- F. On/Off Status Indication: All devices which indicate on/off status to GUI, shall have this on/off status manually or automatically controlled from GUI, and shall have positive proof of on or off by differential pressure switch or other applicable device.
- G. Programming: Provide complete system totally programmed to provide all specified sequences, monitoring data, communications and features.
- H. Installation: Provide all wiring, connections, and accessories for items indicated to have a control sequence as necessary to accomplish the sequence indicated.
- I. Refrigerant Gas Detector: Provide exhaust/sample tubing per manufacturer.

TACOMA PUBLIC LIBRARY SECTION 25 50 00 HVAC REPLACEMENT INTEGRATED AUTOMATION FACILITY CONTROLS BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

3.02 START-UP

A. Calibration and Commissioning: As each part of the systems become operational, this Contractor shall calibrate all sensing and readout devices and shall test and observe the operation of each and every air moving and/or heating unit and shall adjust all controls so that the items function according to the intent of the specifications. The control contractor shall commission all controls. This commissioning work shall include a point-to-point check of all devices, check of sequences, check of proper wiring, and documentation substantiating the work.

B. Owner Instruction: See Section 20 05 00.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.
- B. Requirements of Section 20 05 00 apply to this Section.

1.02 WORK INCLUDED

- A. Control System Design.
- B. Control System Sequence of Operation.

1.03 SUBMITTALS

- A. General: Comply with Section 20 05 00.
- B. Sequences: Submit complete description of sequence of operation for all systems. Sequence submitted shall not be a direct copy of the sequence specified herein, but shall be written to reflect the actual control sequences provided and to more closely match the actual programming used.
- C. Programming: Submit copy of system programming logic.

1.04 GENERAL REQUIREMENTS

- A. Modifications: Software, graphics, and sequences shall be revised and updated as necessary to reflect Owner or Engineer desired changes. Contractor to include in bid no less than 16 hours of control technician's/programmer's time to accomplish the required system modifications.
- B. Sequence Terminology: Wherever the control sequences refer to an article, device or piece of equipment in the singular number, such reference shall mean to include as many of such articles, devices, or equipment as are shown on the plans, required for the sequence, or required to complete the installation. Wherever the control sequence refers to an operating stage in the singular number, such reference shall mean to include as many stages as are specified for the equipment and shall mean analog (i.e. proportional) type control where specified for the equipment (reference drawings and equipment specifications).
- C. All DDC Control: All controls and sequences shall be provided by the Division 25 DDC control system, unless specifically noted otherwise. Where interval timer, switch control, or a similar manual control is indicated, the control device shall provide an input to the DDC system with the DDC system providing an output for control. No line voltage controls or other controls which do not "pass through" the DDC control system are allowed, unless directly stated that is the method of control to be used. Exceptions to DDC Control: emergency shut-down and similar safety devices required (or noted) to be hard wired.

PART 2 - PRODUCTS

NOT USED

PART 3 - INSTALLATION

3.01 GENERAL

A. Complete System:

- 1. General: Provide all software, programming, wiring, and control devices as required to allow for automatic control of all mechanical equipment and other systems as indicated; with sequences of operation and features specified; see also Section 25 50 00. Provide all control interconnections between indoor and outdoor units, all required control connections between equipment components, and to any other devices needed for proper operation.
- Various thermostats, motorized dampers, and other devices are not shown on the drawings but are required per the sequence of operation specified. Coordinate with Engineer for location of all such devices prior to installing. Indicate proposed locations on submittals.

B. Sequences:

- 1. Additional Sequences: See Section 25 50 00 for system requirements that relate to control sequences; see drawings for additional control sequences and requirements.
- 2. Control Action: Sequences which involve maintaining a setpoint in response to variable conditions shall use proportional-integral (PI) or proportional-integral derivative (PID) control (unless noted otherwise). Sequences shall comply with the system performance requirements and other requirements of Section 25 50 00.
- 3. Missing Sequences: Where no sequence of operation is indicated submit a proposed sequence to the Engineer for review. Such sequences shall match the intended equipment use, code, and ASHRAE standards for the type of equipment and application. HVAC equipment shall have control of heating/cooling operation by area thermostats and control of unit components (i.e. fans dampers) to allow for distribution of heating/cooling and control of ventilation air; fans and similar on/off items shall have time schedule and thermostat control (unless the application clearly implies a different method).

C. Settings:

- 1. Adjustability: All settings, setpoints, and differentials shall be adjustable. All setpoints indicated are initial settings.
- 2. Confirm Settings: Confirm with Owner all setpoints, all time schedules, and all other adjustable programming parameters before substantial completion.
- 3. Thermostat Setpoints: Shall be adjustable at operator's workstation, with initial settings as follows unless indicated otherwise:

Occupied Heating 70°F

Unoccupied Heating 65°F Occupied Cooling 75°F Unoccupied Cooling 85°F

D. Time Control:

- 1. Control system shall provide time schedules for occupied/unoccupied mode switching for all items having sequences with occupied/unoccupied modes, and for all items indicted as having time schedule control.
- 2. Provide independent time schedules for all mechanical equipment, except where equipment is indicated to be interlocked to other equipment.
- 3. Provide seasonal (i.e. time of year) control for all mechanical equipment.
- 4. Provide a single Holiday Schedule or Master Holiday schedule for logical equipment groups as directed by the Owner at submittal time and revised by the Owner during the Owner training. At the end of the warranty period readjust the grouping of equipment as directed by the Owner.
- 5. Provide independent optimum start schedules (i.e. warm-up cycles) for mechanical equipment indicated to have (or required to have) optimum start.
- E. Hand-Off-Auto Control: Provide all control devices and connections to allow Hand-Off-Auto (HOA) control of all controlled items; where unit starters or VFD's provide HOA control no additional controls are required, but this Section controls shall be arranged to allow for HOA controls.
- F. Average Thermostats: Where average thermostats are indicated on plans combine and average requirements from each sensor and use these average requirements to control unit. Averaging shall combine the deviation from setpoint from each thermostat and rate of change of this deviation combined to create control values as if they are from a single thermostat to determine control actuation. Each thermostat shall have the same functions as the other. Provide means (at GUI, in single screen command) the ability to select between use of either thermostat.
- G. Variable Speed Operation: On variable speed (including staged) equipment, start equipment low speed (or other appropriate speed as recommended by equipment manufacturer or system requirements) and control speed changes at a rate that is coordinated with other equipment to provide proper system operation without undesirable effects, nuisance trips and system alarms.
- H. Alarms: Provide alarms for the following:
 - 1. Status of item does not equal commanded status (where proof of status is monitored, e.g. supply fan not proven on when commanded on).
 - 2. Equipment in alarm (where equipment alarm state is monitored).
 - System response is not consistent with commanded response (e.g. air handling unit SA temperature is not less than MA temperature and unit is commanded to cooling).
 - 4. Freezestat alarm.

- 5. Safety device alarm (where device is monitored by or connected to the control system).
- 6. Space temperature in alarm range (10°F or more above cooling setpoint; 10°F or more below heating setpoint).
- 7. Sensor failure (out of range).

I. Fire/Smoke Shutdown:

- 1. Smoke Detector: Provide necessary conduit, wiring, and accessories to shutdown each unit upon activation of that unit's smoke detectors. Connections shall be hardwired; independent of any control system logic, so that failure of control system or loss of control system will in no way prevent the shutdown of each unit. In addition to shutting down the unit with the alarmed smoke detector, all equipment interlocked or served by that unit shall be off. Other units shall also shut-off as required to avoid building pressure differentials and similar undesirable effects.
- 2. Fire Alarm System: Shut-down all air handling equipment when the building fire alarm system goes into alarm. Contacts in the fire alarm system are available for this purpose. This shut-down may be accomplished by use of control logic and is not required to be hardwired but shall be of a fail-safe nature so as to provide the necessary shut-down in case of control failure and the control components shall be rated for such purposes (as required by the AHJ).

J. Automatic Restart:

- 1. General: Equipment shall automatically restart after being shut-off by a power outage, fire alarm, smoke detector, or similar alarm (or fault); upon clearing of the alarm (or fault). System shall revert to its normal operation for the conditions at the time of restarting.
- 2. Controlled Restart: Provide controlled re-start by building wing or building floor and in a manner to prevent pressure differentials, equipment issues, or other undesirable effects. Provide time delay on the re-start of equipment 2.5 KW and larger to minimize electrical surges.
- K. Interlocks: May be accomplished by software rather than field hard wired relays or other devices, except for: fire alarm shut-down of equipment 2000 cfm and greater, freezestat shutdown, boiler and chiller emergency shut-off switches, where required by manufactures, where required by AHJ, and where noted to be hard-wired.

3.02 AIR-TO-AIR HEAT PUMPS

A. General:

- 1. Control unit's cooling, heating, and system dampers (economizer), in proper sequence to provide a supply air temperature that will satisfy space conditions.
- 2. Heating and cooling shall be properly sequenced so that there is no overlap between the use of heating and cooling.
- 3. Controls shall evaluate the space deviation from setpoint and rate of change of

this deviation to determine heating/cooling and economizer operation to satisfy setpoint without excess variation in space temperatures.

B. Occupied Mode:

- 1. Fan: Fan shall run continuously.
- 2. Shall be activated by central time schedule or if any thermostat's override mode is activated.
- 3. Heating: Heat pump shall operate at initial stage of heating, with supplementary electric heater as final stage. Activate heater when outdoor unit goes into defrost.
- 4. Cooling: Heat pumps with economizers shall use outside air economizer as the first stage of cooling. Economizer shall be dry bulb or enthalpy type, using OA temperature sensor, Mixed Air (MA) temperature sensor and supply air (SA) temperature control scheme. Economizer shall be enabled only when OA temperature (or enthalpy) is less than the units Return Air (RA) temperature (or enthalpy). The OA/RA dampers shall be modulated as required to satisfy the SA temperature control scheme and shall be limited by a MA sensor low limit setpoint (initial setpoint 54°F). Heat pump shall operate in the cooling mode as the final stage of cooling.
- 5. OA Dampers: OA dampers shall be in the minimum position when unit is in heating and under economizer control when unit is in cooling. OA damper shall not close below the minimum airflow setting indicated on the plans; coordinate with balancer for minimum setting.
- 6. Relief Dampers: Motorized relief dampers (where applicable) shall operate in unison with the OA dampers to progressively open as the OA dampers open; provide with an offset control so that the relief dampers do not begin opening until the OA dampers are at least 15% open.
- C. Unoccupied Mode: Unit fan and heating/cooling shall cycle on and off as required to maintain unoccupied setpoints. OA dampers shall be fully closed unless economizer cooling is required.
- D. Warm-up Mode: Unit shall run as in the unoccupied mode (OA fully closed) until the space temperature has warmed up to the occupied mode heating setpoint, then unit shall operate as specified for the occupied mode.
- E. Mode Control: Units' mode of operation shall be determined by time schedule and time schedule override; warm-up mode shall be initiated by optimum start controls.

3.03 WATER SOURCE HEAT PUMPS

A. General:

- Coordinate with water source heat pump requirements to provide proper interface devices to allow for proper unit operation and the control functions specified.
- 2. Provide proportional and integral type control so that space temperature

overshoot is minimized.

- 3. Operate heat pump hydronic valve allowing water flow to unit prior to activation of unit compressor. Close valve when compressor is no longer operating, after a 30 second delay.
- B. Occupied Mode: Fan shall run continuously.
 - 1. Heating: Outdoor air damper shall be in minimum outside air position. Heat pump shall cycle in heating mode as required to satisfy space thermostat.
 - Cooling: Use of outside air (i.e. economizer) shall be the first stage of cooling. Economizer shall be allowed to operate when OA temperature is less than the RA temperature. Economizer outdoor air and return air dampers shall modulate to maintain mixed air temperature setpoint, with a low limit of 54°F (adjustable). Where units are equipped with relief dampers interlock with OA/RA dampers such that relief dampers open when OA dampers open. Delay opening of relief damper until OA damper is 15% or more open, then provide custom signal to drive relief damper open parallel with OA damper so that both dampers arrive at 100% open at the same time. Compressor cooling shall be the second stage of cooling and shall be integrated with economizer operation.
- C. Unoccupied Mode: Unit shall cycle on and off as required to maintain setback temperatures. Outdoor air dampers shall be fully closed, return dampers fully open, relief dampers fully closed. Fan shall cycle with unit cycling.
- D. Warm-up Mode: Unit shall run as in the unoccupied mode (outdoor air dampers fully closed) until the space temperature has warmed up to the occupied mode heating setpoint, then unit shall operate as specified for the occupied mode.
- E. Mode Control: Units' mode of operation shall be determined by central DDC time clock and time clock bypass switch; warm-up mode shall be initiated by central optimum start controls.
- F. Water Flow Interlock: Units shall be interlocked with flow for circulating pumps that serve units, such that the heat pumps are locked out if there is no flow.
- G. High/Low Temperature Interlock: Units shall be interlocked with system loop temperatures such that if temperature is greater than 100°F (adjustable) or less than 25°F (adjustable), units are locked out.

3.04 WATER SOURCE HEAT PUMP LOOP

A. General:

- 1. Operate boilers and fluid cooler to maintain loop temperature between limits. Boilers shall be off when fluid cooler is allowed to operate.
- 2. Loop temperature shall be maintained between "high" and "low" setpoints. Initial setpoints (adjustable):

High 80 deg F Low 65 deg F

B. Fluid Cooler:

- 1. General: Operate in stages to maintain system below "high" setpoint.
- 2. Operation: Provide 30 second delay between change in fan speeds. Controls shall stage fluid cooler as follows:

<u>Stage</u>	<u>Operation</u>
1	Dampers open and spray pump on
2	Fan On - Low Speed
3	Fan On - High Speed

- 3. Fluid Cooler Controls: Provide all control devices, power wiring, and control wiring to allow proper operation. This includes but is not limited to the following:
 - a. Closure Dampers: Provide time delay relay and connections for dampers to close when unit is off and operate as first stage with unit operation. Time delay shall prevent unit operation until dampers are fully open. Provide damper actuator.
 - b. Water Level Controls: Connect solenoid valve to operate and provide make-up water at proper levels and to be closed upon loss of power.
 - c. Immersion Heater: Interlock with spray water pump to de-energize heaters when spray pump is running. Connect thermostat for operation at temperatures below 40°F.
 - d. Power: Provide power wiring and fusing to all control devices requiring power. See electrical drawings for extent of Division 26 work.
- 4. Heat Tracing: Maintain existing heat tracing controls to allow for pipe freeze protection.

C. Boilers:

- 1. General: Operate boilers to maintain system above "low" setpoint. Boilers shall be off when OA temperature is above boiler lockout setpoint; initially set at 65°F.
- 2. Modes: Provide the following modes of operation selectable at the COS:
 - a. Off: Boilers shall be off.
 - b. On: Boilers shall be enabled to operate, and shall fire as controlled by the boiler's integral controls to maintain system "low" setpoint plus 2 deg F.
 - c. Auto: System shall control boilers in a lead/lag fashion. Provide operator selection for which boiler is lead and which is lag, and run-time totalization for each boiler in each mode. Lead boiler shall operate whenever OA temperature is 2 deg or more below boiler "lockout" setpoint; boiler shall be off when OA temperature rises to "lockout" setpoint (or fluid cooler is activated). Lag boiler shall operate if return temperature to boilers is 3 deg F or more below system "low" setpoint. Lag boiler shall be disabled 24 hours after being activated, with 5 minute

delay before being enabled again. When enabled, boilers shall be controlled by their integral controls to maintain system "low" setpoint plus 2 deg F (initially 67 deg F).

