



City of Tacoma, WA

**TACOMA WATER
REQUEST FOR BIDS
PORTLAND AVENUE ISOLATION VALVE
SPECIFICATION NO. TW23-0025N**



CITY OF TACOMA

TACOMA WATER

REQUEST FOR BIDS TW23-0025N

PORTLAND AVENUE ISOLATION VALVE

Submittal Deadline: 11:00 a.m., Pacific Time, Thursday, March 9, 2023

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, sendbid@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:

By Email:

sendbid@cityoftacoma.org

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

Bid Opening: Submittals in response to a RFB will be recorded as received by a Purchasing representative. Final results are posted to our website www.TacomaPurchasing.org as they come available.

Solicitation Documents: An electronic copy of the complete solicitation documents may be viewed and obtained by accessing the City of Tacoma Purchasing website at www.TacomaPurchasing.org.

- [Register for the Bid Holders List](#) to receive notices of addenda, questions and answers and related updates.
- Click here to see a [list of vendors registered for this solicitation](#).

Project Scope: Procurement of a 18" metal seated ball valve for the Isolation of the fill valve at Tacoma Waters Portland Ave Reservoir.

Estimate: \$125,000

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 [our Minimum Employment Standards Paid Sick Leave 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
Request for Bids Specification No. TW23-0025N
Template Revised: 01/13/2023

(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.

Federal 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 Becky Lewis, Buyer by email to rlewis4@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

Table of Contents	4
1. MINIMUM REQUIREMENTS.....	6
2. STANDARD TERMS AND CONDITIONS	6
3. INSURANCE REQUIREMENTS.....	6
4. DESCRIPTION OF WORK.....	6
5. ANTICIPATED CONTRACT TERM.....	6
6. CALENDAR OF EVENTS.....	6
7. INQUIRIES	7
8. PRE-BID MEETING.....	7
9. DISCLAIMER.....	7
10. RESPONSIVENESS	7
11. AWARD.....	7
12. DELIVERY	8
13. WARRANTY.....	8
14. INSPECTION	9
15. COMPLIANCE WITH SPECIFICATIONS	9
16. MATERIALS AND WORKMANSHIP	9
17. ENVIRONMENTALLY PREFERABLE PROCUREMENT	9
APPENDIX A	11
18. GENERAL	11
19. EXECUTION	15
20. GENERAL	23
21. PRODUCTS	25
22. GENERAL	40
23. PRODUCTS	43
APPENDIX B	48
APPENDIX C	49
APPENDIX D	50

SUBMITTAL CHECK LIST

This checklist identifies items to be included with your submittal. Any submittal received without these required items may be deemed non-responsive and not be considered for award. Submittals must be received by the City of Tacoma Purchasing Division by the date and time specified in the Request for Bids page.

The following items make up your complete electronic submittal package (include all the items below):	
Signature Page (Appendix B) 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.	
Price Proposal Form (Appendix B) The unit prices bid must be shown in the space provided. Check your computations for omissions and errors.	
After award, the following documents will be executed:	
City of Tacoma Contract (See sample in Appendix C) Must be executed by the successful bidder.	
Certificate of Insurance and related endorsements (Appendix D) Shall be submitted with all required endorsements	
General Release (See sample in Appendix C)	

HEALTH & SAFETY: Be sure to comply with all City of Tacoma health and safety requirements.

This project has been deemed to be an essential project by the City of Tacoma and it is anticipated that the contract will be operational during the COVID-19 outbreak. Therefore the contractor shall complete a health and safety plan describing how the contractor will complete the work while combating the COVID-19 spread (social distancing practices) and what Personal Protective Equipment (PPE) will be in place.

1. MINIMUM REQUIREMENTS

List any minimum requirements for respondents. See Supplemental Requirements in Notice to Bidders above.

2. STANDARD TERMS AND CONDITIONS

City of Tacoma [Standard Terms and Conditions](#) apply.

3. INSURANCE REQUIREMENTS

Successful proposer will provide proof of and maintain the insurance coverage in the amounts and in the manner specified in the City of Tacoma Insurance Requirements contained in this solicitation. (See Appendix D)

4. DESCRIPTION OF WORK

The City of Tacoma (City) / Tacoma Public Utilities (TPU) is soliciting bids to establish one or more contracts with qualified vendors to fulfill the City's needs for a 18" metal-seated ball valve. Contract(s) will be awarded to the lowest responsive and responsible bidder(s) based on price, product quality and availability.

Vendors may be required to submit samples of their product for evaluation prior to award. Products that fail to meet City standards or any of the specifications herein may be rejected. Should a contracted vendor fail to meet quality and/or availability requirements contained in these specifications, the City may move to terminate the contract with 10 days written notice.

5. ANTICIPATED CONTRACT TERM

The contract will be for a three-year period and is subject to the price increase/decrease provisions per the [Price Adjustments](#) section. The City reserves the right to cancel the contract for any reason, by written notice, as stipulated in the contract.

6. CALENDAR OF EVENTS

This is a tentative schedule only and may be altered at the sole discretion of the City.

Contract may be issued after Public Utility Board and/or City Council approval.

The anticipated schedule of events concerning this RFB is as follows:

Question Deadline:	2/23/2023
City response to Questions:	3/2/2023
Submittal Due Date:	3/9/2023
Anticipated Award Date, on or about:	3/16/2023

7. INQUIRIES

- 7.1 Questions can be submitted to *Rebecca Lewis*, Buyer/Senior Buyer, via email to Rlewis@cityoftacoma.org Subject line to read:
Spec # – Spec Title – VENDOR NAME
- 7.2 Questions are due by 3 pm on the date included in the Calendar of Events section.
- 7.3 Questions marked confidential will not be answered or included.
- 7.4 The City reserves the discretion to group similar questions to provide a single answer or not to respond when the requested information is confidential.
- 7.5 The answers are not typically considered an addendum.
- 7.6 The City will not be responsible for unsuccessful submittal of questions.
- 7.7 Written answers to questions will be posted alongside these specifications at www.tacomapurchasing.org.

8. PRE-BID MEETING

No pre-proposal meeting will be held; however, questions and request for clarifications of the specifications may be submitted as stated in the [inquiries](#) section.

9. 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.

10. 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

11. 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.

All other elements or factors, whether or not specifically provided for in this specification, which would affect the final cost to and the benefits to be derived by the City will be considered in determining the award of the contract. The final award decision will be based on the best interests of the City.

The City reserves the right to let the contract to the lowest responsible bidder whose bid will be the most advantageous to the City, price and any other factors considered. In evaluating the proposals, the City may also consider any or all of the following:

1. Compliance with specification.
2. Proposal prices, listed separately if requested, as well as a lump sum total
3. Time of completion/delivery.
4. Warranty terms.
5. Bidder's responsibility based on, but not limited to:
 - a) Ability, capacity, organization, technical qualifications and skill to perform the contract or provide the services required.
 - b) References, judgment, experience, efficiency and stability.
 - c) Whether the contract can be performed within the time specified.
 - d) Quality of performance of previous contracts or services

12. DELIVERY

12.1 Delivery shall be to the City of Tacoma, 3506 South 35th Street, Tacoma, WA, 98409. Each vendor will be required to submit a delivery timeline they can commit to. Purchase order delivery dates will reflect this timeline. In the event a purchase order deliver date is not met, the City reserves the right to purchase these products elsewhere if they are in a time constraint. If constant late deliveries occur, the City may terminate the contract.

12.2 Hours of operation shall be Monday through Friday, 9:00 a.m. to 3:30 p.m., excluding legal holidays, as referred to in the Standard Terms and Conditions or as otherwise approved by the City.

13. WARRANTY

Labor: Minimum three (3) year warranty.

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

Contractor shall arrive on-site at the Portland Avenue Reservoir 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. Repairs shall include free pick-up and delivery. Repairs must be completed and vehicle returned within 48 hours of pick-up.

Contractor agrees to allow City to make minor warranty repairs where that is most cost effective and, if requested, contractor will credit City 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.

14. 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.

15. 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.

16. 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.

17. ENVIRONMENTALLY PREFERABLE PROCUREMENT

In accordance with the [City's Sustainable Procurement Policy](#) and [Climate Action Plan](#), it is the policy of the City of Tacoma to encourage the use of products or services that help to minimize the environmental and human health impacts of City 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 City of Tacoma encourages the use of sustainability practices and desires any awarded contractor(s) to assist in efforts to address such factors when feasible for:

- Durability, reusability, or refillable
- Pollutant releases, especially persistent bioaccumulative toxins (PBTs), low volatile organic compounds (VOCs), and air quality and stormwater impacts

- Toxicity of products used
- Greenhouse gas emissions, including transportation of products and services, and embodied carbon
- Recycled content
- Energy and water resource efficiency

APPENDIX A

Technical Specifications:

SECTION 40 05 63

METAL-SEATED BALL VALVES AND APPURTENANCES

18. GENERAL

18.1 SCOPE OF WORK

- 18.1.1 The Work of this Section shall include the design, manufacture, and delivery of one 18" metal-seated ball valve, which shall be furnished by the Owner to a contractor for installation under a separate contract.
- 18.1.2 Ball valve designs to be installed under this section shall meet the requirements of AWWA C507. Valves covered under this Section have been specified in detail below.

18.2 RELATED WORK

- 18.2.1 The Work defining materials and finish of fasteners for valve assembly, and actuator and drive integration is included in Section 05 43 00.
- 18.2.2 The Work related to Mechanical Operators and Drives for Valves is included in Section 40 05 57.10.

18.3 SUBMITTALS

- 18.3.1 All submittals, including cut-sheets, drawings and operation and maintenance data, shall have text written in the English language, and all numerical data shall be in the foot-pound-second system of units.
- 18.3.2 Materials for all parts shall be identified with the corresponding mark numbers, codes or serial numbers, and refer to the appropriate ASTM standard or other standards recognized in the United States of America; provided that, in the case of materials of construction not covered by such standards, the chemical composition shall be provided to the Engineer to verify if the materials are equivalent. The manufacturer shall include copies of the non-ASTM standards translated into the English language. Submit, in accordance with Section 01300, the following:
 - 18.3.2.1 *Scaled drawings of the valve and actuator general arrangement and cross sectional assemblies, showing dimensions of the principal parts.*
 - 18.3.2.2 *Approximate weight of the assembled valve.*

- 18.3.2.3 *Complete bill of materials with corresponding codes or serial numbers, and reference to the applicable ASTM Standard or other standard recognized in the United States.*
- 18.3.2.4 *For AWWA metal-seated ball valves, regardless of the design, the manufacturer shall submit a diagram illustrating valve position versus torque required superimposed over output torque of the actuator.*
- 18.3.2.5 *Detailed design drawings for all fabricated auxiliary components.*
- 18.3.2.6 *Affidavits of compliance with the governing standards and all other data required to ensure compliance with this Section.*

18.4 REFERENCE STANDARDS

- 18.4.1 American Institute of Steel Construction (AISC)
 - 18.4.1.1 *AISC M016 – Manual of Steel Construction*
- 18.4.2 American National Standards Institute (ANSI)
 - 18.4.2.1 *ANSI Y14.5M – Dimensioning and Tolerancing*
- 18.4.3 American Society for Nondestructive Testing (ANST)
 - 18.4.3.1 *ANST SNT-TC-1A (Supplement) – Question and Answer Book C: Ultrasonic Testing Method.*
 - 18.4.3.2 *ANST RP-TC-1A – Recommended Practice*
- 18.4.4 American Society for Testing and Materials (ASTM)
 - 18.4.4.1 *ASTM A36 - Standard Specification for Carbon Structural Steel.*
 - 18.4.4.2 *ASTM A48 - Standard Specification for Gray Iron Castings.*
 - 18.4.4.3 *ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.*
 - 18.4.4.4 *ASTM A159 - Standard Specification for Automotive Gray Iron Castings.*
 - 18.4.4.5 *ASTM A193 - Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service*
 - 18.4.4.6 *ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High Temperature Service, or Both*
 - 18.4.4.7 *ASTM A240 - Standard Specification for Heat Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.*
 - 18.4.4.8 *ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.*
 - 18.4.4.9 *ASTM A436 - Standard Specification for Austenitic Gray Iron Castings.*
 - 18.4.4.10 *ASTM A536 - Standard Specification for Ductile Iron Castings.*
 - 18.4.4.11 *ASTM B30 - Standard Specification for Copper Based Alloys in Ingot Form.*
 - 18.4.4.12 *ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings*
 - 18.4.4.13 *ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications*
- 18.4.5 American Society of Mechanical Engineers (ASME)
 - 18.4.5.1 *ASME B2.1 - Specifications, Dimensions, Gauging for Taper and Straight Pipe Threads.*
 - 18.4.5.2 *ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.*
 - 18.4.5.3 *ASME B1.1 - Unified Inch Screw Threads (UN and UNR form)*
 - 18.4.5.4 *ASME B1.5 – General Purpose ACME Screw Thread Form*

- 18.4.5.5 *ASME B17.1 – Keys and Keyseats.*
- 18.4.5.6 *ASME B17.2 - Woodruff Keys and Keyseats.*
- 18.4.5.7 *ASME B46.1 – Surface Texture, Surface Roughness, Waviness and Lay*
- 18.4.5.8 *ASME Y14.5M-1994 – Dimensioning and Tolerancing*

18.4.6 American Welding Society (AWS)

- 18.4.6.1 *AWS B2.1 – Standard for Welding Procedure Performance and Qualification*
- 18.4.6.2 *AWS D1.1 – Structural Welding Code – Steel*

18.4.7 American Water Works Association (AWWA)

- 18.4.7.1 *AWWA C507 – Ball Valves, 6-in Through 48-in (150mm Through 1200mm)*
- 18.4.7.2 *AWWA C540 - Power-Actuating Devices for Valves and Sluice Gates.*
- 18.4.7.3 *AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.*

18.4.8 Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

18.5 SPECIAL TOOLS AND SPARE PARTS

18.5.1 Special tools and the manufacturer's standard stock of spare parts, if required for normal operation and maintenance of the valve, shall be supplied with each distinct size of ball valve.

18.6 PRODUCTS

18.7 METAL-SEATED BALL VALVES – GENERAL REQUIREMENTS

18.7.1 Where referenced below, the term “operator” shall refer to a device used to manually position the valve; the term “actuator” shall refer to an electric or fluid powered device that positions the valve via the drive or directly connected to the valve shaft; and, the term “drive” shall refer to a mechanism that drives the valve shaft from an “operator” or an actuator. Operators, actuators and drives shall be positioned on the valve and oriented as directed by the buyer.

18.7.2 The valve manufacturer shall be responsible for determining the correct direction of flow; hand wheel size; mechanical drive size and configuration; and ball design suitable for the flow conditions described.

18.7.3 All parts subject to periodic replacement shall be readily accessible with minimum dismantling of the equipment involved. The assembly shall be designed to prevent vibration and detrimental dimensional distortion during operation under all operating conditions specified. Mechanisms shall be designed having sufficient strength to function smoothly and efficiently under all conditions specified.

18.8 METAL-SEATED BALL VALVES

18.8.1 Ball valves shall be of the single metal-to-metal seated type, configured for downstream sealing, and designed and manufactured in conformance with AWWA C507. The valve shall be designed for a maximum operating pressure of 150-psi and have a 100% port opening. The valve shall consist of the following main components:

- 18.8.1.1 Two piece or four-piece valve body casting.*
- 18.8.1.2 Trunion-mounted rotating ball.*
- 18.8.1.3 Body seat and ball seat components.*
- 18.8.1.4 Mechanical drive mechanism.*
- 18.8.1.5 Water operated hydraulic actuator.*

- 18.8.2 Valve body components shall be constructed of ASTM A536, Grade 65-45-12 cast ductile iron. The valve body end-castings shall be fitted with flat-faced, Class 125-lb ANSI flanges.
- 18.8.3 The body castings shall be bolted together at the mating flanges utilizing carbon steel cap screws or double-ended studs. All body components shall be O-ring sealed at the mating surfaces.
- 18.8.4 The center-body castings shall be fitted with trunion bearings machined from an ASTM B271 bronze casting, or another AWWA C507 equivalent material.
- 18.8.5 On the drive-side of the valve, the center-body casting shall have integrally-cast raised mounting bosses, drilled, faced and tapped for studs, suitable for mounting the mechanical drive. The mounting boss shall be machined to incorporate a stuffing box suitable for installation of vee-type packing, or an O-ring gland.
- 18.8.6 The body seat shall be Alloy 400 (Monel) fused to the downstream ductile iron flanged end-casting, and machined for mating at close tolerances with the ball-mounted seat-ring.
- 18.8.7 Each body casting shall be cast with bosses tapped for installation of lifting eye bolts. A total of four (4) lifting eye-bolts shall be installed on the valve, allowing a four-point-pick during installation in the power station.
- 18.8.8 Fabricated steel or integrally cast ductile iron mounting feet shall be included with the valve for firm anchoring on a concrete housekeeping pad. Mounting anchors shall be Type 316 stainless steel, and be sized and furnished by the valve manufacturer.
- 18.8.9 The valve ball shall be cast ductile iron, ASTM A536, Grade 65-45-12, with integrally cast trunions, machined to accept bronze bushings. The drive-side trunion shall be center-bored and machined to accept the main drive shaft and dowel pins.
- 18.8.10 The ball seat-ring shall be constructed of Series 316 stainless steel, or another AWWA C507 approved material. The seating action shall be assisted by the upstream static pressure, and the seat-ring shall only engage the body seat in the fully-closed position.