- 3. Provide controls to inter-tie boiler alarm indication into DDC system.
- 4. Emergency Boiler Shutdown: Connect boiler controls through a wall mounted emergency shutdown switch to completely stop boiler operation when switch is pressed.
- D. Water Source Heat Pump Loop Circulation Pumps (CP-1A, 1B):
 - 1. General: One pump is a standby the other pump is the primary pump. Provide system occupied and unoccupied time schedule. When system is in the occupied mode the primary pump shall run continuous. When in the unoccupied mode any water source heat pump unit calls for heating or cooling, the primary pump shall run.
 - 2. Primary/Standby Sequence: Provide operator selection of which pump is primary and which is standby. Provide pressure switch and time delay relay to allow automatic transfer to standby pump in case of primary pump failure; de-energize primary pump when transfer occurs. Provide manual reset means at COS and in mechanical room to restore normal pump operation after standby operation. Provide alarm indication upon pump failure. Provide alarm light and reset button in mechanical room. Provide "alternator" sequence to allow for automatic alternating of pumps (if selected at COS).
 - 3. Speed Control: Pumps shall be controlled by variable frequency drive (VFD). Provide a VFD for each pump. Provide differential pressure sensor to control VFD (and pump speed) to maintain system differential. Locate differential pressure sensor in main S/R piping; verify setpoint and location with engineer.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. General requirements specifically applicable to Division 26 in addition to provisions of General Conditions, Supplementary Conditions, and Division 01.
- B. General requirements of this section also apply to Division 28.

1.02 SCOPE OF ELECTRICAL WORK

- A. Provide electrical systems and Work described, identified, specified, referenced, and shown in the Project Documents that are covered under Divisions 26 and 28 of the Construction Specifications Institute (CSI) and/or as otherwise regulated by national, state, and local electrical codes. Electrical Work includes providing all equipment, materials, devices, appurtenances, and accessories necessary to provide complete and operating systems according to the intent of Project Documents.
- B. Electrical work is not limited to Division 26 and 28 specifications and what is shown on the electrical drawings. The Contractor is responsible to review all Project Documents for additional Electrical Work and requirements and to include this work as part of their scope under the Contract.

1.03 REGULATORY REQUIREMENTS

A. Comply with requirements of the following codes as adopted and supplemented by authority having jurisdiction:

ANSI/NFPA 70 - National Electric Code (NEC)

NFPA 101 - Life Safety Code

International Building Code (IBC)

International Mechanical Code (IMC)

WAC 296-46B - Washington State Electrical Safety Standards, Administration, and Installation

Washington State Energy Code (WSEC)

- B. Comply with additional codes and regulations referenced in other sections.
- C. Comply with additional codes and regulations required by authority having jurisdiction.
- D. Obtain and pay for permits, and inspections from authorities having jurisdiction over work included under applicable Division Sections.
- E. Include all testing, shop drawings, and documentation required by the inspection authorities for permitting and final approval.

1.04 SUBMITTALS

- A. Comply with requirements of Division 01. Unless otherwise specified, furnish product data and shop drawings to Engineer as follows:
 - 1. Product information sheets shall be neat, readable, 8.5 x 11 inch, submitted in PDF format. Generic product sheets with multiple products or product descriptions shall clearly highlight or otherwise indicate which product is being

furnished.

- 2. Furnish product submittals with index tabs between categories or in separate submittals that correspond to each section of the specifications. Transmittal shall indicate name of the Project, Owner, Architect, Engineer, Contractor, and Date of Submittal.
- 3. Furnish system design shop drawings in PDF format. Title block shall include Project, Owner, Contractor, and Date of Submittal.
- 4. Furnish product data and shop drawings specifically indicating any conflict or deviation from requirements of contract documents.
- B. Confirm dimensions, ratings, and specifications of electrical materials, devices, fixtures, and equipment conform to project requirements prior to furnishing submittals. Coordinate electrical requirements with utilization equipment submitted under other sections and verify that voltage, phase, and rating are compatible with work shown in the electrical project documents.
- C. Do not order materials or commence Work until applicable submittal has been reviewed and the Architect/Engineer has approved or taken other appropriate action.

1.05 SUBSTITUTIONS

- A. Comply with requirements of Division 01. Products specified by naming one or more manufacturers establishes a basis for quality, styling, capacity, and function. Unless otherwise specified, written requests for substitution must be received at least 14 days prior to Bid Opening by Architect/Engineer who will determine acceptability of proposed substitution. Written acceptance must be obtained from Architect/Engineer prior to Bid Opening.
- B. Substitution requests may be submitted for any manufacturer or named product unless specified as "no substitute".
- C. Substitution approval does not relieve the Contractor of complying with the work requirements or the concept and intent of the project documents. Pay for any and all additional project costs that may be caused by Contractor requested substitutions, regardless of whether or not additional costs are overlooked, missed, or unforeseen, and regardless of when substitutions may be approved.

1.06 RECORD DOCUMENTS

- A. Comply with requirements of Division 01. Maintain at project site one set of clean, dry, and legible red-lined record drawings for submittal at Contract Close-out. Record information concurrently with construction progress.
- B. Indicate electrical changes in the contract documents. Include change orders, revised branch circuit and feeder wiring layouts, revised circuit identification, pull & junction boxes added during construction, and actual dimensioned location and routing of each underground conduit on record drawings.
- C. Record branch circuit routing, switch legs, equipment connections, and home runs on the power and lighting plans. Indicate conduit size, wire counts, and conductor size if greater than a #12 2-wire branch circuit or feeder.

1.07 LABELING

A. Where labeling that includes room names and numbers is required for any system to identify devices or for programming purposes, use final room names and numbers determined during construction. Verify room names and numbers prior to manufacturing labels or programming software.

1.08 OPERATION AND MAINTENANCE MANUALS

- A. Comply with requirements of Division 01. Unless otherwise specified, furnish one labeled CD in PDF format and two duplicate hard copy printed sets of Operation and Maintenance Manuals prior to completion of contract. Submit hard copy manuals in labeled and indexed 3-ring binder(s).
- B. Include the following information as applicable:
 - 1. Names, addresses, and telephone numbers of the contractor, the installing sub-contractor, and the local representative for each system or equipment.
 - 2. All approved product data and shop drawings.
 - 3. Identify all manufacturer warranties which exceed one year.
 - 4. Model number and serial number of each piece of equipment provided.
 - 5. Data from test results performed under the Contract.
- C. Operation and maintenance data shall include complete parts lists, installation and maintenance instructions, safety precautions, operation sequence describing start- up, operation, and shut-down, internal and interconnecting wiring and control diagrams with data to explain detailed operation and control, and testing methods for each system and item of equipment.
- D. Furnish a draft copy of Operations and Maintenance Manual for Engineer review and incorporate comments prior to final submittal. Allow 14 days for Engineer review.

1.09 CONFLICTS

A. Notify the Engineer of any conflicts or discrepancies before proceeding with any work or the purchasing of any materials related to the conflict or discrepancy until requesting and obtaining written instructions from the Engineer on how to proceed. Where conflicts occur, the most expensive and stringent requirement as judged by the Engineer shall prevail. Any work done after discovery of such discrepancies or conflicts and prior to obtaining the Engineer's instructions on how to proceed shall be done at the Contractor's expense.

1.10 WARRANTY

- A. In addition to requirements covered under General Conditions or Division 01, include manufacturer product warranties that exceed one year. Assemble or list warranties that exceed one year in Operation and Maintenance Manuals indicating start date. Certificates of extended warranty shall identify the Owner as the beneficiary.
- B. If the Electrical Contractor does not have offices located within 150 miles of the project,

provide a service/warranty work agreement with a local electrical subcontractor approved by the Owner. The service/warranty work agreement shall extend for the contract warranty period, and a copy shall be included in the Operation and Maintenance Manuals.

1.11 INTENT OF PROJECT DOCUMENTS

- A. Drawings and specifications are complementary and what is called for in either is binding as if called for in both.
- B. The drawings are diagrammatic and show the general arrangement of the construction and do not attempt to show all features of work, exact construction details, or actual routing of conduit and cable. Provide all necessary supports, off-sets, bends, risers, fittings, boxes, wiring, and accessories which are required for a complete and operating installation. Determine locations for required electrical outlets and connections prior to rough-in base on equipment product and installation submittal data and/or review of equipment on site.
- C. The level of design presented in the documents represents the extent of the design being furnished to the Contractor; any additional design needed to perform the Work shall be provided by the Contractor. All design by the Contractor shall be performed by individuals skilled and experienced in such work, and where required by local code (or elsewhere in the documents) shall be performed by engineers licensed in the State where the project is located. Include in bid the costs of all such project design; including engineering, drafting, coordination, and all related activities and work. Contractor provided design services shall be included for but not limited to bidder design specifications, temporary electrical systems, layout routing to install the Work and share project space with other building systems, hanger and support systems, seismic bracing, preparation of shop drawings, locating and identifying requirements for equipment and fixture terminations, and methods/means of accomplishing the work.

1.12 COORDINATION

- A. Examine mechanical drawings and specifications and consult with other trades, as required to coordinate use of Project space and sequence of installation.
- B. Arrange wiring and equipment to avoid interference with other work and to maximize accessibility for maintenance and repairs.
- C. Coordinate with suppliers and installers to obtain product electrical data, shop drawings, and installation requirements for systems, equipment, and products furnished by Owner and/or other trades as required perform electrical work.
- D. Contractor is responsible ensure that equipment, fixtures, and devices being furnished and installed shall fit the space available, taking into account connections, service access, and clearances required by product manufacturer and/or Code. Contractor shall make the necessary field measurements to ascertain the space requirements for proper installation, and shall furnish and/or install equipment so that final installation meets the intent of the Project Documents. If approval is received by Addendum or Change Order to use other than the originally specified items, Contractor shall be responsible for specified capacities and for ensuring that items to be furnished will fit the space available.
- E. Contractor is responsible to review all the Project Documents and approved shop drawings provide under other divisions to identify and resolve conflicts between electrical systems and building construction, equipment, cabinets, counters, trim, and special

finishes, prior to rough-in.

1.13 REQUIREMENTS FOR EQUIPMENT FURNISHED UNDER OTHER SECTIONS OR BY OWNER

- A. Provide power wiring, disconnect switches, electrical connection of equipment, installation of furnished electrical controllers, parts, and accessories, and field wiring for systems, equipment, and products furnished under other divisions or by Owner. Install controllers, operator stations, and control devices such as limit and temperature switches furnished with equipment.
- B. Review equipment submittals prior to electrical rough-in and installation. Verify location, rating, size, type of connections, and required space requirements. Coordinate field wiring requirements and details with supplier and installer. Notify Architect/Engineer of conflicts between requirements for actual equipment being furnished and equipment indicated in contract documents prior to commencing Work.
- C. Provide motor controllers and operator stations unless otherwise indicated on the project drawings.
- D. Make final connections to equipment. Provide cord and plug where required for plug-in connection.

1.14 DEFINITIONS

- A. Electrical terms used in these specifications are as defined in NEC Art. 100 unless otherwise noted.
- B. Abbreviations: Where not defined elsewhere in the Contract Documents, shall be as defined in RS Means Illustrated Construction Dictionary.
- C. Accessible Ceiling: Signifies access that requires the removal of an access panel or similar removable obstruction.
- D. As Required: As necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all codes.
- E. Concealed: Hidden from view as in walls, trenches, chases, furred spaces, crawl spaces, unfinished attics, and above suspended ceilings.
- F. Conduit: Includes conduit and tubing raceways.
- G. Coordinate: Accomplish the work with all others that are involved in the work by directly discussing the work with them, arranging and participating in special meetings with them to discuss and plan the work being done by each, obtaining and completing any necessary forms and documentation required for the work to proceed, reaching agreement on how parts of the work performed by each trade will be installed relative to each other both in physical location and in time sequence, exchanging all necessary information so as to allow the work to be accomplished with a united effort in accordance with the project requirements.
- H. Equipment Connection: Make branch circuit connection, mount and connect control devices as required. Provide disconnect and overcurrent protection when required by

NEC and IMC, if not otherwise indicated or furnished with equipment.

- I. Exposed: Exposed to view in any room, hallway, passageway or outdoors.
- J. Finished Areas or Spaces: Areas and/or spaces receiving a finish coat of paint on one or more wall surface.
- K. Furnish: Obtain and/or prepare and deliver to the project.
- L. Indicated: Shown, scheduled, noted, or otherwise called out on the drawings.
- M. Install: Enter permanently into the project complete and ready for service.
- N. Open Cable or Wiring: Conductors above grade not installed in conduit or raceway.
- O. Panel: Distribution panelboard, lighting and appliance panelboard, load center, and/or low voltage cabinet.
- P. Provide: Furnish and install complete and ready for service.
- Q. Wiring: Conductors in raceway or an approved cable assembly.
- R. Verify: Obtain, by a means independent of the project Architect/Engineer and Owner, the information noted and the information needed to properly perform the work.

1.15 SCHEDULE OF VALUES

- A. Provide Schedule of Values for use by Engineer to evaluate progress payment requests during construction.
- B. Submit Schedule of Values using the line items included at the end of this Section.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT

- A. General: Furnish only products that are new and free from defects with a manufacture date that is less than six months from date of installation. Where product and applicable software updates or upgrades are available from the manufacturer, furnish the latest version unless otherwise specified. Furnishing discontinued products and/or products of manufacturers who are no longer in business is not permitted.
- B. Listing and Labeling: Furnish and install only products that are listed and labeled by one or more of the following testing laboratories as approved by the Authority Having Jurisdiction:

Underwriter's Laboratories, Inc. (UL)
ETL Testing Laboratories, Inc. (ETL)
Factory Mutual (FM)

C. Each specified product and system to be furnished shall be from a single approved manufacturer. Providing multiple product brands or manufacturers for each type or category, or for multiple units of the same specified product and/or system, is not

permitted.

D. Products shall be delivered, handled, and stored per manufacturer recommendations. Protect fixtures, materials, and equipment from rain, water, dust, dirt, snow, and damage. Do not install products that have marred, scratched, deformed, or otherwise damaged. Do not install products that have been wet or exposed to the weather prior to assembly and/or installation.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. Electrical work shall conform to requirements of ANSI/NECA 1-2015, Standard Practice of Good Workmanship in Electrical Construction.

3.02 INSTALLATION

- A. Provide all electrical work as specified and shown in the Project Documents. Provide all labor, equipment, material, accessories, and testing for electrical systems complete and operating. Include all scaffolding, rigging, hoisting, and services necessary for delivery and installation of materials and equipment.
- Include all required software applications, licensing and associated system programming for electronic products. Provide all software to owner for onsite programming and interfacing
- C. Provide as part of the Electrical Work all hangers, brackets, supports, framing, backing, accessories, incidentals, not specifically identified the project documents, but required to complete the system(s) in a safe and satisfactory working condition.
- D. Quantity of materials and layout of the Work shall be provided based on field measurement of the actual project conditions and shall not be based on plan dimensions.
- E. Provide all testing and documentation of electrical systems as required to demonstrate compliance with the Project Documents.
- F. Provide testing, documentation, and filing required to comply with commissioning requirements of Section C408 of the Energy Code. Include documentation in Operation and Maintenance Manuals.

3.03 CUTTING AND PATCHING

- A. Provide cutting and patching to complete electrical work and to provide openings in elements of Work for electrical penetrations. Comply with requirements of Division 01.
- B. Locate and execute cuts so as not to damage other work or weaken structural components. Core drill or saw cut rigid materials.
- C. Patch to restore to original condition. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

3.04 SCHEDULE OF VALUES

- A. Provide schedule of values broken down as follows:
 - 1. General Electrical (Mobilization, Submittals, Management).
 - 2. Fern Hill Library.
 - 3. Swasey Library.
 - 4. Wheelock Library.
 - 5. Electrical Closeout (Punchlists, O&M Manuals, Record Drawings).

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Demolition of systems applicable to Division 26.
- B. Requirements of this section also apply to Division 28.

1.02 SCOPE OF WORK

- A. Provide demolition of all existing electrical systems as indicated on the plans.
- B. Work shall include the following:
 - 1. Feeder and branch circuit conduit, wire, and cable.
 - 2. Wiring devices, equipment connections, outlets, and trim.
 - 3. Disconnects, controllers, contactors, and relays.
 - 4. Electric space heating equipment and controls.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 PREPARATION

- A. Field verify existing conditions as required to bid and perform Work.
- B. Disconnect power to allow for safe execution of the Work.
- C. Disconnect electrical systems serving mechanical equipment.

3.02 DEMOLITION OF EXISTING ELECTRICAL WORK

- A. Electrical demolition includes the disconnecting, removal, and disposal of fixtures, devices and equipment where indicated, along with associated wiring, supports, brackets, stems, hangers, and backboards.
- B. Remove abandoned wire to source of supply.
- C. Remove conduit, cable, and outlets where exposed and within accessible ceiling, attic, crawl, plenum, and opened wall spaces. Cut conduit flush with walls and floors where not accessible. Outdoors remove abandoned conduit and cable down to 24 inches below grade and restore site to its original grade and finish.

3.03 DISPOSITION OF MATERIALS

A. Materials and equipment removed shall become the property of the Contractor unless

- otherwise indicated. Remove such material and equipment from the Owner's property and legally dispose off site.
- B. Transformers, ballasts, fluorescent lamps, capacitors, oil switches, and other removed materials and equipment which may contain Polychlorinated Biphenyls (PCB's) or mercury shall be considered hazardous waste. Handle, package, transport, and dispose of these materials and equipment in accordance applicable state and federal laws. Provide to the Owner a certificate of disposal within the one year contract warranty period.

END OF SECTION

26 04 00 - 2

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Conduit and Fittings.
- B. Surface Metal Raceway.
- C. Building Wire and Cable.
- D. Wiring Connections and Terminations.
- E. Boxes.
- F. Wiring Devices.
- G. Cord Reels.
- H. Supporting Devices.
- I. Requirements for Fire Rated Construction.

1.02 SUBMITTALS

A. Submit product data for conduit fittings, wire and cable, watertight connectors, wiring devices, floor boxes, cord reels, smoke detectors, and cable tray.

1.03 OPERATION AND MAINTENANCE DATA

A. Include data for wiring devices, floor boxes, and smoke detectors in Operation & Maintenance Manuals.

PART 2 - PRODUCTS

2.01 CONDUIT

- A. Rigid Steel Conduit (RGS): ANSI C80.1; hot dipped galvanized.
- B. Intermediate Metal Conduit (IMC): Hot dipped galvanized.
- C. Electric Metallic Tubing (EMT): ANSI C80.3; galvanized tubing.
- D. Flexible Metal Conduit: Galvanized steel. Heavy wall except reduced wall may be used where concealed in building construction.
- E. Liquid Tight Flexible Metal Conduit: Galvanized steel, PVC jacket.

2.02 FITTINGS

A. RGS and IMC Conduit: ANSI/NEMA FB 1; threaded type. Provide bushings, hubs and connectors with insulated throat, for conduit terminations.

- B. EMT Conduit: ANSI/NEMA FB 1; steel, compression type. Crimp-on, drive-on, indenter, and set screw type prohibited. Provide connectors with insulated throat for conduit larger than 3/4-inch diameter. Provide rain tight fittings for conduit installed outdoors.
- C. Flexible Conduit: ANSI/NEMA FB 1; steel, single screw squeeze type.
- D. Liquid tight Flexible Conduit: ANSI C33.84, steel. Provide PVC coated fitting where installed outdoors.
- E. Water and Vapor Conduit Sealants: Hydra-Seal S-50 conduit sealing putty or approved; Tyco/Rachem/TE blank duct plug or approved; Polywater FST conduit sealing foam system or approved.
- F. Metal-Clad Cable: ANSI/NEMA FB 1; steel, single screw squeeze type with insulated throat.

2.03 WIRE AND CABLE

- A. Copper Building Wire, Interior: Type THWN-2, 600 volt insulation; conductors 8 AWG and larger shall be stranded. Type XHHW-2 may be substituted for conductor sizes 4 AWG and larger.
- B. Copper Building Wire, Outdoors: Type RHW/USE-2, 600 volt insulation; conductor 8 AWG and larger shall be stranded.
- C. Fire Rated Building Wire: Type RHH or RHW-2, UL2196, 600 volt insulation, copper conductor, UL classified 2-hour rated cable when installed in approved steel conduit system. Type RHH may be used only in dry locations.
- D. Metal Clad (MC Cable): UL 1569; copper conductors, 600 volt 90 degree C rated conductor insulation, phase identified, with green insulated copper grounding conductor and steel outer covering. Include neutral conductor for switch legs per NEC 404.2(C). Provide PVC jacketed MC cable listed for the purpose where used in damp or wet locations or where otherwise indicated.

2.04 WIRE CONNECTORS

- A. Connectors for Wire Size 10 AWG and Smaller: Insulated steel spring twist-on pressure connector with plastic cap. Outdoors use watertight type with prefilled sealant gel.
- B. Connectors for Wire Size 8 AWG and Larger: Solderless mechanical or compression type with pre-formed or shrink sleeve insulated cover. Outdoors make watertight using shrink sleeve or pigtail cap and sealing mastic.
- C. Outdoor Taps Below Grade for Wire Size #6 AWG and Larger: Ilsco PED series underground multi-tap, wire range and number of ports as required.
- D. Gutter/Wireway Taps for Wire Size #6 AWG and Larger: Ilsco type PDB series AL/CU lug type distribution block, number of poles and quantity/size of primary/secondary lug ports as required for the application.

2.05 BOXES

- A. Outlet Boxes: ANSI/NEMA OS 1; galvanized sheet steel, with ½-inch male fixture studs or plaster rings as required.
- B. Surface Outlet Boxes Below 8 Feet: Cast aluminum or malleable iron, threaded hubs.
- C. Surface Outlet Boxes for Outdoor and Wet Locations: Gasketed cover, stainless steel hardware. Outlet boxes shall have threaded hubs.
- D. Junction and Pull Boxes: Outlet box with blank cover except boxes larger than 4 inch square shall be screw cover type, galvanized steel with grey enamel finish, NEMA 1 indoors and NEMA 3R outdoors, unless otherwise indicated.
- E. Fire Rated Construction: Recessed outlet boxes and rough-in cans that are installed in 2 hour rated area separation walls shall be UL listed with 1-1/2 hour rating label.
- F. Color Coding of Device and Junction Boxes for Special Systems: Field painted or otherwise manufactured in the specified color, both inside and outside of box and cover. Provide color identification for the following electrical systems: Fire Alarm System RED, Emergency Systems (NEC 700) ORANGE.

2.06 SUPPORTING DEVICES

- A. Metal Conduit Clamps & Straps: Steel, screw type; zinc or cadmium plated minimum indoors, hot dipped galvanized minimum outdoors.
- B. Support Channel: Slotted 12-gauge steel channel with fittings, fasteners, brackets, clamps, floor plates, and accessories required; Pre-galvanized zinc coated (G90) indoors, ASTM 123 hot dipped galvanized outdoors.
- C. Fasteners: Expansion anchors in concrete and solid masonry; toggle bolts in hollow masonry, plaster, or gypsum board wall construction; sheet metal screws in metal construction; wood screws in wood construction; set screw type beam clamps on steel columns and beams; U.L. listed clips for metal studs. Metal parts and accessories to be zinc or cadmium plated minimum indoors and hot dipped galvanized minimum outdoors.
- D. Support Wires: Support wires above accessible ceiling grids, steel #12 AWG minimum.

2.07 FIRE RATED CONSTRUCTION

A. Products for Fire Stopping to Seal Around Enclosures and Annular Space between Conduit and Building Construction at Conduit Penetrations: ANSI/UL 1479; Comply with requirements of Division 07.

PART 3 - EXECUTION

3.01 WIRING METHODS

A. General:

- 1. Fixed wiring shall be conductors installed in conduit.
- 2. Conceal all wiring within construction unless otherwise noted on drawings or specifically authorized by the Architect/Engineer.

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

- 3. Where contractor wiring methods require the application of conductor ampacity adjustment or correction factors under NEC 310.15, the contractor shall submit calculations that show Code compliance, except the adjusted ampacity of the conductors installed shall not be less than the circuit overcurrent device rating shown or specified.
- 4. Conduit sizes shall not be reduced to smaller size than shown or otherwise noted on plans.
- 5. Feeders shown or otherwise noted on plans shall not be combined to share a common conduit homerun. Branch circuit homeruns shown or otherwise noted on plans shall not be combined to share a common conduit with other circuits.
- 6. Device Plates: It is the electrical contractor's responsibility to ensure that all line voltage and low voltage system faceplates and visible trim pieces are the same color. Exception: Where stainless steel device plates are used for line voltage systems, low voltage systems may use non-metallic plates of the same color.

B. Conduit Requirements:

- 1. Rigid Steel Conduit (RGS): May be used in all areas. Required at penetrations thru fire rated construction rated greater than 1 hour.
- 2. Intermediate Metal Conduit (IMC): May be used in all areas except where RGS is required or indicated.
- 3. Electrical Metallic Tubing (EMT): May be used in dry and damp locations where not subject to damage. May not be used in concrete, where in contact with earth, or where RGS is required or indicated. May not be used for service entrance conductors inside a building. Maximum trade size 2 inches.
- 4. Flexible Conduit: May be used concealed in casework, up to 1 inch maximum trade size. Required for final equipment connections (maximum length 36 inches) and where raceway passes thru seismic joints. Use liquid tight in damp or wet locations.

C. Wire and Cable Requirements:

- 1. Use copper conductors.
- Metal Clad (MC) Cable: May only be used for fixture whips and for branch circuit wiring where concealed in walls between wiring devices in finished spaces of 300 SF or less, and extending no more than 72 inches to first junction box in a crawl space or above an accessible ceiling. May not be used for branch circuit homeruns, feeders, or services. May not be used in mechanical ducts or fabricated air plenums. May not be used for any portion of a homerun to a single outlet or device. May not be used in concrete or below concrete slabs on grade. May not be used between floors.

3.02 SUPPORT - GENERAL

A. Support wiring, conduit, raceways, boxes, equipment, and fixtures from building structural members. Provide additional framing, channel, or listed support attachments as required

TACOMA PUBLIC LIBRARY HVAC REPLACEMENT

BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

to span or support between structural members and to avoid interference from pipes, ducts, and other equipment.

- B. Do not install support anchors to penetrate thru roof deck.
- C. Do not violate the integrity or exceed the capacity of the building structure used for support. Provide/fabricate additional support elements to transmit loads to the floor or other parts of the building structure that can carry the load as approved by the Architect/Engineer.

3.03 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. Minimum conduit trade size 1/2-inch diameter except all homeruns and where installed below grade outdoors conduits shall be 3/4-inch minimum diameter. Prewired 3/8 inch diameter flexible conduit not to exceed 72 inches in length may be used for fixture whips from an outlet box to recessed light fixture.
- B. Arrange conduit to maintain headroom and present a neat appearance.
- C. Route conduit parallel and perpendicular to walls and adjacent piping.
- D. Maintain 12-inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- E. Locate holes in joists within center third of member depth measured from the edge and at least 24 inches from load bearing points. Maximum hole diameter one inch.
- F. Support conduits from building structure with conduit straps or rods and hangers. #8 solid wire and CADDY clips may be used to hang 3/4-inch diameter conduit and smaller above accessible ceiling spaces.
- G. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- H. Do not support conduit with perforated pipe straps or tie wraps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.
- I. Do not bore holes in truss members or notch structural members.
- J. Steel conduit installed as part of a 2 hour fire rated wiring assembly shall be supported 5 feet on center where required by the cable system installation requirements.

3.04 CONDUIT INSTALLATION

- A. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp locations.
- B. Use conduit bodies to make sharp changes in direction, as around beams.
- C. Install insulated bushings on each end of conduit larger than 1 inch.
- D. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

- E. Install pull wire in empty conduits.
- F. Install flexible conduit thru oversized bushed sleeve or cored opening where conduit crosses building wall expansion or seismic joints. Provide up to 54 inches of flexible wiring with 6 inches minimum of conduit slack each side of the wall assembly to allow for free movement across the joint.
- G. Do not install conduit in concrete slab on grade.
- H. Do not install conduit in direct contact with underside of roof deck.
- I. Seal all underground conduits entering and terminating within a building or structure using approved non hardening duct seal putty or a sealing bushing. Seal spare conduits using a watertight blank plastic duct plug. Seal all underground conduits entering and terminating below grade, such as in a crawl space or basement, using an approved closed cell foam sealant system.

3.05 CONDUIT PENETRATIONS

- A. Exterior Walls: Core drill or cast sleeve for each conduit one size larger than conduit diameter. Seal all openings at each penetration with acrylic weatherproof caulking suitable for painting. Below grade seal with "Chase-Foam" silicone sealant or other approved method acceptable to Architect/Engineer.
- B. Interior Walls and Partitions: Cut one size larger than conduit diameter. Seal all openings at each penetration with low VOC level general purpose interior sealant as specified in Section 07900.
- C. Fire Rated Construction: Comply with requirements of paragraph, FIRE RATED CONSTRUCTION, this specification.

3.06 SURFACE METAL RACEWAY (SMR)

- A. Provide SMR in lieu of conduit in finished spaces where exposed raceway is specifically indicated or otherwise approved.
- B. Install parallel to building surface in least conspicuous location. Verify routing with Engineer and make directed adjustments prior to installation.
- C. Where multiple-compartment SMR is used for both signal and power, identify compartments per NEC 386.70.

3.07 METAL CLAD CABLE

A. Arrangement and Support: Comply with requirements specified for conduit. Provide maximum support spacing of 6 feet on center and within 12 inches of terminations.

3.08 CONDUCTOR INSTALLATION

- A. Minimum Conductor Size: #12 AWG, except #10 AWG minimum for outdoor and exterior building lighting circuits and #14 AWG minimum for control circuits and for lighting fixture taps not to exceed 72 inches.
- B. Splice conductors only in junction or outlet boxes.