18.8.11 The seat-ring shall be mounted to the ball by a retainer ring constructed of Type-316 stainless steel, or another AWWA C507 approved material. The seat-ring and retainer-ring mating surfaces shall be O-ring sealed. The retainer-ring shall be mounted to the ball by counter-sunk Type-316 stainless steel cap screws. The retainer-ring and ball casting mating surface shall be O-ring sealed.

18.8.12 Shafts, Bearings and Seals

18.8.12.1 The drive shaft shall be machined from Type 17-4 PH stainless steel, or another AWWA C507 approved material. The shaft pins shall be constructed of the same material as the shaft.

18.8.12.2 Bearings shall be installed on ball and body trunions. The bearing load shall not exceed 2000-psi at the highest operating differential pressure.

18.8.12.3 All O-rings and vee-type packing shall be Buna-N, or another AWWA C507 approved elastomer.

18.8.13 Ball valves shall be furnished with a worm gear drive and handwheel operator as specified in Section.40 05 57.10.

18.8.14 AWWA ball valves shall be:

18.8.14.1 List 26 Series 2600 Metal-Seated Ball Valve manufactured by Dezurik, Sartell, Minnesota.

18.8.14.2 Metal-Seated Ball Manufactured by Henry Pratt Company, Aurora, Illinois.

18.8.14.3 Figure R507 Metal-Seated Ball Valve manufactured by G.A. Industries, LLC, Cranberry Township, Pennsylvania.

19. EXECUTION

19.1 QUALITY ASSURANCE

19.1.1 All production facilities including factories, foundries, welded fabrication and machine shops utilized in the production of the valves specified herein shall be ISO 9001:2015 certified. Quality control (QC) and quality assurance (QA) for the design, fabrication, and installation of the valves specified herein shall be the responsibility of the Supplier, including all QC and QA procedures in the factory and field required to comply with this Section.

19.1.2 QA verification inspections and witnessed factory testing are a requirement of this Section. All QA verification inspections, examination, and testing shall be completed after QC and QA procedures have been performed by the Supplier.

19.1.3 The Supplier shall provide airfare (direct flights where available), hotel, taxi, and the current GSA per diem rate for the location of inspection (GSA region), and all other travel expenses, in accordance with latest amendment of USGSA FTR §§ 300-304. Flights over eight (10) hours shall be business class or better. The Supplier shall notify the Owner and Engineer three (3) weeks prior to scheduled factory inspection and testing.

- 19.1.4 Testing and inspection of all valves and components shall be conducted on consecutive days in accordance with the QAP such that all HOLD POINT inspections of a particular part or accessory may be completed during a single trip. The Owner may retain the services of industry specialists and the Engineer to perform QA verification inspections. The Supplier will be notified a minimum of 30 business days prior to the visit, and shall allow unhindered access to the Engineer, inspection staff, and the Owner's personnel, including access for progress photographs and video documentation of the work. QA verification inspections shall be performed for all valves.
- 19.1.5 If work is rejected after QA verification inspection, repeat QA verification examination or testing performed on corrected work shall be paid for by the Supplier. The Supplier shall provide travel arrangements for repeat QA verification inspections equal to those provided for the initial QA verification. In addition, reimbursement for Engineer's labor and expenses required for subsequent QA verification inspections. These expenses shall include all repeat testing and/or inspection related costs, including costs associated with all necessary inspection staff; laboratory analysis; and testing or inspection report review by the Engineer.
- 19.1.6 If there are difficulties in operation of the equipment due to the Supplier's fabrication or, additional services in the factory or on site required to correct such deficiencies, shall be provided at no change in Contract Price or Contract Time to correct the problems.
- 19.1.7 Inspection by the Owner's representative or failure to inspect shall not relieve the Supplier of responsibility to provide specified equipment and perform the work in accordance with the Contract documents.
- 19.1.8 The Owner and Engineer reserve the right to sample and test any materials after delivery and to reject all components represented by a sample that fails to comply with the specified requirements.
- 19.1.9 After the successful castings inspection and machining, and prior to assembly, valve components shall be subjected to a HOLD POINT inspection for dimensions and tolerances. The inspection shall be carried out and measurements recorded by the Supplier. The Engineer will perform a random crosscheck of each inspection carried out by the Supplier as part of the QA inspection and review of the Supplier's inspection documentation.
- 19.1.10 Following a comparison of mark numbers and nameplate data, to verify they correspond, the valves shall have the following dimensions verified in accordance with the approved shop drawings:
- 19.1.10.1 *Outside diameter of the line flanges.*
 - 19.1.10.2 *Thickness of line flanges.*
 - 19.1.10.3 *Diameter of flange bolt holes.*
 - 19.1.10.4 *Flange bolt circle diameter.*
 - 19.1.10.5 *Valve port diameters.*
 - 19.1.10.6 *Base of the body to valve port centerline.*

19.1.11 Valves having electric motor-driven actuators shall be performance tested at the factory to verify and record base-line operating parameters. This may be saved in the electric actuators data acquisition system depending on the Supplier and model. The parameters shall include the following at a minimum:

19.1.11.1 For each electric motor phase, the current when seating and unseating the valve, and during disc travel.

19.1.11.2 Stroke time for each CLOSE-OPEN-CLOSE cycle.

19.1.11.3 Limit switch operation.

19.1.11.4 Valve position.

19.2 DELIVERY, STORAGE, AND HANDLING

19.2.1 Prior to crating, and after protective coated surfaces are dry and cured, coat all bare machined surfaces and bolt holes with rust preventive slush oil as described further herein. Valves shall be shipped to the site on wooden blocks to prevent movement during transport. Flanges shall be protected by bolted plywood covers on each flange after application of slush oil and wrapping with oil impregnated or corrosion inhibiting Kraft paper for corrosion protection.

19.2.2 Oil impregnated Kraft paper shall be the neutral pH type manufactured in accordance with MIL-P-17667, and manufactured by Central Coated Products, Inc. or equivalent. Corrosion inhibiting craft paper shall be Cortec® VpCI®. Band clamps, wire rope, shackles and other metallic rigging devices used for securing the valve to the pallet, transport vessel, flat-bed trailer, or rail car shall be fitted with soft-padded chocks in a configuration that will prevent damage to the protective coatings.

19.2.3 Where valves are shipped with heavy-duty hydraulic cylinders, the cylinders shall be shipped filled with the specified hydraulic oil, pre-filtered to 10 microns. Hydraulic cylinders and their electronic and hydraulic accessories shall have isolation ball valves (operator levers removed and packaged for delivery) installed at the SAE J518 Code 61 flanged ports on the cylinder head and cap, and have blind flanges installed at the opposite valve ports. All electrical and electronic components shall have all ports and termination enclosures plugged and covered with an impermeable plastic tarp to prevent exposure of sensitive electronics to foul weather.

19.2.4 Valves planned for shipping by rail or destined for ocean crossings on cargo ships shall be shipped on heavy-duty structural steel and timber-framed pallets. Large valves not capable of shipping within a fully enclosed container or vessel compartment shall be wrapped with a thick film, marine grade, industrial heat shrink cargo wrapping material for protection from wind-blown contaminants, rain, and salt spray. This requirement shall apply to completely assembled valves and those shipped partially disassembled where applicable.

19.2.5 The Supplier shall be responsible for protecting the valves while being transported to the site. Valves shall be crated, wrapped, and otherwise protected from damage during shipment. Care shall be taken in loading, transporting, and unloading to prevent injury to the mechanical components and the coating system.

19.2.6 The Supplier shall submit written notice of shipping at least one week prior to shipment and include instructions regarding the necessary equipment required to receive and unload the valves. Unloading (hoisting equipment and rigging) and storage of the valves shall be the responsibility of the Owner, who shall inspect the components with the Engineer for damage at the time of delivery. Valves and/or components that are found to be damaged shall not be accepted until properly repaired or replaced by the Supplier, including reapplication of protective coatings.

19.3 SUPPLIER'S FIELD INSTALLATION SERVICES

19.3.1 Supplier's services shall be provided by a Supplier's Field Installation Technician whose experience shall be submitted and approved by the Engineer. Tasks shall include assistance with location of support, leveling and alignment, coordination of power and control connections. The technician shall provide installation assistance for two 8-hour man days (exclusive of travel and preparation) for each valve supplied.

19.3.2 For valves furnished with powered actuators, shall have additional startup services performed by the OEM Equipment Supplier's Installation Technician, including a complete review of their actuators and accessories as specified in the actuator specifications. Prior to the performance test, both Suppliers' Field Installation Technicians shall provide written certification that the installation is complete and operable in all respects and that no conditions exist that may affect the warranty.