- C. Arrange conductors neatly at termination such that a clamp-on ammeter may be used.
- D. Clean conduit free of debris before conductor installation; install conductors using pulling lubricant.

3.09 CONDUCTOR IDENTIFICATION

- A. Provide non-metallic wire markers on each conductor in panelboards and in junction boxes having more than 6 conductors. Identify branch circuit or feeder number for power and lighting circuits.
- B. Color Coding of Insulated Equipment Ground: Solid green.
- C. Color Coding of 208/120; 120/240 Volt System: Phase A black, Phase B red, Phase C blue, Neutral white.
- D. Color Coding of Switch Legs: Pink.
- E. Provide color tracers on neutrals to differentiate circuits on multi-wire branch circuits with separate neutrals.

3.10 BOX LOCATIONS

- A. Provide electrical boxes for outlets, junctions and equipment connections as shown and as required for splices, taps, wire pulling, and code compliance.
- B. Electrical box locations shown are approximate unless dimensioned. Obtain equipment outlet locations from equipment manufacturer prior to rough-in. Install to fit conditions or as directed

3.11 BOX INSTALLATION

- A. Set wall outlet and wall switch boxes vertically.
- B. Support boxes independently of conduit, piping, and ductwork; securely fasten in place.
- C. Provide recessed outlet boxes in finished areas. Flush front edge of box or plaster ring even with finished surface.
- D. Provide blank cover plate over all boxes that do not contain devices or are not covered by equipment.
- E. Do not install flush boxes on opposite sides of a wall within the same stud space. Maintain 24 inch minimum box separation in fire rated wall assemblies.

3.12 FIRE RATED CONSTRUCTION

- A. Verify location of fire rated walls and ceilings prior to rough-in.
- B. Installation of boxes, rough-in cans, conduits, and sleeves that result in membrane or through penetrations shall comply with IBC 712.1 through 712.4 as required to maintain fire rating of construction assembly. Coordinate locations and construction requirements with General Contractor.

C. Provide approved conduit and/or pathway sleeve kits for installation of open cable through fire rated construction.

3.13 LABELING

- A. Outlets: Identify panel and circuit number on faceplate of convenience and special purpose outlets. Use self-adhesive, polyester or vinyl laminated labels with machine generated alpha-numeric circuit identification, 1/4-inch high black letters on clear background. Exception: Use white letters on black or brown color device plates.
- B. Junction Boxes: Label or mark cover with panel and circuit number. Locate on inside of cover except locate on outside of junction box cover in attics, crawl spaces, equipment rooms and above accessible ceilings.

3.14 TESTS

- A. Perform continuity test on all feeder and branch circuit conductors. Verify proper phasing and that no short circuits or accidental grounds exist.
- B. Check all convenience outlets for correct wiring connections using a polarity circuit tester. Test AFCI and GFCI circuits for proper operation with an approved tester.
- C. Torque test conductor lug terminations to manufacturers recommended values.
- D. Ground Impedance: Values of up to 2 ohms are acceptable.

END OF SECTION

TACOMA PUBLIC LIBRARY
HVAC REPLACEMENT
BRANCH LOCATIONS: FERN HILL, SWASEY, WHEELOCK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical Equipment and Raceway Grounding.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Mechanical Connectors at Ground Connections: Heavy duty, solderless, bolted pressure or compression type connectors or clamps labeled as being suitable for the purpose. Manufacturer's standard grounding lug when furnished as part of panelboards and other equipment.
- B. Exothermically Welded Connections: Copper Thermit weld process conforming to manufacturer's instructions; use molds, weld material, tools, and accessories supplied by the manufacturer. ERICO CADWELD or equal.
- C. Ground & Bonding Conductors: Bare, soft drawn copper; stranded for 8 AWG and larger, unless otherwise indicated or specified. Equipment grounding conductors may be insulated with green color identification per Code.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Ground electrical service system neutral per Code. Size grounding electrode conductor, main bonding jumper, equipment bonding jumpers, and supplemental electrode bonding connections per applicable paragraphs of NEC Article 250 except when larger size is shown or specified. Minimum of two (2) NEC 250.52 permitted grounding electrodes must be installed and shall include a concrete encased electrode where concrete building foundation is provided.
- B. Make grounding connections which are buried or otherwise inaccessible using exothermic welds. Where installed outdoors, bury ground conductors with minimum 18 inches of cover unless otherwise indicated.
- C. Equipment Grounding Conductor: Provide separate insulated green equipment grounding conductor in feeders and in branch circuits. Provide equipment grounding conductor in non-metallic conduits and flexible conduit. Size equipment grounding conductors per NEC 250.122 unless larger size is shown or specified.
- D. Provide grounding locknuts on each end of feeder conduits serving panelboards. Exception: Provide grounding bushing with bonding jumper where conduit is used as equipment ground.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Manual Motor Starters.
- B. Magnetic Motor Starters.
- C. Combination Magnetic Motor Starters.
- D. Operator Stations.

1.02 SUBMITTALS

- A. Submit product data for all items specified under Part 2 of this section.
- B. Coordinate dimensions of equipment with site and project space dimensions to verify equipment will fit, conform to indicated layout, and meet NEC and manufacturer clearance requirements.

1.03 OPERATION AND MAINTENANCE DATA

A. Include data for motor starters, adjustable speed drives, and motor control centers in Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Square 'D'
- B. Allen Bradley
- C. General Electric
- D. Westinghouse
- E. I.T.E.
- F. Cutler-Hammer

2.02 MANUAL STARTERS

A. Manual Motor Starters: NEMA ICS 2; AC general purpose Class A manually operated full-voltage controller for fractional horsepower induction motors, thermal overload unit, green neon "ON" pilot light, toggle operator pad lockable in "OFF" position.

2.03 MAGNETIC MOTOR STARTERS

A. Magnetic Motor Starters, Size 2 and Smaller: NEMA ICS 2; AC general purpose Class A magnetic controller for induction motors rated in horsepower, full voltage non-reversing type (FVNR), hand reset solid state overload relay with phase 3:1 current adjustability, selectable Class 10, 20, 30 motor over load protection and loss protection, green 20,000

hour "On" pilot light, one normally open and one normally closed auxiliary contacts, fused 120 volt control transformer, 120 volt operating coil, additional features indicated. Provide cover mounted "Hand-Off-Auto" selector switch unless operator station is indicated.

- B. Overload Relay: Installed relay shall have an adjustable current range up to 140% of NEC rated motor full load amperes.
- C. Magnetic Motor Starters, Size 3 and Larger: Same design and features as magnetic motor starters, size 2 and smaller, except starter shall be closed transition autotransformer type for reduced voltage starting.

2.04 COMBINATION MAGNETIC MOTOR STARTERS

- A. Combination Magnetic Motor Starters: Combine magnetic motor starter specified above with fusible switch in common enclosure.
- B. Fusible Switch: NEMA KS 1; Quickmake, quickbreak, handle lockable in OFF position, Class R fuse provisions.

2.05 OPERATOR STATION

A. General: NEMA ICS 2; heavy duty oil tight, operator and legend plate.

2.06 ENCLOSURES

- A. Enclosures: NEMA ICS 6; Type 1 for dry locations; Type 3R for damp or outdoor locations.
- B. Enclosure Finishes: Manufacturer's standard enamel over rust inhibitor on all interior and exterior surfaces.

2.07 NAMEPLATES AND LABELS

A. Nameplates and Labels: Specified under section 26 05 00.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install motor control equipment in accordance with manufacturer's instructions.
- B. Adjust solid state overload relays to match installed motor characteristics and ambient conditions. Initial setting shall not exceed 125% of nameplate full load amps.
- C. Seismic Restraint: Comply with requirements of the International Building Code (IBC). Obtain anchoring plans from equipment manufacturer indicating size and location of anchors suitable for seismic zone 3. Secure each enclosure section to concrete floor or pad with corrosion proof anchors having a minimum embedded length equal to 12 times the nominal bolt diameter.

3.02 NAMEPLATES

A. Individual Circuit Breakers, Switches: Identify circuit/section number and load served.

- B. Individual Motor Controls: Identify load served. Nameplate may be deleted when load is immediately adjacent and obvious as determined by the Engineer.
- C. Nameplate and Label Locations: Secure to equipment fronts.

3.03 TESTS

A. Motors and Compressors: Record all nameplate data. Measure actual voltage and running amperes for each phase. Record manufacturer and catalog number of overload thermal units installed.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Building Fire Detection and Alarm System, Bidder Design.

1.02 RELATED SECTIONS

- A. Section 26 01 00 Electrical General Requirements.
- B. Section 26 04 00 Electrical Demolition.
- C. Section 26 05 00 Basic Materials and Methods.
- D. Section 26 05 26 Grounding and Bonding.

1.03 REGULATORY REQUIREMENTS

- Conform to requirements of Washington State Fire Marshal's office and local Fire Marshal.
- B. Conform to requirements of following publications in addition to requirements of 26 01 00:

IFC International Fire Code
NFPA 72 National Fire Alarm Code
Local fire alarm code adopted by the jurisdiction

1.04 SCOPE OF WORK

- A. Existing System: General: Existing fire alarm system is to remain. Existing duct smoke detectors are to be replaced with new and be salvaged installed in new units and be connected to the existing fire alarm system.
- B. Duct Detector Supervision: Actuation of any smoke duct detector shall result in an alarm at the existing FAP.
- C. Pre-bid Coordination: Obtain and review all construction documents prior to bidding as required to verify site conditions, floor plans, building sections, ceiling types, building construction, mechanical systems, building equipment and other conditions that will affect the fire alarm system design. Verify fire alarm design and system requirements with local authority having jurisdiction.

1.05 GENERAL REQUIREMENTS

A. Access: Provide service access to detectors not readily accessible and to sampling tubes of duct smoke detectors.

B. Duct Smoke Detectors:

- 1. Provide for HVAC units rated above 2000 CFM.
- 2. Coordinate quantity, location, and access for duct smoke detectors with Division 23 Contractor.

- C. Provide conductors installed in conduit except fire rated MC cable is approved where concealed in ceiling spaces and/or building construction.
- D. Device Locations: Subject to review and approval by Architect/Engineer during shop drawing review. Changes in device locations may be directed and shall be accommodated subject to Code compliance.

1.06 TEMPORARY FIRE ALARM SYSTEM

A. Comply with requirements of Fire Marshal for areas scheduled to be occupied during construction. The facility will be occupied and continue normal operations during the construction work. Comply with requirements of Fire Marshal regarding temporary alarm system and/or fire watch during construction. See section 26 04 00 for additional requirements.

1.07 SUBMITTALS

- A. Submit product data for all items specified under Part 2 of this section.
- B. Provide shop drawings of existing system as required by the AHJ.

1.08 OPERATION AND MAINTENANCE DATA

A. Include data for complete system in Operation and Maintenance Manuals.

1.09 QUALIFICATIONS

- A. Company: Have minimum five (5) years' experience in the installation of fire alarm systems and capable of providing 24 hour repair service with 2 hour response time.
- B. Shop Drawing Preparation: Technician possessing a current Certification in Engineering Technologies (NICET) Level III certification shall design and prepare the fire alarm system shop drawings unless otherwise approved by the AHJ.
- C. Installers: Trained technicians possessing a current specialty electrician certificate of competency issued by the State of Washington and National Institute for Certification in Engineering Technologies (NICET) Level II certification shall perform the work.
- D. Authorized factory representative of the system being installed shall supervise installation, testing, and adjustment of the system.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Honeywell.

2.02 INITIATING DEVICES

A. Duct Detector, Smoke: UL 268; addressable photoelectric or ionization type smoke detector, duct mounted detector housing with sampling tubes extending width of duct, visual indication of detector actuation. Provide auxiliary DPDT contacts for HVAC

shutdown and/or smoke damper actuation, rated 1/8 HP at 120 VAC and 1/4 HP at 240 VAC minimum.

2.03 MATERIALS

- A. Conductors for 120 Volt Circuits: Building wire as specified in Section 26 05 00.
- B. Conductors for 24 Volt DC Circuits: Comply with NFPA 70, Article 760 for insulation requirements. Solid copper conductor, minimum #14 AWG for signal circuits and #16 AWG for initiating circuits. Jacketed twisted pair, copper conductor, with shielding as recommended by alarm system manufacturer for SLC intelligent loop wiring. Outside plant cable shall UL listed for the purpose.
- C. Conduit: As specified in Section 26 05 00, metallic only.
- D. MC Cable: Dual rated MC/FPLP, 90°C MC/105°C FPLP copper conductors, with ground conductor(s) and steel outer covering with red identifier. UL listed and approved for fire alarm and control, multi-conductor and/or twisted shielded pair as required.
- E. Device and Junction-Boxes: As specified in Section 26 05 00, except surface boxes shall be furnished by alarm system manufacturer to match devices. Boxes shall be red in color. Device and junction boxes located outside of buildings shall be tamper proof. Outdoor boxes shall be weatherproof.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to completion of rough-in, review existing system type, location of devices, and equipment arrangement.

3.02 EXISTING SYSTEM

A. See Section 26 04 00, Electrical Demolition, for additional requirements.

3.03 INSTALLATION

- A. Install system in accordance with manufacturer's instructions. Provide all necessary programming and adjustment of system equipment to make operational.
- B Wiring methods shall comply with requirements of Section 26 05 00. Exposed wiring is not permitted in finished spaces. Wiring shall be dedicated to the fire alarm system consistently color coded per shop drawings. Wiring shall not share conduits with other systems.
- C. Coordinate quantity, location, and access for duct smoke detectors and sampling tubes with Division 23 Contractor. Furnish sampling tube/detector housing assemblies for installation by ductwork installer. Do not locate sampling tubes less than 6 duct widths from return air inlet, bend in duct, or other obstruction in duct. Locate sampling tube/detector housing assemblies for smoke dampers on the damper housing where recommended by smoke damper manufacturer.

- D. Provide recessed backboxes for semi-flush installation of devices where construction permits, otherwise provide surface boxes.
- E. Fan Shut-Down: Provide conduit, wire, relays and connection for shutdown of air moving equipment rated over 2000 cfm per IMC. Final connection to HVAC equipment with integral motor controls shall be provided under Division 25.
- F. Adjust sensitivity for each smoke detector based on the application and type of space being protected as recommended by the product installation instructions.
- G. SLC Interface: Provide addressable interface modules for all non-addressable initiating devices and equipment furnished under other sections.
- H. Pathway Identification: J-boxes, outlets and condulet covers shall be identified red in color. Conduit in accessible attic and ceiling spaces, and where surface mount in electrical, telecomm and mechanical spaces, shall be identified red in color every 8 feet or fraction thereof, along its length.

3.04 TESTING

- A. Test system in accordance with NFPA 72 and Fire Marshal requirements.
- B. During testing verify device address descriptions match device type, location description, and zoning assignments shown on record drawings. Submit address log and correction report and confidence test report with record drawings.

3.05 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation, maintenance and programming of system to Owner's personnel prior to Contract Closeout. Allow one four-hour session scheduled at convenience of Owner.
- B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. Demonstrate operation, control, trouble shooting, maintenance, and testing of system.

END OF SECTION

PART III

STATE PREVAILING WAGE RATES AND GENERAL INFORMATON

PREVAILING WAGE RATES

This project requires prevailing wages under chapter 39.12 RCW. Any worker, laborer, or mechanic employed in the performance of any part of the work shall be paid not less than the applicable prevailing rate of wage.

The project site is located in Pierce County.

The effective date for prevailing wages on this project will be the **submittal deadline** with these exceptions:

- a. If the project is not awarded within six months of the submittal deadline, the award date is the effective date.
- b. If the project is not awarded pursuant to a competitive solicitation, the date the contract is executed is the effective date.
- c. Janitorial contracts follow WAC 296-127-023.

Except for janitorial contracts, these rates shall apply for the duration of the contract unless otherwise noted in the solicitation.

Look up prevailing rates of pay, benefits, and overtime codes from this link: http://www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/default.asp

REQUIRED DOCUMENTS

The Contractor shall submit to the City the following Department of Labor and Industries (L&I) forms for itself and for each firm covered under 39.12 RCW that provided work and materials for the Contract:

- A copy of an approved Statement of Intent to Pay Prevailing Wages, L&I form number <u>F700-029-000</u>. The City will make no payment under this Contract for the Work performed until this statement has been approved by L&I and a copy of the approved form has been submitted to the City.
- A copy of an approved Affidavit of Prevailing Wages Paid, L&I form number <u>F700-007-000</u>. The Contracting Agency will not grant completion or release retainage held under chapter 60.28 RCW until all approved Affidavit of Wages paid for Contractor and all Subcontractors have been received by the City.

PART IV INSURANCE REQUIREMENTS

The Contractor (Contractor) shall maintain at least the minimum insurance set forth below. By requiring such minimum insurance, the City of Tacoma shall not be deemed or construed to have assessed the risk that may be applicable to Contractor under this Contract. Contractor shall assess its own risks and, if it deems appropriate and/or prudent, maintain greater limits and/or broader coverage.

1. GENERAL REQUIREMENTS

The following General Requirements apply to Contractor and to Subcontractor(s) of every tier performing services and/or activities pursuant to the terms of this Contract. Contractor acknowledges and agrees to the following insurance requirements applicable to Contractor and Contractor's Subcontractor(s):

- 1.1. City of Tacoma reserves the right to approve or reject the insurance provided based upon the insurer, terms and coverage, the Certificate of Insurance, and/or endorsements.
- 1.2. Contractor shall not begin work under the Contract until the required insurance has been obtained and approved by City of Tacoma.
- 1.3. Contractor shall keep this insurance in force during the entire term of the Contract and for Thirty (30) calendar days after completion of all work required by the Contract, unless otherwise provided herein.
- 1.4. Insurance policies required under this Contract that name "City of Tacoma" as Additional Insured shall:
 - 1.4.1. Be considered primary and non-contributory for all claims.
 - 1.4.2. Contain a "Separation of Insured provision and a "Waiver of Subrogation" clause in favor of City of Tacoma.
- 1.5. Section 1.4 above does not apply to contracts for purchasing supplies only.
- 1.6. Verification of coverage shall include:
 - 1.6.1. An ACORD certificate or equivalent.
 - 1.6.2. Copies of all endorsements naming the City of Tacoma as additional insured and showing the policy number.
 - 1.6.3. A notation of coverage enhancements on the Certificate of Insurance shall not satisfy these requirements actual endorsements must be submitted.
- 1.7. Liability insurance policies, with the exception of Professional Liability and Workers' Compensation, shall name the City of Tacoma and its officers, elected officials, employees, agents, and authorized volunteers as additional insured.
 - 1.7.1. No specific person or department should be identified as the additional insured.
 - 1.7.2. All references on certificates of insurance and endorsements shall be listed as "City of Tacoma".
 - 1.7.3. The City of Tacoma shall be additional insured for both ongoing and completed operations using Insurance Services Office (ISO) form CG 20 10 04 13 and CG 20

37 04 13 or the equivalent for the full available limits of liability maintained by the Contractor irrespective of whether such limits maintained by the Contractor are greater than those required by this Contract and irrespective of whether the Certificate of Insurance describes limits lower than those maintained by the Contractor.

- 1.8. Contractor shall provide a Certificate of Insurance for each policy of insurance meeting the requirements set forth herein when Contractor provides the signed Contract for the work to City of Tacoma. Contractor shall provide copies of any applicable Additional Insured, Waiver of Subrogation, and Primary and Non-contributory endorsements. Contract or Permit number and the City Department must be shown on the Certificate of Insurance.
- 1.9. Insurance limits shown below may be written with an excess policy that follows the form of an underlying primary liability policy or an excess policy providing the required limit.
- 1.10. Liability insurance policies shall be written on an "occurrence" form, except for Professional Liability/Errors and Omissions, Pollution Liability, and Cyber/Privacy and Security
- 1.11. If coverage is approved and purchased on a "Claims-Made" basis, Contractor warrants continuation of coverage, either through policy renewals or by the purchase of an extended reporting period endorsement as set forth below.
- 1.12. The insurance must be written by companies licensed or authorized in the State of Washington pursuant to RCW 48 with an (A-) VII or higher in the A.M. Best's Key Rating Guide www.ambest.com.
- 1.13. Contractor shall provide City of Tacoma notice of any cancellation or non-renewal of this required insurance within Thirty (30) calendar days.
- 1.14. Contractor shall not allow any insurance to be cancelled or lapse during any term of this Contract, otherwise it shall constitute a material breach of the Contract, upon which City of Tacoma may, after giving Five (5) business day notice to Contractor to correct the breach, immediately terminate the Contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith; with any sums so expended to be repaid to City of Tacoma by Contractor upon demand, or at the sole discretion of City of Tacoma, offset against funds due Contractor from City of Tacoma.
- 1.15. Contractor shall be responsible for the payment of all premiums, deductibles and self-insured retentions, and shall indemnify and hold the City of Tacoma harmless to the extent such a deductible or self-insured retained limit may apply to the City of Tacoma as an additional insured. Any deductible or self-insured retained limits in excess of Twenty Five Thousand Dollars (\$25,000) must be disclosed and approved by City of Tacoma Risk Manager and shown on the Certificate of Insurance.
- 1.16. City of Tacoma reserves the right to review insurance requirements during any term of the Contract and to require that Contractor make reasonable adjustments when the scope of services has changed.

Insurance Requirements
Template Revised 10/3/2019

Spec/Contract Number: LB21-0613F

- 1.17. All costs for insurance shall be incidental to and included in the unit or lump sum prices of the Contract and no additional payment will be made by City of Tacoma to Contractor.
- 1.18. Insurance coverages specified in this Contract are not intended and will not be interpreted to limit the responsibility or liability of Contractor or Subcontractor(s).
- 1.19. Failure by City of Tacoma to identify a deficiency in the insurance documentation provided by Contractor or failure of City of Tacoma to demand verification of coverage or compliance by Contractor with these insurance requirements shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- 1.20. If Contractor is a State of Washington or local government and is self-insured for any of the above insurance requirements, a certification of self-insurance shall be attached hereto and be incorporated by reference and shall constitute compliance with this Section.

2. CONTRACTOR

As used herein, "Contractor" shall be the Supplier(s) entering a Contract with City of Tacoma, whether designated as a Supplier, Contractor, Vendor, Proposer, Bidder, Respondent, Seller, Merchant, Service Provider, or otherwise.

3. SUBCONTRACTORS

It is Contractor's responsibility to ensure that each subcontractor obtain and maintain adequate liability insurance coverage. Contractor shall provide evidence of such insurance upon City of Tacoma's request.

4. REQUIRED INSURANCE AND LIMITS

The insurance policies shall provide the minimum coverages and limits set forth below. Providing coverage in these stated minimum limits shall not be construed to relieve Contractor from liability in excess of such limits.

4.1 Commercial General Liability Insurance

Contractor shall maintain Commercial General Liability Insurance policy with limits not less than One Million Dollars (\$1,000,000) each occurrence and Two Million Dollars (\$2,000,000) annual aggregate. The Commercial General Liability Insurance policy shall be written on an Insurance Services Office form CG 00 01 04 13 or its equivalent. Products and Completed Operations shall be maintained for a period of three years following Substantial Completion of the Work related to performing construction services.

This policy shall include product liability especially when a Contract solely is for purchasing supplies. The Commercial General Liability policy shall be endorsed to include:

4.2 A per project aggregate policy limit, using ISO form CG 25 03 05 09 or an equivalent endorsement.

4.2.1

4.3 Commercial (Business) Automobile Liability Insurance

Contractor shall maintain Commercial Automobile Liability policy with limits not less than One Million Dollars (\$1,000,000) each accident for bodily injury and property damage and bodily injury

and property damage coverage for owned (if any), non-owned, hired, or leased vehicles. Commercial Automobile Liability Insurance shall be written using ISO form CA 00 01 or equivalent. Contractor must also maintain an MCS 90 endorsement or equivalent and a CA 99 48 endorsement or equivalent if "Pollutants" are to be transported.

4.4 Workers' Compensation

4.4.1 Contractor shall comply with Workers' Compensation coverage as required by the Industrial Insurance laws of the State of Washington, as well as any other similar coverage required for this work by applicable federal laws of other states. The Contractor must comply with their domicile State Industrial Insurance laws if it is outside the State of Washington.

4.5 Employers' Liability Insurance

Contractor shall maintain Employers' Liability coverage with limits not less than One Million Dollars (\$1,000,000) each employee, One Million Dollars (\$1,000,000) each accident, and One Million Dollars (\$1,000,000) policy limit.

4.6 Excess or Umbrella Liability Insurance

Contractor shall provide Excess or Umbrella Liability Insurance with limits not less than Three Million Dollars (\$3,000,000) per occurrence and in the aggregate. This coverage shall apply, at a minimum, in excess of primary underlying Commercial General Liability, Employer's Liability, Pollution Liability, Marine General Liability, Protection and Indemnity, and Automobile Liability if required herein.

4.7 <u>Installation Floater Insurance</u>

Contractor shall maintain during the term of the Contract, at its own expense, Installation Floater Insurance covering Contractor's labor, materials, and equipment to be used for completion of the work performed under this Contract against all risks of direct physical loss, excluding earthquake and flood, for an amount equal to the full amount of the Contract improvements.

4.8 Other Insurance

Other insurance may be deemed appropriate to cover risks and exposures related to the scope of work or changes to the scope of work required by City of Tacoma. The costs of such necessary and appropriate Insurance coverage shall be borne by Contractor.

Insurance Requirements Template Revised 10/3/2019

PART V GENERAL PROVISIONS

GENERAL PROVISIONS

(Revised December 15, 2020)

SECTION I - BIDDING REQUIREMENTS

SECTION I REQUIREMENTS ARE BINDING ON ALL RESPONDENTS.

1.01 USE AND COMPLETION OF CITY PROPOSAL SHEETS

A. Respondent's Proposal

Each Respondent must bid exactly as specified on the Proposal sheets. All proposals must remain open for acceptance by the City for a period of at least 60 calendar days from the date of opening of the bids.

B. Alterations of Proposals Not Allowed

Proposals that are incomplete or conditioned in any way contain alternatives or items not called for in the General Provisions and Specifications, or not in conformity with law may be rejected as being nonresponsive. The City cannot legally accept any proposal containing a substantial deviation from these Specifications.

C. Filling Out City Proposal Sheets

All proposals must be completed using the proposal sheets and forms included with this specification, and the prices must be stated in figures either written in ink or typewritten. No proposal having erasures or interlineations will be accepted unless initialed by the Respondent in ink.

1.02 CLARIFICATION OF PROPOSAL FOR RESPONDENT

If a prospective Respondent has any questions concerning any part of the Proposal, he/she may submit a written request for answer of his/her questions. Any interpretation of the Proposal will be made by an Addendum duly issued and mailed or delivered to each prospective Respondent. Such addendum must be acknowledged in the proposal. The City of Tacoma will not be responsible for any other explanation or interpretation of the bid documents.

1.03 RESPONDENT'S BOND OR CERTIFIED CHECK

Each bid for construction must be accompanied either by a certified or cashier's check for 5 percent of the total amount bid, including tax, payable to the City Treasurer, or an approved bid bond, by a surety company authorized to do business in the State of Washington, for 5 percent of the total amount bid. The person legally authorized to sign the bid must sign all bid bonds. The approved bid bond form attached to these Specifications should be used: no substantial variations from the language thereof will be accepted.

If a bid bond is used, the 5 percent may be shown either in dollars and cents, or the bid bond may be filled in as follows, "5 percent of the total amount of the accompanying proposal."

The check of the successful Respondent will be returned after award of the Contract, acceptance of the Payment and Performance Bond and City's receipt of the signed Contract. The checks of all other Respondents will be returned immediately upon the award of the Contract. Bid bonds will not be returned.

1.04 DELIVERY OF PROPOSALS TO THE CITY'S PURCHASING OFFICE

- **A.** Proposal packages must be received by the City's Procurement and Payables Division in SAP Ariba (unless another form of delivery is stated), prior to the scheduled time and date stated in the Solicitation.
- **B.** Supplier is solely responsible for timely delivery of its Submittal.
- C. Submittals received after the time stated in the solicitation will not be accepted.
- **D.** For purposes of determining whether a Submittal has been timely received in SAP Ariba, the City's Procurement and Payables Division will rely on the submittal clock in SAP Ariba.

1.05 LICENSES/PERMITS

- A. Suppliers, if applicable, must have a Washington state business license at the time of Submittal and throughout the term of the Contract. Failure to include a Washington state business license may be grounds for rejection of the Submittal or cancellation of contract award. Information regarding Washington state business licenses may be obtained at http://bls.dor.wa.gov.
- B. Upon award, it is the responsibility of the Supplier to register with the City of Tacoma's Tax and License Division, 733 South Market Street, Room 21, Tacoma, WA 98402-3768, 253-591-5252, https://www.cityoftacoma.org/government/city departments/finance/tax and license/. Supplier shall obtain a business license as is required by Tacoma Municipal Code Subtitle 6C.20.
- C. During the term of the Contract, Supplier, at its expense, shall obtain and keep in force any and all necessary licenses and permits.

1.06 CONTRACTOR'S STATE REGISTRATION NUMBER

Contractors for construction or public works construction are required to be licensed by the state. If the provisions of Chapter 18.27 of the Revised Code of Washington apply to the Respondent, then the Respondent's Washington State Contractor's Registration No. must accompany the bid.

1.07 BID IS NONCOLLUSIVE

The Respondent represents by the submission of the Proposal that the prices in this Bid are neither directly nor indirectly the result of any formal or informal agreement with another Respondent.

1.08 EVALUATION OF BID

A. Price, Experience, Delivery Time and Responsibility

In the evaluation of bids, the Respondent's experience, delivery time, quality of performance or product, conformance to the specifications and responsibility in performing other contracts (including satisfying all safety requirements) may be considered in addition to price. In addition, the bid evaluation factors set forth in City Code Section 1.06.262 may be considered by the City. Respondents who are inexperienced or who fail to properly perform other contracts may have their bids rejected for such cause.