19.4 FACTORY APPLICATION OF LIQUID EPOXY COATINGS

- A. The valve shall receive coatings by application in the factory or at a coating applicator's facility having environmental controls necessary to maintain the temperature and relative humidity required by the coatings manufacturer and specified herein.
- B. The valve shall be shop coated using the primer, intermediate and top coating system in accordance with the coating system manufacturers instructions, and the coating application equipment manufacturers instructions. The shop coating shall be maintained in good condition by cleaning and touching up of areas damaged during pump assembly and rigging. If pinpoint or general rusting appears, surfaces shall again be prepared and re-coated and inspected at no additional cost to the Owner. All repairs shall be completed and inspected prior to crating of the valve.
- C. All machined faces of sealing surfaces including the flange connections, casting mating surfaces and stuffing box interior surfaces shall be protected during coating application by masking. The flange faces shall remain bare following machining. However, all other surfaces of the flanges shall be coated including the interior surfaces of the bolt holes. The flange shall be shipped with a protective coating of slush oil and oil-impregnated Kraft paper for protection during shipping from the Manufacturer's shop to the Buyer's Point of Destination.

- D. After blasting and successful inspection of the surface preparation, surfaces shall be cleaned of dust and residual particles from blasting operations by dry (no oil or water vapor) air blast cleaning or other method prior to coating system application. Vacuum clean enclosed areas and other areas where dust settling is a problem and wiped with a tack cloth. Coatings shall be applied to surfaces the same day they are sandblasted. Surfaces having rust/corrosion initiated on the surface shall be re-blasted prior to application of the coating system. Each pump casting shall be solvent cleaned following abrasive blasting in accordance with SSPC-SP1. The surface to be coated shall be dry, clean, dull, and free from dirt, grease, oil, rust, mill scale, salts or any other surface contaminants that interfere with adhesion. The Manufacturer shall test the surfaces of the castings for salts and other contaminants in the presence of the Engineer to demonstrate compliance with this requirement.
- E. Coatings shall only be applied when the temperature of surfaces to be coated and ambient temperatures within the paint booth are between 50 and 95 deg F. Coatings Shall not be applied when the relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces. Coated pump castings shall be allowed to cure in an atmosphere having environmental controls that will maintain the conditions described above by heating, cooling and ventilation, as necessary, until each coat has cured.
- F. Chipped, peeled, or abraded coating shall be power-sanded to feather the edges. Spot primer shall be applied in those areas using the approved primer coating. Surfaces such as ribs, body flanges and others having angles, edges, corners etc., shall be stripe-coated. Stripe coat shall be an extra coat of the intermediate or topcoat material. The stripe coat shall be a separate coat of paint from those specified herein. The minimum number of coats shall be as specified, irrespective of the coating thickness. Additional coats may be required to obtain the minimum required DFT, depending on method of surface preparation and application, differences in Manufacturers' products, and atmospheric conditions. These factors shall be taken into account when purchasing coatings to avoid unnecessary delays in the equipment delivery schedule.
- G. The Manufacturer shall be responsible for performing all QC procedures necessary to be in compliance with this Section prior to QA verification inspections performed by the Owner and Engineer.

19.5 FACTORY COATINGS INSPECTION AND ACCEPTANCE CRITERIA

- A. All coated pump castings shall be inspected by the Manufacturer and the results submitted to the Engineer. The inspection shall be conducted at the Manufacturer's or coating applicator's shop. The coating system shall be visually inspected to ensure complete coverage has been attained in the target areas. Particular attention shall be given to edges, angles, flanges, and other areas where insufficient DFT is often present. Holiday locations and DFT readings shall be recorded by the Manufacturer on a form having a graphic representation of each component and the surfaces under inspection. The Engineer will perform a random crosscheck of each inspection

procedure carried out by the manufacturer as part of the Buyer's QA inspection and review of the Manufacturer's inspection documentation.

- B. The Manufacturer shall conduct a coatings holiday inspection of the primer, intermediate and top coats. The inspection shall be carried out after application of each coat has been applied and cured accordance with the coatings manufacturer's instructions. Each inspection shall be conducted with a low voltage, wet-sponge type holiday detector instrument designed to measure coating DFT up to 20 mils. The holiday detector shall be used with a wetting agent recommended by the instrument manufacturer. Locations of holidays shall be marked for repair on the valve and graphically recorded in the inspection documentation by the Manufacturer for review by the Engineer. Acceptance criteria for each coated part shall be 99 percent holiday free.
- C. Areas having holidays shall be power-sanded to feather the edges and spot-primed prior to reapplication of the coating layers under review. The areas having recorded holidays shall be re-inspected prior to the coatings thickness inspection.
- D. After holidays are repaired on each coat the Manufacturer shall measure and graphically record the coating system DFT. The Manufacturer shall inspect each coat for the correct DFT as the work proceeds. The inspection of each coat shall not be conducted before the minimum cure time. Measurements shall be taken on an approximate 6 inch grid with a digital DFT inspection gauge. The acceptance criterion shall be readings at all locations equal to 85 percent minimum through 125 percent maximum of the target DFT range specified by the coatings manufacturer. The digital DFT gauge used by the Manufacturer shall be one of the following:
 - 1. Positector 6000 manufactured by DeFelsko, Anaheim, California
 - 2. Model 456 manufactured by Elcometer, Rochester Hills, Michigan
 - 3. Or an equivalent instrument having the same accuracy and resolution as those specified.
- E. Areas of the coating system not meeting the minimum DFT as specified above shall be repaired by the Manufacturer or coatings applicator in accordance with the coatings manufacturer's recommendations. The designated deficient areas shall be re-tested by the Manufacturer, recorded and cross-checked by a random Engineer's inspection after the minimum cure/dry time.

19.6 FIELD PERFORMANCE TEST AND ACCEPTANCE CRITERIA

19.6.1 All valves and accessories shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the valves or their accessories shall be repaired to their original condition and inspected by the Engineer before they're installed. Installation procedures recommended by the Supplier and related OEMs shall be closely followed.

- 19.6.2 Install all wall brackets, stem extensions, guide bearings, operators and actuators as required. Before setting these items, check all plans and figures which have a direct bearing on the proper location of valves and their accessories.
- 19.6.3 After proper installation and receipt of the Suppliers' certification that the installation has been properly completed, all valves and accessories shall be tested. Performance testing shall be identical to the testing performed at the factory. The parameters shall be recorded and compared to the original results. Acceptance criteria shall be results are similar the parameters that passed at the factory. Parameters shall be recorded and the data included in the QA/QC Report.

19.7 TRAINING OF BUYER'S OPERATION AND MAINTENANCE PERSONNEL

- A. The Contractor shall coordinate with the Manufacturer's Field Installation Technician to train/instruct the Owner's designated personnel in the operation, adjustment, and maintenance of the valves. A portion of the training shall be carried out by the Manufacturer concurrently with the installation of each valve to allow some of the inspection work to serve as training. The Manufacturer's hours of training shall be used to the upper limit stated in the Bid Form. Some training shall be scheduled and held at times to accommodate the work schedules of Owner's personnel, including splitting the required training/instruction time into separate sessions and/or presented at reasonable times other than the Contractor's "normal working hours" or the Owner's normal day shift. Training during inspection shall occur based on the Installation Contractor's schedule. A minimum of two separate training sessions shall be scheduled for non-installation training. Schedule training with the Engineer a minimum of 4 weeks prior to expected training sessions.
- B. The Contractor shall use the approved O&M manuals as basis for instruction by the Manufacturer as supplemented by teaching aids, slide/video presentations, and/or models. Train/instruct the Owner's personnel, in detail, based on the contents of the manual explaining all aspects of O&M for the equipment. If the respective equipment is inter-related to the operation of other equipment, all interlock, constraints, and permissive logic shall be explained.
- C. The Contractor shall submit a schedule for the training, a detailed lesson plan, and representative material to be covered during the instruction for the Engineer's approval a minimum of two weeks prior to the scheduled training. A detailed lesson plan, representative of the material to be covered during instruction shall be included. Lesson plans shall consist of in-depth outlines of the training material, including a table of contents, materials to be covered, startup procedures, maintenance requirements, safety considerations, and shut-down procedures. All training materials, including presentations, teaching aids, slides/videos, models, etc. shall become the property of the Owner for future personnel training.

END OF SECTION

SECTION 05 43 00
MECHANICAL FASTENERS AND HARDWARE

20. GENERAL

20.1 SCOPE OF WORK

20.1.1 The Work of this Section shall include material, dimensional and surface finish requirements for mechanical fasteners and used in the field assembly and installation of pipe hangers, supports and structural attachments; modular channel strut framing systems; rotating machinery; valves, valve actuators, operators, intermediate drives; and mechanical accessories as specified in all Sections making reference this Section. The Work of this Section does not apply to Code regulated structural fasteners and anchors.

20.1.2 Fastener components are specified below by use of a "Grade" or "Type" designation, which are also used to identify them in the details.

20.1.3 Specifications describing products and installation requirements for the Work of standard and technical bolting of pressure pipe flanges, at the Site by the Contractor, are not covered under this Section.

20.2 SUBMITTALS

20.2.1 Submit a list of products to be furnished, the names of the suppliers, and the date of delivery of materials to the site. Submittals shall include the following:

20.2.1.1 *Shop Drawings of all items to be furnished under this Section. Submittals shall include complete layouts and schedules; location plans and complete total bill of materials for all mechanical fasteners and anchors to be used for field installation on the project.*

20.2.1.2 *Shop Drawings shall include product data sheets for all fasteners and anchors used in field erection at the site.*

20.2.1.3 *Where standard hangers and supports are not suitable, submit detailed drawings showing materials and details of construction for each type of special hanger and support.*

20.2.1.4 *Submittals shall include complete piping drawings indicating type of hanger and support, location, magnitude of load transmitted to the structure and type of anchor, guide and other pipe supporting appurtenances. Submittals shall use detail numbers as shown on the Drawings to indicate type of support proposed wherever possible.*

20.2.1.5 *Types and locations of pipe hangers and supports shall also be shown on the piping layouts.*

20.2.2 Assembly torque calculations for all bolting and assembly of mechanical equipment and components in the field. These calculations shall be furnished regardless of whether a detail of the mechanical assembly is shown on the drawings or not. In some cases the design tension necessary to achieve the clamping force and elongation of fasteners and anchors will be specified by the Engineer herein, or by an equipment manufacturer. Where no tension requirement is provided for an assembly the Supplier shall be required to determine the tension requirements. However, in all cases the Supplier shall be responsible for calculating the assembly torque required to achieve the necessary design tension, and for the selection of the method of assembly to be implemented in the field.

20.3 REFERENCE STANDARDS

- 20.3.1 Manufacturing and assembly of products specified shall be in accordance with, but not limited to, the published standards specified herein.
- 20.3.2 American Society of Mechanical Engineers (ASME)
- 20.3.2.1 *ASME B1.1 – Unified Inch Screw Threads (UN and UNR form)*
 - 20.3.2.2 *ASME B18.2.1 – Square and Hex Bolts and Screws: Inch Series*
 - 20.3.2.3 *ASME B18.2.2 – Square and Hex Nuts*
 - 20.3.2.4 *ASME B18.3 – Socket Cap, Shoulder and Set Screws – Inch Series*
 - 20.3.2.5 *ASME B18.6.2 – Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series.*
 - 20.3.2.6 *ASME B18.22.1 – Plain Washers*
 - 20.3.2.7 *ASME Y14.5M-1994 – Dimensioning and Tolerancing*
- 20.3.3 American Society for Testing and Materials (ASTM)
- 20.3.3.1 *A36 – Standard Specification for Carbon Structural Steel*
 - 20.3.3.2 *ASTM A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service*
 - 20.3.3.3 *ASTM A194 – Standard Specification for Carbon Alloy Steel Nuts for Bolts for High Pressure or High-Temperature Service or Both*
 - 20.3.3.4 *ASTM A240 – Standard Specification for Heat Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels*
 - 20.3.3.5 *ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength*
 - 20.3.3.6 *ASTM A320 – Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service*
 - 20.3.3.7 *ASTM A480 – Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip*
 - 20.3.3.8 *ASTM A575 – Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades*
 - 20.3.3.9 *ASTM A576 – Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality*
 - 20.3.3.10 *ASTM A635 – Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for*
 - 20.3.3.11 *ASTM A653 -Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*
 - 20.3.3.12 *ASTM A967 – Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts*
 - 20.3.3.13 *ASTM A1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable*
 - 20.3.3.14 *ASTM A1011 – Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability (Formerly ASTM A570)*
 - 20.3.3.15 *ASTM A1018 – Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength*
 - 20.3.3.16 *ASTM B221 – Standard Specification for Aluminum Alloy and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes*

- 20.3.3.17 *ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel*
- 20.3.3.18 *ASTM D5363 – Anaerobic Single-Component Adhesives*
- 20.3.3.19 *ASTM F606 – Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets*
- 20.3.3.20 *ASTM F467 – Standard Specification for Nonferrous Nuts for General Use*
- 20.3.3.21 *ASTM F468 – Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use*
- 20.3.3.22 *ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws,*
- 20.3.3.23 *ASTM F594 – Standard Specification for Stainless Steel Nuts*
- 20.3.4 American National Standardization Institute (ANSI)
 - 20.3.4.1 *ANSI H35.1 – Alloy and Temper Designation Systems for Aluminum*
- 20.3.5 Society of Automotive Engineers (SAE)
 - 20.3.5.1 *SAE J924 – Thrust Washers – Design and Application*
 - 20.3.5.2 *SAE J995 – Mechanical and Material Requirements for Steel Nuts*
 - 20.3.5.3 *SAE J429 – Mechanical and Material Requirements for Externally Threaded Fasteners*
- 20.3.6 United States Military Specification (MIL)
 - 20.3.6.1 *MIL-A-907E – Anti-Seize Thread Compound*
- 20.3.7 Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

21. PRODUCTS

21.1 MECHANICAL FASTENERS AND HARDWARE – GENERAL REQUIREMENTS

- 21.1.1 The sizing and selection of mechanical fasteners and anchors for non-structural equipment and supports shall be determined by the Manufacturer. The configuration and material requirements for each type of fastener and surface treatment process required are included in the paragraphs below.
- 21.1.2 Although the equipment, supports for piping and valves, and accessories covered under this section are considered non-structural, the anchors used for their installation shall be designed in accordance with the building code requirements included in the most recent version ACI 381.
- 21.1.3 This specification uses the term “screw”, “stud”, “bolt”, “stud-bolt”, “threaded rod”, “nuts” and “washers” based on their traditional use, and shall be substituted by the word “fasteners” when discussing requirements for all. The term “anchor” shall refer to an assembly of “fasteners” and accessories used to anchor equipment and non-structural supports to concrete structures.
- 21.1.4 The Supplier and Manufacturer shall become familiarized with the following terms for reference while reviewing this Section. The following terms define how the fasteners and anchors specified below shall be used.

- 21.1.4.1 *Screws shall refer to fasteners and anchors installed in holes tapped with internal matching threads to attach one component to another. Studs have the same use except they're fully threaded across their entire length, or at each end (plain rod in the middle), and used with nuts.*
- 21.1.4.2 *The requirements specified for machine and cap screws shall apply to studs and nuts constructed of the same material and having the same the same thread form.*
- 21.1.4.3 *Bolts shall be used to join two or more components using nuts, by installation through plain holes and clamping the components together. Stud-bolts and threaded rod shall have the same use, except they're either double-ended having limited threads on each end and have a solid shank between, or they're fully threaded across their entire length.*
- 21.1.4.4 *The requirements specified for bolts shall also apply to stud-bolts, threaded rod and nuts constructed of the same material and having the same the same thread form.*
- 21.1.4.5 *Selection and size of mechanical anchors shall be for non-structural equipment and supports, such as those for pipe supports. Anchors for non-structural equipment and supports shall still be sized, selected and installed in accordance with the codifying agencies in the jurisdiction of the Site.*
- 21.1.5 The length of all bolts, studs, stud-bolts, threaded rod and anchors shall be selected by the Supplier and Manufacturer such that three circumferentially full threads, at a minimum, protrude from the top of the nut after assembly.
- 21.1.6 Fasteners and anchors shall be furnished plain or with special surface treatments according to the finish or coating system described for each type of fastener, except those that receive shop applied coating systems specified in the pipe and equipment specifications or field applied coatings specified. In those cases zinc-plated fasteners and anchors shall be furnished.

21.2 MACHINE SCREWS AND STUDS

- 21.2.1 Standard machine screws shall have dimensions as specified in ASME B18.6.3, and threads shall have dimensions specified in ASME B1.1 UNC Class 2A fit.
- 21.2.2 Pan-head, button-head, fillister-head, and cheese-head machine screws shall have dimensions specified in ASME B18.6.3 and threads shall have dimensions specified in ASME B1.1 UNC or UNF, Class 2A fit. Screws shall be furnished in slotted head; drilled slotted head, for wire secured screws; Type 1 and Type II cross recessed head (Phillips); and/or hexalobular internal (Torx) head pattern.
- 21.2.3 Oval head and flat head countersunk screws shall have dimensions specified in ASME B18.6.3 and threads shall have dimensions specified in ASME B1.1 UNC or UNF, Class 2A fit. Oval and flat heads shall be configured for a 100 degree countersink. Screws shall also be furnished in slotted head; drilled slotted head, for wire secured screws; Type 1 and Type II cross recessed head (Phillips); and/or hexalobular internal (Torx) head pattern.
- 21.2.4 Tamper-resistant screws shall have dimensions specified in ASME B18.6.3 and threads shall have dimensions specified in ASME B1.1 UNC or UNF, Class 2A fit. Tamper-resistant screws shall be button head or configured for a 100 degree countersink flat head. Tamper-resistant screws shall have drilled spanner heads; a one-way slotted button head pattern; and/or a pin-drilled hexalobular internal (Pin-in-Torx) head pattern.