B. Prequalified Electrical Contractor

Certain types of electrical construction require special expertise, experience, and prequalification of the Contractor (or subcontractor) by the City. In such cases, the Respondent must be prequalified or the Respondent must subcontract with a City prequalified electrical contractor for the specialty work.

C. Insertions of Material Conflicting with Specifications

Only material inserted by the Respondent to meet requirements of the Specifications will be considered. Any other material inserted by the Respondent will be disregarded as being nonresponsive and may be grounds for rejection of the Respondent's Proposal.

D. Correction of Ambiguities and Obvious Errors

The City reserves the right to correct obvious errors in the Respondent's proposal. In this regard, if the unit price does not compute to the extended total price, the unit price shall govern.

1.09 WITHDRAWAL OF BID

A. Prior to Bid Opening

Any Respondent may withdraw his/her Proposal prior to the scheduled bid opening time by delivering a written notice to the City's Procurement and Payables Office. The notice may be submitted in person or by mail; however, it must be received by the City's Procurement and Payables Office prior to the time of bid opening.

B. After Bid Opening

No Respondent will be permitted to withdraw his/her Proposal after the time of bid opening, as set forth in the Call for Bids, and before the actual award of the Contract, unless the award of Contract is delayed more than sixty (60) calendar days after the date set for bid opening. If a delay of more than 60 calendar days does occur, then the Respondent must submit written notice withdrawing his/her Proposal to the Purchasing Manager.

1.10 OPENING OF BIDS

At the time and place set for the opening of bids, all Proposals, unless previously withdrawn, will be publicly opened and read aloud, irrespective of any irregularities or informalities in such Proposal.

1.11 CITY COUNCIL/PUBLIC UTILITY BOARD FINAL DETERMINATION

The City Council or Public Utility Board of the City of Tacoma shall be the final judge as to which is the lowest and best bid in the interest of the City of Tacoma. The City reserves the right to reject any and all bids, waive minor deviations or informalities, and if necessary, call for new bids.

1.12 RESPONDENT'S REFUSAL TO ENTER INTO CONTRACT

Any Respondent who refuses to enter into a Contract after it has been awarded to the Respondent will be in breach of the agreement to enter the Contract and the Respondent's certified or cashier's check or bid bond shall be forfeited.

1.13 TAXES

A. Include In Proposal All Taxes

Respondent shall include in his/her Proposal all applicable local, city, state, and federal taxes. It is the Respondent's obligation to state on his/her Proposal sheet the correct percentage and total applicable Washington State and local sales tax. The total cost to the City including all applicable taxes may be the basis for determining the low Respondent.

B. Federal Excise Tax

The City of Tacoma is exempt from federal excise tax. Where applicable, the City shall furnish a Federal Excise Tax Exemption certificate.

C. City of Tacoma Business and Occupation Tax

Sub-Title 6A of the City of Tacoma Municipal Code (TMC) provides that transactions with the City of Tacoma, may be subject to the City of Tacoma's Business and Occupation Tax. It is the responsibility of the Respondent awarded the Contract to register with the City of Tacoma's Department of Tax and License, 733 South Market Street, Room 21, Tacoma, WA 98402-3768, telephone 253-591-5252. The City's Business and Occupation Tax amount shall not be shown separately but shall be included in the unit and/or lump sum prices bid.

1.14 FIRM PRICES/ESCALATION

Except as specifically allowed by the Special Provisions, only firm prices will be accepted.

1.15 AWARD

A. Construction and/or Labor Contracts

Unless specifically noted in the Special Provisions or Proposal sheets, all construction and/or labor contracts will be awarded to only one Respondent.

B. Supply/Equipment Contracts

The City reserves the right to award an equipment or supply contract for any or all items to one or more Respondents as the interests of the City will be best satisfied.

1.16 INCREASE OR DECREASE IN QUANTITIES

The City of Tacoma reserves the right to increase or decrease the quantities of any items under this Contract and pay according to the unit prices quoted in the Proposal (with no adjustments for anticipated profit).

1.17 EXTENSION OF CONTRACT

Contracts resulting from this specification shall be subject to extension by mutual agreement per the same prices, terms and conditions.

1.18 PAYMENT TERMS

- A. Prices will be considered as net 30 calendar days if no cash discount is shown. Payment discount periods of twenty (20) calendar days or more if offered in the submittal, will be considered in determining the apparent lowest responsible submittal. Discounts will be analyzed in context of their overall cumulative effect. Invoices will not be processed for payment nor will the period of cash discount commence until receipt of a properly completed invoice and until all invoiced items are received and satisfactory performance of the Contractor has been attained. If an adjustment in payment is necessary due to damage or dispute, the cash discount period shall commence on the date final approval for payment is authorized.
- **B.** ePayable/Credit Card Acceptance. Submittals offering ePayable/Credit card acceptance may be compared against submittals offering a prompt payment discount to evaluate the overall cumulative effect of the discount against the advantage to the City of the ePayable/Credit card acceptance, and may be considered in determining the apparent lowest responsible submittal.

1.19 PAYMENT METHOD - EPAYABLES - CREDIT CARD ACCEPTANCE - EFT/ACH ACCEPTANCE

- A. Payment methods include:
 - EPayables (Payment Plus). This is payment made via a virtual, single use VISA card number
 provided by the City's commercial card provider. Suppliers accepting this option will receive "due
 immediately" payment terms. Two options for acceptance are available to suppliers. Both are
 accompanied by an emailed advice containing complete payment details:
 - Straight-through processing (buyer initiated). Immediate, exact payments directly deposited to supplier accounts by the City's provider bank; the supplier does not need to know card account details.
 - Supplier retrieves card account through the secure, on-line portal provided via email notifications sent by the City's commercial card provider.
 - Credit card. Tacoma's VISA procurement card program is supported by standard bank credit suppliers and requires that merchants abide by the VISA merchant operating rules. It provides "due immediately" payment terms.
 - Suppliers must be PCI-DSS compliant (secure credit card data management) and federal FACTA (sensitive card data display) compliant.
 - Suppliers must be set up by their card processing equipment provider (merchant acquirer) as a minimum of a Level II merchant with the ability to pass along tax, shipping and merchant references information.
 - Electronic Funds Transfer (EFT) by Automated Clearing House (ACH). Standard terms are net 30 for this payment method.
 - · Check or other cash equivalent. Standard terms are net 30 for this payment method.
- B. The City's preferred method of payment is by ePayables (Payment Plus) followed by credit card (aka procurement card). Suppliers may be required to have the capability of accepting the City's ePayables or credit card methods of payment. The City of Tacoma will not accept price changes or pay additional fees when ePayables (Payment Plus) or credit card is used.
- **C.** The City, in its sole discretion, will determine the method of payment for goods and/orservices as part of the Contract.

1.20 COOPERATIVE PURCHASING

The Washington State Interlocal Cooperative Act RCW 39.34 provides that other governmental agencies may purchase goods and services on this solicitation or contract in accordance with the terms and prices indicated therein if all parties are agreeable.

1.21 PUBLIC DISCLOSURE: PROPRIETARY OR CONFIDENTIAL INFORMATION

A. Respondent's Submittals, all documents and records comprising any Contract awarded to Respondent, and all other documents and records provided to the City by Respondent are deemed public records subject to disclosure under the Washington State Public Records Act, Chapter 42.56 RCW (Public Records Act). Thus, City may be required, upon request, to disclose the Contract and documents or records related to it unless an exemption under the Public Records Act or other laws applies. In the event CITY receives a request for such disclosure, determines in its legal judgment that no applicable exemption to disclosure applies; and Respondent has complied with the requirements to Respondent has complied with the requirements to mark records considered confidential or proprietary

as such requirements are stated below, City agrees to provide Respondent 10 days written notice of impending release. Should legal action thereafter be initiated by Respondent to enjoin or otherwise prevent such release, all expense of any such litigation shall be borne by Respondent, including any damages, attorneys' fees or costs awarded by reason of having opposed disclosure. City shall not be liable for any release where notice was provided and Respondent took no action to oppose the release of information.

- **B.** If Respondent provides City with records or information that Respondent considers confidential or proprietary, Respondent must mark all applicable pages or sections of said record(s) as "Confidential" or "Proprietary." Further, in the case of records or information submitted in response to a Request for Proposals, an index must be provided indicating the affected pages or sections and locations of all such material identified Confidential or Proprietary. Information not included in the required index will not be reviewed for confidentiality or as proprietary before release. If Supplier fails to so mark or index Submittals and related records, then the City, upon request, may release said record(s) without the need to satisfy the requirements of subsection A above; and Respondent expressly waives its right to allege any kind of civil action or claim against the City pertaining to the release of said record(s).
- 1.22 Submission of materials in response to City's Solicitation shall constitute assent by Respondent to the foregoing procedure and Respondent shall have no claim against the City on account of actions taken pursuant to such procedure. FEDERAL AID PROJECTS

The City of Tacoma in accordance with Title VI of the Civil Rights Act of 1964, 78 Stat. 252, 42 U.S.C. 2000d to 2000d-4 and Title 49, Code of Federal Regulations, Department of Transportation, subtitle A, Office of the Secretary, part 21, nondiscrimination in federally assisted programs of the Department of Transportation issued pursuant to such Act, hereby notifies all bidders that it will affirmatively insure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises as defined at 49 CFR, part 26, will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin, or sex in consideration for an award.

SECTION II - CONTRACT REQUIREMENTS

2.01 CONTRACTOR'S RESPONSIBILITY

A. Contract Documents

The Respondent to whom the Contract is awarded, hereinafter called the Contractor, shall enter into a Contract with the City of Tacoma, within 10 days after receipt from the City of Tacoma of a properly prepared Contract. In addition, the Contractor will do all things required to promptly perform this Contract pursuant to the terms of this Contract. Certain contracts for supplies, goods or equipment may use the City Purchase Order in place of a formal contract document.

B. Surety Bonds

Except as modified by the Special Provisions, the Respondent to whom the Contract is awarded shall provide a payment and performance bond, including power of attorney, for 100 percent of the amount of his/her bid (including sales taxes), to insure complete performance of the Contract including the guarantee. The bonds must be executed by a surety company licensed to do business in the State of Washington. For a supply-type contract, a cashier's check or cash may be substituted for the bonds; however, this cash or cashier's check must remain with the City through the guarantee period and any interest on said amount shall accrue to the City.

C. Independent Contractor

Contractor is an independent contractor; no personnel furnished by the Contractor shall be deemed under any circumstances to be the agent or servant of the City. Contractor shall be fully responsible for all acts or omissions of Subcontractors and its and their suppliers and of persons employed by them, and shall be specifically responsible for sufficient and competent supervision and inspection to assure compliance in every respect with the Contract. There shall be no contractual relationship between any Subcontractors or supplier and the City arising out of or by virtue of this agreement. No provision of the Contract is intended or is to be construed to be for the benefit of any third party.

2.02 CONFLICTS IN SPECIFICATIONS

Anything mentioned in the Specifications and not shown on the Drawings and anything on the Drawings and not mentioned in the Specifications shall be of like effect and shall be understood to be shown and/or mentioned in both. In case of differences between Drawings and Specifications, the Specifications shall govern. In addition, in the event of any conflict between these General Provisions, the Special Provisions, the Technical Provisions and/or the Proposal pages, the following order of precedence shall control:

- 1. Proposal pages prevail if they conflict with the General, Special or Technical Provisions.
- 2. Special Provisions prevail if they conflict with the General Provisions and/or Technical Provisions.
- 3. Technical Provisions prevail if they are in conflict with the General Provisions.

In case of discrepancy of figures between Drawings, Specifications or both, the matter shall immediately be submitted to the Engineer for determination. Failure to submit the discrepancy issue to the Engineer shall result in the Contractor's actions being at his/her own risk and expense. The Engineer shall furnish from time to time such detailed drawings and other information as he/she may consider necessary.

2.03 INSPECTION

A. Of the Work

All materials furnished and work done shall be subject to inspection.

The Inspector administering the Contract shall at all times have access to the work wherever it is in progress or being performed, and the Contractor shall provide proper facilities for such access and inspection. Such inspection shall not relieve the Contractor of the responsibility of performing the work correctly, utilizing the best labor and materials in strict accordance with the Specifications of this Contract. All material or work approved and later found to be defective shall be replaced without cost to the City of Tacoma.

B. Inspector's Authority

The inspector shall have power to reject materials or workmanship which do not fulfill the requirements of these Specifications, but in case of dispute the Contractor may appeal to the Director or Superintendent, whose decision shall be final. The word "Director" means the Director of the City of Tacoma General Government department that is administering the contract. The word "Superintendent" means the Superintendent of the City of Tacoma, Department of Public Utilities Division that is administering the contract.

The Contract shall be carried out under the general control of the representative of the particular City Department or Division administering the Contract, who may exercise such control over the conduct of the work as may be necessary, in his or her opinion, to safeguard the interest of the City of Tacoma. The Contractor shall comply with all orders and instructions given by the representative of the particular Department or Division administering the Contract in accordance with the terms of the Contract.

Provided, that for the purposes of construction contracts, such control shall only apply (a) to the extent necessary to ensure compliance with the provisions of this contract, and (b) to the extent necessary to fulfill any nondelegable duty of the City for the benefit of third parties not engaged in promoting the activity of this contract.

Nothing herein contained, however, shall be taken to relieve the Contractor of his/her obligations or responsibilities under the Contract.

2.04 FEDERAL, STATE AND MUNICIPAL REGULATIONS

All federal, state, municipal and/or local regulations shall be satisfied in the performance of all portions of this Contract. The Contractor shall be solely responsible for all violations of the law from any cause in connection with work performed under this Contract.

2.05 INDEMNIFICATION

A. Indemnification

Contractor acknowledges that pursuant to the terms of this agreement, Contractor is solely and totally responsible for the safety of all persons and property in the performance of this Contract. To the greatest extent allowed by law, Contractor assumes the risk of all damages, loss, cost, penalties and expense and agrees to indemnity, defend and hold harmless the City of Tacoma, from and against any and all liability which may accrue to or be sustained by the City of Tacoma on account of any claim, suit or legal action made or brought against the City of Tacoma for the death of or injury to persons (including Contractor's or subcontractor's employees) or damage to property involving Contractor, or subcontractor(s) and their employees or agents, arising out of and in connection with or incident to the performance of the Contract including if the City is found to have a nondelegable duty to see that work is performed with requisite care. except for injuries or damages caused by the sole negligence of the City. In this regard, Contractor recognizes that Contractor is waiving immunity under industrial Insurance Law, Title 51 RCW. This indemnification extends to the officials, officers and employees of the City and also includes attorney's fees and the cost of establishing the right to indemnification hereunder in favor of the City of Tacoma. In addition, within the context of competitive bidding laws, it is agreed that this indemnification has been mutually negotiated. Provided however, this provision is intended to be applicable to the parties to this agreement and it shall not be interpreted to allow a Contractor's employee to have a claim or cause of action against Contractor.

B. Limitation of Liability for Primarily Supply-Type Contracts

In all contracts where the total cost of the supply of materials and/or equipment constitute at least 70 percent of the total contract price (as determined by the City), the City agrees that it will not hold the contractor, supplier or manufacturer liable for consequential damages for that part of the contract related to the manufacture and/or design of the equipment, materials or supplies.