- 21.2.5 Hex machine screws and studs shall have dimensions specified in ASME B18.2.1, and threads shall have dimensions specified in ASME B1.1 UNC Class 2A fit.
- 21.2.6 Socket head machine screws and set screws shall have dimensions specified in ASME B18.3 and threads shall have dimensions specified in ASME B1.1 UNC Class 2A fit.
- 21.2.7 Studs shall be fully threaded shall have dimensions specified in ASME B1.1, and threads shall have dimensions specified in ASME B1.1 UNC Class 2A fit.
- 21.2.8 All carbon steel machine screws and studs shall be furnished plain. Carbon steel machine screws and studs shall be furnished with one of the following finishes:
- 21.2.8.1 *Zinc-plated by electroplating process with a Type III supplemental clear chromate satin finish, Class SC3 thickness, in accordance with ASTM B633 and F1941.*
- 21.2.8.2 *Hot-dipped galvanized in accordance with ASTM A153 and F2329.*
- 21.2.9 GRADE 5 STL carbon steel machine screws and studs, shall be manufactured of SAE J429, Grade 5 medium carbon steel, having minimum proof load strength of 85,000 psi; minimum yield strength of 92,000 psi; minimum tensile strength of 120,000 psi; and finished Brinell hardness of 253 to 319 BHN.
- 21.2.10 GRADE 8 STL carbon steel machine screws and studs shall be manufactured of SAE J429, Grade 8 medium carbon alloy steel, quenched and tempered, having minimum proof load strength of 120,000 psi; minimum yield strength of 130,000 psi; minimum tensile strength of 150,000 psi; and Brinell hardness of 311 to 362 BHN.
- 21.2.11 TYPE 304 SSTL stainless steel machine screws and studs shall be manufactured to F593, Alloy Group 1, condition CW, Supplementary Condition S8. Type 304 stainless steel hex head machine screws shall be furnished with a plain finish, chemically passivated in accordance with the Nitric 1 or Nitric 2 process in accordance with ASTM A967. Surface finish shall be 70 µinch Ra all over in accordance with ASME B46.1 as a minimum.
- 21.2.12 TYPE 316 SSTL stainless steel cap screws and studs shall be manufactured to F593, Alloy Group 2, condition CW, Supplementary Condition S8. Finished cap screw hardness shall be Rockwell B70. Type 316 stainless steel hex head cap screws and nuts shall be furnished chemically passivated in accordance with the Nitric 1 or Nitric 2 process in accordance with ASTM A967. Surface finish shall be 70 µinch Ra all over in accordance with ASME B46.1 as a minimum.

21.3 NUTS FOR MACHINE SCREW AND STUDS

- 21.3.1 Nuts for machine screws and studs shall meet the dimensions of ASME B18.2.2 and have ASME B1.1, UNC threads, Class 2B fit; or manufacturer's preferred or proprietary design. Hex nut and channel nut materials shall match that of the connecting material.
- 21.3.2 GRADE 5 STL nuts for use with Grade 5 machine screws and studs shall be manufactured of SAE J995, Grade 5 medium carbon steel, having a minimum proof load strength of 120,000 psi; and finished Brinell hardness of 301 BHN.
- 21.3.3 GRADE 8 STL nuts for use with Grade 8 machine screws and studs shall be manufactured of SAE J995, Grade 8 medium carbon steel alloy steel, having minimum proof load strength of 150,000 psi; and Brinell hardness of 247 to 336 BHN.

21.3.4 TYPE 304 SSTL nuts used with Type 304 stainless steel machine screws shall be manufactured to ASTM F594, Alloy Group 1, Type 304.

21.3.5 TYPE 316 SSTL nuts used with Type 316 stainless steel machine screws shall be manufactured to ASTM F594, Alloy Group 2, Type 316.

21.4 HIGH-STRENGTH CAP SCREWS, BOLTS AND STUDS

21.4.1 GRADE B7 ferritic hex-head and heavy hex-head high-strength cap screws, bolts and studs, shall be used with carbon steel pipe in high temperature service (>100 degrees F). Cap screws bolts and studs shall be constructed of ASTM A193, Grade B7, chromium-molybdenum steel, carbide solution treated. Cap screws, bolts, studs and threaded rod shall be marked "B7". Grade B7 fasteners shall have the following mechanical properties:

21.4.1.1 Cap screws, bolts and studs up to 2.5 inch nominal size shall have minimum yield strength of 105,000 psi; minimum tensile strength of 125,000 psi; and maximum Brinell hardness of 321 BHN (35 HRC).

21.4.1.2 Cap screws, bolts and studs 2.5 inch to 4.0 inch nominal size shall have minimum yield strength of 95,000 psi; minimum tensile strength of 115,000 psi; and maximum Brinell hardness of 321 BHN (35 HRC).

21.4.1.3 Cap screws, bolts and studs 4.0 inch to 7.0 inch nominal size shall have minimum yield strength of 75,000 psi; minimum tensile strength of 100,000 psi; and maximum Brinell hardness of 321 BHN (35 HRC).

21.4.2 GRADE L7 ferritic steel hex-head and heavy hex-head high-strength cap screws, bolts and studs shall be used with carbon steel and ductile iron pipe in low temperature service (-150 degrees F to 100 degrees F). Cap screws, bolts and studs shall be constructed of ASTM A320, Grade L7, Class 1, chromium-molybdenum steel, carbide solution treated. Cap screws, bolts, studs and threaded rod shall be marked "L7". Grade L7 Bolts up to 2.5 inch nominal size shall have minimum yield strength of 105,000 psi; minimum tensile strength of 125,000 psi; and maximum Brinell hardness of 321 BHN (35 HRC).

21.4.3 GRADE F593U, stainless steel heavy hex-head high strength cap screws, bolts and studs shall be used with carbon steel pipe in low temperature service (0 to 100 degrees F). Cap screws, bolts and studs shall be constructed of ASTM F593, Alloy Group 7 (Alloy 603), condition AH precipitation hardening stainless steel, solution annealed and aged, having a minimum yield strength of 105,000 psi; minimum tensile strength of 135,000 psi; and, maximum hardness of Rockwell C28 to C38 up to 1½" nominal diameter.

21.4.4 For applications requiring F593U hex-head bolts greater than 1½" nominal diameter, custom designed cap screws, bolts and studs shall be furnished, with a designated nut or nut pair as specified below. Custom cap screws, bolts and studs shall be furnished.

21.4.5 One additional custom cap screws, bolts and studs, and a designated nut or nut pair shall be manufactured for every 10 flange kits furnished, or a minimum of one representative specimen in cases where less than 10 kits are furnished, for use as a specimen for proof testing. Each specimen shall be proof tested in accordance with ASTM F606 to Supplier's calculated clamping load for each stud. Acceptance criteria shall be no permanent during and following application of the proof load.

- 21.4.6 Grade F593U heavy hex heads on cap screws, bolts and studs shall be marked "F593U" on the top of the head in raised characters suitable for visual inspection during installation. Threaded rod studs shall be marked "F593U", machine-struck using character dies, on the plain metal face at the tip of each threaded end in recessed characters.

21.5 INTERMEDIATE-STRENGTH HEX HEAD BOLTS AND STUD-BOLTS

- 21.5.1 GRADE B6 ferritic steel hex-head and heavy hex-head high-strength bolts and stud-bolts, shall be used with carbon steel pipe in high temperature service (>100 degrees F), shall be constructed of ASTM A193, Grade B6, chromium-molybdenum steel, carbide solution treated. Bolts and stud-bolts shall be marked "B6". Grade B6 bolts up to 4.0 inch nominal size shall have minimum yield strength of 85,000 psi; minimum tensile strength of 110,000 psi; and maximum Brinell hardness of 321 BHN (35 HRC).
- 21.5.2 GRADE B8, CLASS 2 stainless steel heavy hex head intermediate strength bolts, stud bolts and threaded rod shall be ASTM A193, Grade B8 (Type 304), Class 2, carbide solution treated and strain hardened SSTL, in accordance with supplementary requirement S1; and have a minimum yield strength of 50,000 psi; minimum tensile strength of 100,000 psi; and maximum finished Brinell hardness of 321 BHN. Grade B8, Class 2 heavy hex heads on bolts shall be marked "B8" on the top of the head in raised characters suitable for visual inspection during installation. Stud bolts shall be marked "B8" machine-struck on the plain metal face at the tip of each threaded end in recessed characters.
- 21.5.3 GRADE B8M, CLASS 2 stainless steel heavy hex-head intermediate strength bolts, shall be ASTM A193, Grade B8M (Type 316), Class 2, carbide solution-treated and strain hardened SSTL, in accordance with supplementary requirement S1; and have a minimum yield strength of 50,000 psi; minimum tensile strength of 90,000 psi; and maximum finished Brinell hardness of 321 BHN. Grade B8M, Class 2 heavy hex heads on bolts shall be marked "B8M" on the top of the head in raised characters suitable for visual inspection during installation. Stud bolts shall be marked "B8M" machine-struck on the plain metal face at the tip of each threaded end in recessed characters.

21.6 LOW-STRENGTH HEX HEAD BOLTS AND STUD-BOLTS

- 21.6.1 GRADE B, ferritic steel hex-head and heavy hex-head low-strength bolts and stud-bolts, shall be used with ductile iron pipe in low temperature service (0 to 100 degrees F). Bolts and stud-bolts shall be constructed of ASTM A307, Grade B, stress-relief-annealed. Bolts and stud-bolts shall be marked "B". Grade B bolts up to 4.0 inch nominal size shall have a tensile strength of 60,000 to 100,000 psi; and maximum Brinell hardness of 121 to 212 BHN (69 to 95 HRC).
- 21.6.2 GRADE B8, CLASS 1 stainless steel heavy hex-head low strength bolts and stud-bolts, shall be constructed of ASTM A193, Grade B8, Class 1, carbide solution treated, (Type 304) SSTL, having a minimum yield strength of 30,000 psi; minimum tensile strength of 75,000 psi; and maximum Brinell hardness of 223 BHN. Grade B8, Class 1 heavy hex-heads on bolts shall be marked "B8" on the top of the head in raised characters suitable for visual inspection after installation. Stud bolts and threaded rod shall be marked "B8" machine-struck on the plain metal face at the tip of each threaded end in recessed characters.

- 21.6.3 GRADE B8M, CLASS 1 stainless steel heavy hex-head low strength bolts and stud-bolts, shall be ASTM A193, Grade B8M, Class 1, carbide solution treated, (Type 316) stainless steel, having a minimum yield strength of 30,000 psi; minimum tensile strength of 75,000 psi; and, maximum Brinell hardness of 223 BHN. Hex heads on bolts shall be marked "B8M" on the top of the head in raised characters suitable for visual inspection during installation. Stud bolts and threaded rod shall be marked "B8M" machine-struck on the plain metal face at the tip of each threaded end in recessed characters.

21.7 HIGH-STRENGTH HEX NUTS

- 21.7.1 Nuts shall meet the dimensions of ASME B18.2.2 and have ASME B1.1, UNC threads, Class 2B fit; or manufacturer's proprietary design, where applicable.
- 21.7.2 Grade 2H quenched and tempered medium carbon steel nuts shall be used with Grade B7 bolts and stud-bolts shall be manufactured of hot forged or cold punched ASTM A194, Grade 2H, ferritic steel, carbide solution treated, each nominal nut size having proof load tension capacity based on a proof load stress of 175,000 psi, and Brinell hardness of 248 to 327 BHN. Hex nuts shall be marked "2H" on a non-load bearing surface, with engraved or mechanically stamped characters, suitable for visual inspection after installation.

21.8 INTERMEDIATE STRENGTH HEX NUTS

- 21.8.1 Grade 8 SSTL nuts used with Grade B8 fasteners and anchors shall be constructed of ASTM A194, Grade 8 (Type 304) stainless steel, having proof load tension capacity based on 80,000 psi proof stress across all nominal nut sizes, and Brinell hardness of 126 to 300 BHN. Hex nuts shall be marked "8" on a non-load bearing surface, with engraved or mechanically stamped characters, suitable for visual inspection after installation. Grade B8 fasteners and anchors and Grade 8 heavy hex nuts shall be furnished with a scale free bright finish by chemical passivation using the Nitric 1 or Nitric 2 process in accordance with ASTM A967. Surface finish shall be 70 pinch Ra all over as a minimum.
- 21.8.2 Grade B8M SSTL nuts used with Grade B8M fasteners and anchors shall be hot forged or cold punched manufactured of ASTM A194, Grade 8M (Type 316) stainless steel, having proof load strength of 80,000 psi and Brinell finished hardness of 126 to 300 BHN. Hex nuts shall be marked "8M" on a non-load bearing surface, with engraved or mechanically stamped characters, suitable for visual inspection after installation.
- 21.8.3 Grade 8M SSTL nuts used with Grade B8MSH fasteners and anchors shall be manufactured of ASTM A194, Grade 8M (Type 316) stainless steel, drawn or cold forged, strain hardened (finished hardness shall be manufacturers standard). Grade 8M nuts shall have proof load strength as follows:
- 21.8.3.1 *110,000 psi, up to 0.75 inch nominal nut size*
 - 21.8.3.2 *100,000 psi, 0.875 inch to 1.0 inch nominal*
 - 21.8.3.3 *95,000 psi, 1.125 inch to 1.25 inch nominal*
 - 21.8.3.4 *90,000 psi, 1.375 inch to 1.50 inch nominal*

21.9 LOW STRENGTH HEX NUTS

- 21.9.1 Grade 8 SSTL nuts used with Grade B8 fasteners and anchors shall be constructed of ASTM A194, Grade 8 (Type 304) stainless steel, having proof load tension capacity based on 80,000 psi proof stress across all nominal nut sizes, and Brinell hardness of 126 to 300 BHN. Hex nuts shall be marked "8" on a non-load bearing surface, with engraved or mechanically stamped characters, suitable for visual inspection after installation. Grade B8 fasteners and anchors and Grade 8 heavy hex nuts shall be furnished with a scale free bright finish by chemical passivation using the Nitric 1 or Nitric 2 process in accordance with ASTM A967. Surface finish shall be 70 μ inch Ra all over as a minimum.
- 21.9.2 Grade B8M SSTL nuts used with Grade B8M fasteners and anchors shall be hot forged or cold punched manufactured of ASTM A194, Grade 8M (Type 316) stainless steel, having proof load strength of 80,000 psi and Brinell finished hardness of 126 to 300 BHN. Hex nuts shall be marked "8M" on a non-load bearing surface, with engraved or mechanically stamped characters, suitable for visual inspection after installation.
- 21.9.3 Grade 8M SSTL nuts used with Grade B8MSH fasteners and anchors shall be manufactured of ASTM A194, Grade 8M (Type 316) stainless steel, drawn or cold forged, strain hardened (finished hardness shall be manufacturers standard). Grade 8M nuts shall have proof load strength as follows:
- 21.9.3.1 *110,000 psi, up to 0.75 inch nominal nut size*
 - 21.9.3.2 *100,000 psi, 0.875 inch to 1.0 inch nominal*
 - 21.9.3.3 *95,000 psi, 1.125 inch to 1.25 inch nominal*
 - 21.9.3.4 *90,000 psi, 1.375 inch to 1.50 inch nominal*

21.10 WASHERS

- 21.10.1 Type A STL plain carbon steel washers shall be manufactured to the dimension included in ASME B18.22.1, Type A, Tables 1A and Tables 1B. SAE J924 washer configurations shall also be allowed.
- 21.10.2 Carbon steel washers shall meet the requirements included in ASTM F844, and be fabricated from high strength and low-alloy carbon steel sheet stock conforming with the requirements of ASTM A568.
- 21.10.3 Type A carbon steel washers shall be furnished with a plain descaled finish. Where noted, washers shall be furnished with one of the following factory applied finishes:
- 21.10.3.1 *Zinc-plated by electroplating process with a Type II supplemental yellow chromate satin finish, Class SC3 thickness, in accordance with ASTM B633.*
 - 21.10.3.2 *Hot-dipped galvanized in accordance with ASTM A153 and F2329.*

21.11 TIE-ROD RESTRAINT ASSEMBLIES FOR BOLTED SLEEVE COUPLINGS

- 21.11.1 Tie-rod restraints for bolted sleeve couplings for ductile iron pipe shall be installed. Tie-rod restraint assemblies shall consist of ASTM A36 steel lugs, ASTM A193, Grade B8 (Type 304) stainless steel tie-rods, ASTM A194, Grade 8 (Type 304) stainless steel hex heavy nuts and washers.
- 21.11.2 The tie-rod lugs shall be fabricated in the materials, finish and dimensions shown on the Drawings, or manufactured lugs may be provided. Manufactured tie-rod lugs shall be:
- 21.11.2.1 *Romac Harness Lugs, manufactured by Romac Industries, Bothell Washington.*

- 21.11.2.2 *Style 441 Tie-Plate manufactured by Dresser Industries, Addison, Texas.*
- 21.11.2.3 *Item 364-4000 manufactured by Trumbull Industries, Youngstown, Ohio.*