2.06 CONTRACTOR'S INSURANCE

- **A.** During the course and performance of a Contract, Contractor will provide proof and maintain the insurance coverage in the amounts and in the manner specified in the City of Tacoma Insurance Requirements as is applicable to the services, products, and deliverables provided under the Contract. The City of Tacoma Insurance Requirements document, if issued, is fully incorporated into the Contract by reference.
- **B.** Failure by City to identify a deficiency in the insurance documentation provided by Contractor or failure of City to demand verification of coverage or compliance by Contractor with these insurance requirements shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

2.07 ASSIGNMENT AND SUBLETTING OF CONTRACT

C. Assignment

The Contract shall not be assigned except with the consent of the Superintendent or his/her designee.

Requests for assignment of this contract must be in writing with the written consent of the surety, and the request must show the proposed person or organization to which the contract is assigned is capable, experienced and equipped to perform such work. The proposed substitute person or organization may be required to submit to the City information as to his/her experience, financial ability and give statements covering tools, equipment, organization, plans and methods to fulfill any portion of the Contract prior to approval of assignment.

D. Subletting

The Contract shall not be sublet except with the written consent of the Superintendent or his/her designee. In the event that a prequalified electrical contractor is necessary to perform certain portions of the work, such work may be subcontracted with a City prequalified electrical contractor for the type of work involved.

Requests for subletting of this Contract must be in writing with the written consent of the Surety, and the request must show the proposed person or organization to which the Contract is sublet is capable, experienced and equipped to perform such work. The proposed substitute person or organization may be required to submit to the City information as to his experience, financial ability and give statements covering tools, equipment, organization, plans and methods to fulfill any portion of the Contract prior to approval of subletting.

The written consent approving the subletting of the Contract shall not be construed to relieve the Contractor of his/her responsibility for the fulfillment of the Contract. The Subcontractor shall be considered to be the agent of the Contractor and the Contractor agrees to be responsible for all the materials, work and indebtedness incurred by the agent.

A subcontractor shall not sublet any portion of a subcontract for work with the City without the written consent of the City.

2.08 DELAY

E. Extension of Time

With the written approval of the Superintendent or his/her designee, the Contractor may be granted additional time for completion of the work required under this Contract, if, in the Superintendent's opinion the additional time requested arises from unavoidable delay.

F. Unavoidable Delay

Unavoidable delays in the prosecution of the work shall include only delays from causes beyond the control of the Contractor and which he/she could not have avoided by the exercise of due care, prudence, foresight and diligence. Delay caused by persons other than the Contractor, Subcontractors or their employees will be considered unavoidable delays insofar as they necessarily interfere with the Contractor's completion of the work, and such delays are not part of this Contract.

Unavoidable delay will not include delays caused by weather conditions, surveys, measurements, inspections and submitting plans to the Engineer of the particular Division involved in administering this Contract.

2.09 GUARANTEE

A. Guarantee for Construction, Labor or Services Contract

Neither the final certificate of payment or any provision in the Contract Documents, nor partial or entire occupancy of the premises by the City, shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from the date of final acceptance of the work unless a longer period is specified. The City will give notice of observed defects with reasonable promptness.

If it has been discovered, before payment is required under the terms of the Contract, that there is a failure to comply with any of the terms and provisions of this Contract, the City has the right and may withhold payment.

In case of a failure of any part of the work, materials, labor and equipment furnished by the Contract or to fully meet all of the requirements of the Contract, the Contractor shall make such changes as may be necessary to fully meet all of the specifications and requirements of this Contract. Such changes shall be made at the Contractor's sole cost and expense without delay and with the least practicable inconvenience to the City of Tacoma. Rejected material and equipment shall be removed from the City's property by and at the expense of the Contractor.

B. Guarantee for Supply Contracts

Unless a longer period is specified, the supplier and/or manufacturer of the supplies, materials and/or equipment furnished pursuant to this Contract agrees to correct any defect or failure of the supplies, materials and/or equipment which occurs within one year from the date of: (1) test energization if electrical or mechanical equipment; (2) commencement of use if supplies or materials, provided, however, said guarantee period shall not extend beyond eighteen months after date of receipt by the City. All of the costs (including shipping, dismantling and reinstallation) of repairs and/or corrections of defective or failed equipment, supplies and/or material is the responsibility of the supplier and/or manufacturer.

When the supplier is not the manufacturer of the item of equipment, supplier agrees to be responsible for this guarantee and supplier is not relieved by a manufacturer's guarantee.

C. Guarantee Period Extension

The Contract guarantee period shall be suspended from the time a significant defect is first documented by the City until the work or equipment is repaired or replaced by Contractor and accepted by the City. In addition, in the event less than ninety (90) days remain on the guarantee period (after recalculating), the guarantee period shall be extended to allow for at least ninety (90) days from the date the work or equipment is repaired or replaced and accepted by the City.

2.10 DEDUCTIONS FOR UNCORRECTED WORK

If the City of Tacoma deems it expedient to correct work not done in accordance with the terms of this Contract, an equitable deduction from the Contract price shall be made.

2.11 CITY OF TACOMA'S RIGHT TO TERMINATE CONTRACT

A. Termination for Convenience

- 1. Supplies. The City may terminate a Contract for supplies at any time upon prior written notice to Contractor. Upon the effective date of termination specified in such notice, and payment by the City, all conforming supplies, materials, or equipment previously furnished hereunder shall become its property.
- 2. Services. The City may terminate a Contract for services at any time, with or without cause, by giving 10-business day's written notice to Supplier. In the event of termination, all finished and unfinished work prepared by Supplier pursuant to the Contract shall be provided to the City. In the event City terminates the Contract due to the City's own reasons and without cause due to Supplier's actions or omissions, the City shall pay Supplier the amount due for actual work and services necessarily performed under the Contract up to the effective date of termination, not to exceed the total compensation set forth in the Contract.

B. Termination for Cause

- 1. The City may terminate a Contract for either services or supplies in the event of any material breach of any of the terms and conditions of the Contract if the Contractor's breach continues in effect after written notice of breach and 30 days to cure such breach and fails to cure such breach
- 2. Bankruptcy. If the Contractor should be adjudged as bankrupt, or makes a general assignment for the benefit of creditors, or a receiver should be appointed on account of his/her insolvency, or if he/she or any of his/her subcontractors should violate any of the provisions of the Contract, or if the work is not being properly and diligently performed, the City of Tacoma may serve written notice upon the Contractor and Surety, executing the Payment and Performance Bond, of its intention to terminate the Contract; such notice will contain the reasons for termination of the Contract, and unless within 10 days after the serving of such notice, such violation shall cease and an arrangement satisfactory to the City of Tacoma for correction thereof shall be made, the Contract shall, upon the expiration of said I 0 days, cease and terminate and all rights of the Contractor hereunder shall be forfeited. In the event the Contract is terminated for cause, Contractor shall not be entitled to any lost profits resulting therefrom.
- 3. Notice. In the event of any such termination for cause, the City of Tacoma shall immediately send (by regular mail or other method) written notice thereof to the Surety and the Contractor. Upon such termination the Surety shall have the right to take over and perform the Contract, provided however, the Surety must provide written notice to the City of its intent to complete the work within 15 calendar days of its receipt of the original written notice (from the City) of the intent to terminate. Upon termination and if the Surety does not perform the work, the City of Tacoma may take over the work and prosecute the same to completion by any method it may deem advisable, for the account of and at the expense of the Contractor, and the Contractor and the Surety shall be liable to the City of Tacoma for all cost occasioned to the City of Tacoma thereby. The City of Tacoma may without liability for doing so, take possession of and utilize in completing the work, such materials, equipment, plant and other property belonging to the Contractor as may be on the site of the work and necessary therefore.

2.12 LIENS

In the event that there are any liens on file against the City of Tacoma, the City of Tacoma shall be entitled to withhold final or progress payments to the extent deemed necessary by the City of Tacoma to properly protect the outstanding lien claimants until proper releases have been filed with the City Clerk.

2.13 LEGAL DISPUTES

A. General

Washington law shall govern the interpretation of the Contract. The state or federal courts located in Pierce County Washington shall be the sole venue of any mediation, arbitration, or litigation arising out of the Contract.

Respondents providing submittals from outside the legal jurisdiction of the United States of America will be subject to Tacoma's City Attorney's Office (CAO) opinion as to the viability of possible litigation pursuant to a contract resulting from this Specification. If it is the opinion of the CAO that any possible litigation would be beyond reasonable cost and/or enforcement, the submittal may be excluded from evaluation.

B. Attorney Fees

For contracts up to \$250,000, which become the subject of litigation or arbitration, the substantially prevailing party may be entitled to reasonable attorney fees, as provided in RCW 39.04.240. Provided, however, the attorney fee hourly rate for the City of Tacoma's assistant city attorneys is agreed to be \$150 per hour or the same as the hourly rate for Contractor's legal counsel, whichever is greater.

2.14 DELIVERY

Prices must be quoted F.O.B. destination, freight prepaid and allowed with risk of loss during transit remaining with Contractor/Supplier (unless otherwise stated in these Specifications) to the designated address set forth in these Specifications.

Deliveries shall be between 9:00 a.m. and 3:30 p.m.; Monday through Friday only (except legal holidays of the City of Tacoma).

Legal holidays of the City of Tacoma are:

New Year's Day January I

Martin Luther King's Birthday

Washington's Birthday

Memorial Day

3rd Monday in February
Last Monday in May

Independence Day July 4

Labor Day 1st Monday in September

Veteran's Day November 11

Thanksgiving Day 4th Thursday of November Day after Thanksgiving 4th Friday of November

Christmas Day December 25

When any of these holidays occur on Saturday or Sunday, the preceding Friday or the following Monday, respectively, is a legal holiday for the City of Tacoma.

2.15 PACKING SLIPS AND INVOICES

- **A.** Packing slips and shipping notices shall be sent to the specific City Division or Department receiving the item(s) at the address stated in City's Solicitation or as otherwise stated in the Contract and include complete description of items, contents of items if crated or cased, quantity, shipping point, carrier, bill of lading number and City of Tacoma purchase order.
- **B.** Each invoice shall show City of Tacoma purchase order number, release number if applicable, quantity, unit of measure, item description, unit price and extended price for each line if applicable, services and deliverables provided if applicable. Line totals shall be summed to give a grand total to which sales tax shall be added, if applicable.
 - 1. For transactions conducted in SAP Ariba, invoices shall be submitted through Ariba.
 - 2. For invoices paid by ACH or by check, unless stated otherwise, invoices shall be electronically submitted by email with corresponding PO number listed in the subject line to_accountspayable@cityoftacoma.org.

3. For invoices paid by credit card, invoices shall also display the last name of the cardholder and last four digits (only) of the card number (e.g., Jones/6311). Unless stated otherwise, invoices shall be electronically submitted by email with corresponding PO number listed in the subject line to (do not combine different POs into one invoice or charge) to pcardadmin@cityoftacoma.org.

2.16 APPROVED EQUALS

A. Unless an item is indicated as "No substitute", special brands, when named, are intended to describe the standard of quality, performance or use desired. Equal items will be considered by the City, provided that the respondent specifies the brand and model, and provides all descriptive literature, independent test results, product samples, local servicing and parts availability to enable the City to evaluate the proposed "equal".

B. The decision of the City as to what items are equal shall be final and conclusive. If the City elects to purchase a brand represented by the respondent to be an "equal", the City's acceptance of the item is conditioned on the City's inspection and testing after receipt. If, in the sole judgment of the City, the item is determined not to be an equal, the item shall be returned at the respondent's expense.

C. When a brand name or level of quality is not stated by the respondent, it is understood the offer is exactly as specified. If more than one brand name is specified, respondents must clearly indicate the brand and model/part number being bid.

2.17 ENTIRE AGREEMENTS

This written contract represents the entire Agreement between the parties and supersedes any prior oral statements, discussions or understandings between the parties.

2.18 CODE OF ETHICS

The City's Code of Ethics, Chapter 1.46, Tacoma Municipal Code, provides ethical standards for City personnel and prohibits certain unethical conduct by others including respondents and contractors. Violation of the City's Code of Ethics will be grounds for termination of this contract.

2.19 FEDERAL FINANCIAL ASSISTANCE

If federal funds, including FEMA financial assistance to the City of Tacoma, will be used to fund, pay or reimburse all or a portion of the Contract, Contractor will comply with all applicable Federal law, regulations, executive orders, FEMA policies, procedures, and directives and the following clauses will be incorporated into the Contract:

- A. EQUAL EMPLOYMENT OPPORTUNITY During the performance of this Contract, Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:
 - 1. Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
 - 2. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
 - 3. The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other

employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

- 4. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- 5. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- 6. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- 7. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- 8. The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

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

B. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

- 1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- 2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (B)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (B)(1) of this section, in the sum of \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

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

C. CLEAN AIR ACT

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

D. FEDERAL WATER POLLUTION CONTROL ACT

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

E. DEBARMENT AND SUSPENSION

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

F. BYRD ANTI-LOBBYING AMENDMENT

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

APPENDIX A, 44 C.F.R. PART 18 - CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

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

- No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- 2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The Contractor,	, certifies or affirms the truthfulness and accuracy of each statement of its
certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of	
31 U.S.C. Chap.38, Adr disclosure, if any.	ministrative Remedies for False Claims and Statements, apply to this certification and
Signature of Contractor	s Authorized Official
Name and Title of Contr	ractor's Authorized Official
Date	

G. PROCUREMENT OF RECOVERED MATERIALS

- 1. In the performance of this contract, the Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired:
 - a. Competitively within a timeframe providing for compliance with the contract performance schedule;
 - b. Meeting contract performance requirements; or
 - c. At a reasonable price.
- 2. Information about this requirement, along with the list of EPA- designated items, is available at EPA's Comprehensive Procurement Guidelines web site, https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program.
- Contractor also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.

[Section III is for contracts that involve construction and/or labor, and are not applicable to contracts solely for material/supply purchases.]

GENERAL PROVISIONS

SECTION III - CONSTRUCTION AND/OR LABOR CONTRACTS

SECTION III REQUIREMENTS APPLY ONLY TO CONSTRUCTION AND/OR LABOR CONTRACTS AND ARE IN ADDITION TO APPLICABLE REQUIREMENTS CONTAINED IN SECTION II CONTRACT REQUIREMENTS.

3.01 RESPONDENT'S DUTY TO EXAMINE

The Respondent agrees to be responsible for examining the site(s) and to have compared them with the Specifications and Contract Drawings, and to be satisfied as to the facilities and difficulties attending the execution of the proposed Contract (such as uncertainty of weather, floods, nature and condition of materials to be handled and all other conditions, obstacles and contingencies) before the delivery of his/her Proposal. No allowance will be subsequently made by the City on behalf of the Respondent by reason of any error or neglect on Respondent's part, for such uncertainties as aforesaid.

3.02 PERMITS

Except when modified by the Special Provisions, the Contractor shall procure and pay for all permits and licenses necessary for the completion of this Contract including those permits required by the City of Tacoma. The City will obtain county or state road crossing permits if required. In the event a necessary permit is not obtained, the Contractor will not be permitted to work on items subject to said permit and any delays caused thereby will not be subject to extra compensation or extensions.

3.03 NOTIFICATION OF OTHER GOVERNMENTAL AGENCIES AND UTILITIES WHEN UNDERGROUND WORK IS INVOLVED

The Contractor shall notify all other affected governmental agencies and utilities whenever underground work is done under the terms of this Contract. The Contractor is required to obtain permission of the appropriate public and private utilities and governmental agencies before performing underground work pursuant to the terms of this Contract. The Contractor is required to call "one call" at 1-800-424-5555 for all work involving excavation or digging more than 12 inches beneath ground or road surface.

The City may have indicated on the plans and specifications the existence of certain underground facilities that are known to the City department responsible for this Contract. It is the Contractor's responsibility to fully comply with the Underground Utility Locate Law, Chapter 19.122 RCW. If the site conditions are "changed or differing" as defined by RCW 19.122.040(I), the Contractor may pursue the party responsible for not properly marking or identifying the underground facility. The Contractor agrees not to file any claim or legal action against the City (department responsible for this Contract) for said "changed or differing" conditions unless said City department is solely responsible for the delay or damages that the Contractor may have incurred.

3.04 TRENCH EXCAVATION BID ITEM

In the event that "trench excavation" in excess of four feet requires a safety system pursuant to Washington State law and safety shoring, sloping, sheeting, or bracing is used, a separate bid item should be set forth in the Proposal for this work. If a separate bid item is not set forth in the Proposal pages, said installed safety system shall be paid at \$3.00 per lineal foot of trench, which unit price includes both sides of the trench.

3.05 SAFETY

A. General

The Contractor shall, at all times, exercise adequate precautions for the safety of all persons, including its employees and the employees of a Subcontractor, in the performance of this Contract and shall comply with all applicable provisions of federal, state, county and municipal safety laws and regulations. It is the Contractor's responsibility to furnish safety equipment or to contractually require Subcontractors to furnish adequate safety equipment relevant to their responsibilities.

The Contractor shall obtain the necessary line clearance from the inspector before performing any work in, above, below or across energized Light Division circuits.

The Inspector and/or Engineer may advise the Contractor and the Safety Officer of any safety violations. It is the Contractor's responsibility to make the necessary corrections. Failure to correct safety violations is a breach of this Contract and, as such, shall be grounds for an order from the Safety Officer, Inspector or Engineer to cease further work and remove from the job site until the condition is corrected. Time and wages lost due to such safety shutdowns shall not relieve the Contractor of any provisions of Section 3.14 of this Specification and shall be at the sole cost of the Contractor. The purpose of this authority to stop work is to enforce the contract and not to assume control except to the extent necessary to ensure compliance with the provisions of this contract.

Any of the above actions by employees of the City of Tacoma shall in no way relieve the Contractor of his/her responsibility to provide for the safety of all persons, including his/her employees.

B. Work Hazard Analysis Report

The Contractor will be required to complete a work hazard analysis report. This report shall outline how the Contractor proposes to satisfy all safety laws and regulations involved in performing the work. This report shall be completed and submitted to the City Safety Officer before the pre-construction conference. A copy of the report shall be maintained at the work site (accessible to the supervisor).

3.06 PROTECTION OF WORKERS AND PROPERTY

The Contractor shall erect and maintain good and sufficient guards, barricades and signals at all unsafe places at or near the work and shall, in all cases, maintain safe passageways at all road crossings, and crosswalks, and shall do all other things necessary to prevent accident or loss of anykind.

The Contractor shall protect from damage all utilities, improvements, and all other property that is likely to become displaced or damaged by the execution of the work under this Contract.

The Contractor is responsible for all roads and property damaged by his/her operations as shall be determined by the Engineer administering this Contract. The Contractor shall be responsible for repairing all damage to roads caused by his/her operations to the satisfaction of the particular governmental body having jurisdiction over the road.

3.07 CONTRACTOR - SUPERVISION AND CHARACTER OF EMPLOYEES

A. Superintendent to Supervise Contractor's Employees

The Contractor shall keep on his/her work, during its progress, a competent superintendent and any necessary assistants, all of whom must be satisfactory to the City of Tacoma. The Contractor's superintendent shall not be changed except with the consent of the City of Tacoma, unless the Contractor's superintendent proves to be unsatisfactory to the Contractor and ceases to be in his/her employ. The Contractor's superintendent shall represent the Contractor in his/her absence and all directions given to him/her shall be binding as if given to the Contractor directly. The Contractor shall give efficient supervision to the work, using his/her best skill and attention.

B. Character of Contractor's Employees

The Contractor shall employ only competent, skillful, faithful and orderly persons to do the work, and whenever the Engineer administering the Contract shall notify the Contractor in writing that any person on the work is, in his or her opinion, incompetent, unfaithful, disorderly or otherwise unsatisfactory, the Contractor shall forthwith discharge such persons from the work and shall not again employ him or her on this Contract.

3.08 CONTRACTOR'S COMPLIANCE WITH THE LAW

A. Hours of Labor

The Contractor and Subcontractors shall be bound by the provisions of RCW Chapter 49.28 (as amended) relating to hours of labor. Except as set forth in the Special Provisions, eight (8) hours in any calendar day shall constitute a day's work on a job performed under this Contract.

In the event that the work is not performed in accordance with this provision and in accordance with the laws of the State of Washington, then this Contract may be terminated by the City of Tacoma for the reason that the same is not performed in accordance with the public policy of the State of Washington as defined in said statutes.

B. Prevailing Wages

If federal, state, local, or any applicable law requires Supplier to pay prevailing wages in connection with a Contract, and Supplier is so notified by the City, then Supplier shall pay applicable prevailing wages.

If applicable, a Schedule of Prevailing Wage Rates and/or the current prevailing wage determination made by the Secretary of Labor for the locality or localities where the Contract will be performed is attached and made of part of the Contract by this reference. If prevailing wages do apply to the Contract, Supplier and its subcontractors shall:

- 1. Be bound by and perform all transactions regarding the Contract relating to prevailing wages and the usual fringe benefits in compliance with the provisions of Chapter 39.12 RCW, as amended, the Washington State Prevailing Wage Act and/or the Davis-Bacon Act (40 U.S.C. 3141- 3144, and 3146-3148) and the requirements of 29 C.F.R. pt. 5 as may be applicable, including the federal requirement to pay wages not less than once a week,
- 2. Ensure that no worker, laborer or mechanic employed in the performance of any part of the Contract shall be paid less than the prevailing rate of wage specified on that Schedule and/or specified in a wage determination made by the Secretary of Labor (unless specifically preempted by federal law, the higher of the Washington state prevailing wage or federal Davis-Bacon rate of wage must be paid)and Additionally, in compliance with applicable federal law, contractors are required to pay wages not less than once a week.
- 3. Immediately upon award of the Contract, contact the Department of Labor and Industries, Prevailing Wages section, Olympia, Washington and/or the federal Department of Labor, to obtain full information, forms and procedures relating to these matters. Per such procedures, a Statement of Intent to Pay Prevailing Wages and/or other or additional documentation required by applicable federal law, must be submitted by Contractor and its subcontractors to the City, in the manner requested by the City, prior to any payment by the City hereunder, and an Affidavit of Wages Paid and/or other or additional documentation required by federal law must be received or verified by the City prior to final Contract payment. In the event any dispute arises as to what are the prevailing rates of wages for work of a similar nature and such dispute cannot be adjusted by the parties in interest, including labor and management representatives, the matter shall be referred for arbitration to the Director of the State of Washington, Department of Labor and industries whose decision shall be final, conclusive and binding on all parties involved in the dispute.

3.09 COPELAND ANTI-KICKBACK ACT

For contracts subject to Davis Bacon Act the following clauses will be incorporated into the Contract:

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

3.10 CHANGES

A. In Plans or Quantities

The City of Tacoma, without invalidating this Contract, or any part of this Contract, may order extra work or make reasonable changes by altering, adding to or deducting from the materials, work and labor and the Contract sum will be adjusted accordingly. All such work and labor shall be executed under the conditions of the original Contract except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such change. When work or bid items are deducted, reduced or eliminated, it is agreed that no payment will be made to Contractor for anticipated profit.

B. Extra Work

Any claim or order for extra materials, work and labor made necessary by alterations or additions to the plans or by other reasons for which no price is provided in this Contract, shall not be valid unless the Contractor and Engineer administering the Contract have agreed upon a price prior to commencing extra work, and the agreement has been signed by the Contractor and approved by the Superintendent or his/her designee, and approved by the payment and performance bond surety.

C. Extra Work - No Agreed Price

If it is impracticable to fix an increase in price definitely in advance, the order may fix a maximum price which shall not under any circumstances, be exceeded, and subject to such limitation, such alteration, modification, or extra shall be paid for at the actual necessary cost as determined by the City of Tacoma, which cost (including an allowance for profit) shall be determined as the sum of the following items (1) to (7) inclusive:

- (1) Labor, computed at regular wage scale, including premium on compensation insurance and charge for social security taxes, and other taxes, pertaining to labor; no charge for premium pay shall be allowed unless authorized by the Engineer administering the Contract;
- (2) The proportionate cost of premiums on comprehensive general liability and other insurance applicable to the extra work involved and required under this Contract;
- Material, including sales taxes pertaining to materials;
- (4) Plant and equipment rental, to be agreed upon in writing before the work is begun; no charge for the cost of repairs to plant or equipment will be allowed;
- (5) Superintendence, general expense and profit computed at 20 percent of the total of paragraphs (1) to (4) inclusive;
- (6) The proportionate cost of premiums on bonds required by this Contract, computed by 1 1/2 percent of the total of paragraphs (1) to (5) inclusive.
- (7) The City of Tacoma reserves the right to furnish such materials as it may deem expedient, and no allowance will be made for profit thereon.

Whenever any extra work is in progress, for which the definite price has not been agreed on in advance, the Contractor shall each day, report to the Engineer the amount and cost of the labor and material used, and any other expense incurred in such extra work on the preceding day, and no claim for compensation for such extra work will be allowed unless such report shall have been made.

The above-described methods of determining the payment for work and materials shall not apply to the performance of any work or the furnishing of any material, which, in the judgment of the Engineer administering the Contract, may properly be classified under items for which prices are established in the Contract.

D. Claims for Extra Work

If the Contractor claims that any instructions by drawings or otherwise, involve extra cost under this Contract, he/she shall give the City of Tacoma written notice thereof within 30 days after receipt of such instruction, and in any event before proceeding to execute the work, except in an emergency endangering life or property, and the procedures governing the same shall be as provided for immediately above in this paragraph. The method in these paragraphs is the only method available to the Contractor for payment of claims for extra work performed under the terms of this Contract.

3.11 CLEANING UP

The Contractor shall at all times, at his/her own expense, keep the premises free from accumulation of waste materials or debris caused by any workers or the work, at the completion of the work the Contractor shall remove all his waste materials from and about the site and all his/her equipment, sanitary facilities and surplus materials. In the case of dispute, the City of Tacoma may remove the debris and charge the cost to the Contractor as the City of Tacoma shall determine to be just. All material that is deposited or placed elsewhere than in places designated or approved by the Engineer administering the Contract will not be paid for and the Contractor may be required to remove such material and deposit or place it where directed.

3.12 PROGRESS PAYMENT

Progress payments will be made up to the amount of ninety-five percent (95%) of the actual work completed as shall be determined by the Engineer administering the Contract.

The Contractor may request that an escrow account be established as permitted by law, in which event the Contractor will earn interest on the retained funds.

When the time for construction, services and/or installation will exceed thirty (30) days, the Contractor may request, by invoice, to be paid a progress payment based on percentage of work completed. The Engineer will review and approve the progress payment request on a monthly basis.

3.13 FINAL PAYMENT

The final payment of five percent (5%) of the Contract price shall be approved on final acceptance of the work under this Contract by the Superintendent or his/her designee. In addition, before final payment is made, the Contractor shall be required to:

- A. Provide a certificate from the Washington State Department of Revenue that all taxes due from the Contractor have been paid or are collectible in accordance with the provisions of Chapter 60.28 and Title 82 of the Revised Code of Washington;
- B. Provide the General Release to the City of Tacoma on the form set forth in these Contractdocuments;
- C. Provide a release of any outstanding liens that have been otherwise filed against any monies held or retained by the City of Tacoma;
- D. File with the City Director of Finance, and with the Director of the Washington State Department of Labor and Industries, on the state form to be provided, an affidavit of wages paid;
- E. File with the City Director of Finance, on the state form to be provided, a statement from the State of Washington, Department of Labor and Industries, certifying that the prevailing wage requirements have been satisfied.
- F. File with the City Director of Finance, on the state form to be provided, a statement of release from the Public Works Contracts Division of the State of Washington, Department of Labor and Industries, verifying that all industrial insurance and medical aid premiums have been paid.

If there is a fee assessed to the City for any certificate, release or other form required by law, the contractor agrees that the fee amount may be passed on to the Contractor and deducted from the monies paid to the Contractor.

3.14 FAILURE TO COMPLETE THE WORK ON TIME

Should the completion of the work required under the Contract be delayed beyond the expiration of the period herein set for the completion of said work, or such extension of said period as may be allowed by reason of unavoidable delays, there shall be deducted from the total Contract price of work, for each calendar day by which such completion shall be delayed beyond said period of such extension thereof the sum of \$300 or a sum of money as set forth hereinafter in these Specifications, as the amount of such deduction per calendar day.

Said sum shall be considered not as a penalty, but as liquidated damages, which the City will suffer by reason of the failure of the Contractor to perform and complete the work within the period, herein fixed or such extensions of said period as may be allowed by reason of unavoidable delays.

Any money due or to become due the Contractor may be retained by the City to cover said liquidated damages, and should such money not be sufficient to cover such damages, the City shall have the right to recover the balance from the Contractor or his/her Sureties.

The filing of any bid for the work herein contemplated shall constitute acknowledgment by the Respondent that he/she understands, agrees and has ascertained that the City will actually suffer damages to the amount hereinabove fixed for each and every calendar day during which the completion of the work herein required shall be delayed beyond the expiration of the period herein fixed for such completion or such extension of said period as may be allowed by reason of unavoidable delays.

3.15 CITY RESERVES RIGHT TO USE FACILITIES PRIOR TO ACCEPTANCE

The City of Tacoma hereby reserves the right to use the facilities herein contracted prior to final acceptance under this Contract. The use of said facilities, as mentioned herein, shall not be construed as a waiver or relinquishment of any rights that the City of Tacoma has under this Contract.

3.16 LIST OF SUBCONTRACTORS

Bid proposals for construction, alteration or repair of any building or other public works that may exceed \$1,000,000 including tax shall satisfy the following requirement: Respondent shall submit as part of the bid, the names of the subcontractors, with whom the respondent, if awarded the contract, will subcontract performance of the work of heating, ventilation and air conditioning, plumbing as described in chapter 18.106 RCW, and electrical as described in chapter 19.28 RCW, or to name itself for the work. The respondent shall not list more than one subcontractor for each category of work identified, unless subcontractors vary with bid alternates, in which case the respondent must indicate which subcontractor will be used for which alternate. Failure to comply with this provision or the naming of two or more subcontractors to perform the same work shall require the City (pursuant to state law RCW 39.30.060) to determine that respondent's bid is nonresponsive; therefore, the bid will be rejected.