21.12 FORGED EYEBOLTS

- 21.12.1 Type 2 lifting eyebolts shall be constructed ASTM F541 alloy steel forgings, having a minimum yield strength of 70,000 psi; minimum tensile strength of 95,000 psi; and maximum finished Brinell hardness of 197 to 248 BHN.
- 21.12.2 Eyebolts shall have dimensions in accordance with ASME B18.15, Type 2, and shoulder pattern. Threads shall have dimensions specified in ASME B1.1 UNC Class 2A fit.
- 21.12.3 Lifting eyebolts shall be furnished with a plain descaled finish. Where noted, lifting eyebolts shall be furnished with one of the following factory applied finishes:
 - 21.12.3.1 *Zinc-plated by electroplating process with a Type II supplemental yellow chromate satin finish, Class SC3 thickness, in accordance with ASTM B633.*
 - 21.12.3.2 *Hot-dipped galvanized in accordance with ASTM A153 and F2329.*

21.13 NICKEL ANTI-SEIZE THREAD LUBRICANTS

- 21.13.1 Anti-seize thread lubricants shall be used with stainless steel fasteners and anchors used for assembly and installation of mechanical equipment, supports and hardware at the site. Fasteners used for the assembly of pressure piping flanges are not covered under this Section.
- 21.13.2 Thread lubricants shall meet the requirements of MIL-A-907E withstand operating temperatures from -65 to 2400 degrees F, and prevent seizure and/or galling in steel and stainless steel fasteners and anchors under high tension clamping forces. The lubricant shall have colloidal nickel particles 4 to 7 microns in size; a static friction factor of no greater than 0.18; and dynamic friction factor of 0.12 in accordance with ASTM D2266. Thread lubricant shall permit disassembly of fasteners and anchors with minimal manual input. Nickel anti-seize compounds shall be:
 - 21.13.2.1 *772 Premium Nickel Anti-Seize Compound, manufactured by Chesterton Technical Products, Stoneham, Massachusetts.*
 - 21.13.2.2 *Nickel Anti-Seize, manufacturer by Permatex, Hartford, Connecticut.*
 - 21.13.2.3 *SAF-T-EZE Nickel Anti-Seize, manufactured by Saf-T-Lok, Lombard, Illinois.*
 - 21.13.2.4 *Never-Seez® Pure Nickel Special Lubricant, manufactured by Bostik, Wauwatosa, Wisconsin*

21.14 THREAD-LOCKING COMPOUNDS – GENERAL REQUIREMENTS

- 21.14.1 All thread-locking compounds shall be the anaerobic curing type and withstand temperatures -65 to 300 degrees F. The thread locker shall be used to maintain bolt and screw tension and clamping force when used with hex nuts and internal threaded holes in vibrating machinery.

21.15 LOW-STRENGTH LIQUID THREAD-LOCKER

- 21.15.1 Low strength liquid thread-locker for fasteners and anchors less than ¼ inch diameter shall meet ASTM D5363, AN0311 having a thixotropic viscosity of 1200 -5000 cP, and shall be effective throughout a temperature range of -65 to 300 degrees F. Low strength thread-locker shall be:
 - 21.15.1.1 *Loctite 222MS™ Thread-locker, manufactured by Henkel Corporation, Rocky Hill, Connecticut.*

- 21.15.1.2 *T22® Thread-locker manufactured by Safe-T-Lok International, Lombard, Illinois.*
- 21.15.1.3 *Low Strength thread-locker PURPLE, manufactured by Permatex, Hartford, Connecticut.*

21.16 MEDIUM-STRENGTH LIQUID THREAD-LOCKER

21.16.1 Medium strength thread-locker for fasteners and anchors ¼ inch to ¾ inch diameter shall meet ASTM D5363, Class AN321 having a thixotropic viscosity of 1200 to 6000 cP, and shall be effective throughout a temperature range of -65 to 300 degrees F. Medium strength Thread-locker shall be:

- 21.16.1.1 *Loctite 242® Liquid Thread-locker, manufactured by Henkel Corporation, Rocky Hill, Connecticut.*
- 21.16.1.2 *T42 Thread-locker manufactured by Safe-T-Lok, Lombard, Illinois.*
- 21.16.1.3 *Medium Strength thread-locker BLUE, manufactured by Permatex, Hartford, Connecticut.*

21.17 HIGH-STRENGTH LIQUID THREAD-LOCKER

21.17.1 High strength low viscosity thread-locker for fasteners and anchors up to 1 inch diameter shall meet ASTM D5363, Class AN0221 having a viscosity of 500 cP, and shall be effective throughout a temperature range of -65 to 300 degrees F. High strength Thread-locker shall be:

- 21.17.1.1 *Loctite 271® Liquid Thread-locker, manufactured by Henkel Corporation, Rocky Hill, Connecticut.*
- 21.17.1.2 *T70 Thread-locker manufactured by Safe-T-Lok, Lombard, Illinois.*
- 21.17.1.3 *High Strength thread-locker RED, manufactured by Permatex, Hartford, Connecticut.*

21.18 HIGH-STRENGTH LIQUID THREAD-LOCKER

21.18.1 High strength thread-locker for fasteners and anchors 7/8 inch diameter and larger shall meet ASTM D5363, Class AN0211 having a thixotropic viscosity of 1200 to 6000 cP, and shall be effective throughout a temperature range of -65 to 300 degrees F. High strength threadlocker for large fasteners and anchors shall be:

- 21.18.1.1 *Loctite 277™ Liquid Thread-locker, manufactured by Henkel Corporation, Rocky Hill, Connecticut.*
- 21.18.1.2 *T77 Thread-locker manufactured by Safe-T-Lok, Lombard, Illinois.*
- 21.18.1.3 *Large Diameter thread-locker RED, manufactured by Permatex, Hartford, Connecticut.*

21.19 PENETRATING GRADE LIQUID THREAD-LOCKER

21.19.1 Penetrating grade (wicking) thread-locker for fasteners and anchors less than ¼ inch diameter, already installed, shall meet ASTM D5363, Class AN0261 having a thixotropic viscosity of 12 cP, and shall be effective throughout a temperature range of -65 to 300 degrees F. Medium strength threadlocker shall be:

- 21.19.1.1 *Loctite 220™ Liquid Thread-locker, manufactured by Henkel Corporation, Rocky Hill, Connecticut.*
- 21.19.1.2 *S90 Thread-locker manufactured by Safe-T-Lok, Lombard, Illinois.*
- 21.19.1.3 *Penetrating Grade Thread-locker GREEN, manufactured by Permatex, Hartford, Connecticut.*

21.20 PENETRATING LIQUID THREAD-LOCKER FOR DRINKING WATER EQUIPMENT

21.20.1 Penetrating grade (wicking) thread-locker having NSF-61 certification for fasteners and anchors less than ½ inch diameter, already installed, shall meet ASTM D5363, Class AN0261 having a thixotropic viscosity of 12 cP, and shall be effective throughout a temperature range of -65 to 300 degrees F. Medium strength thread-locker shall be:

21.20.1.1 *Loctite 290™ Liquid Thread-locker, manufactured by Henkel Corporation, Rocky Hill, Connecticut.*

21.21 U-BOLTS FOR PIPING AND INSTRUMENTATION HANGERS AND SUPPORTS

21.21.1 U-bolts, used in pipe hanger and support assemblies, shall be configured to Type 24 specifications in accordance with MSS SP-69. Each U-bolt shall be furnished with four nuts of the same material and finish. MSS SP-24 U-bolts shall be:

21.21.1.1 *Figure B3188 and Figure 3188C for plastic coated, by B-Line division of Eaton Corp., Highland, Illinois*

21.21.1.2 *Figure 137 and Figure 137C for plastic coated, by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.21.1.3 *Figure 38 by Carpenter & Patterson, Woburn, Massachusetts*

21.21.1.4 *Figure 90 and Figure 90C for plastic coated manufactured by PHD Supports, Columbiana, Ohio.*

21.21.1.5 *Figure 137 and Figure 137PC for plastic coated by Empire Industries, Manchester, Connecticut*

21.22 MALLEABLE IRON EYE SOCKET FOR PIPE HANGERS

21.22.1 Malleable iron eye sockets, used in pipe hanger assemblies, shall be configured to Type 16 specifications in accordance with MSS SP-69. Eye sockets shall have ASME B1.1, UNC internal threads, Class 2B fit. MSS SP-16 malleable iron eye sockets shall be:

21.22.1.1 *Figure B3222 by B-Line division of Eaton Corp., Highland, Illinois*

21.22.1.2 *Figure 110R by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.22.1.3 *Figure 12 by Carpenter & Patterson, Woburn, Massachusetts*

21.22.1.4 *Figure 30 manufactured by PHD Supports, Columbiana, Ohio.*

21.23 WELDLESS EYE NUT FOR PIPE HANGERS

21.23.1 Weldless eye nuts, used in pipe hanger assemblies, shall be configured to Type 17 specifications in accordance with MSS SP-69. Weldless eye nuts shall have ASME B1.1, UNC internal threads, Class 2B fit. MSS SP-17 Weldless eye nuts shall be:

21.23.1.1 *Figure B3200 by B-Line division of Eaton Corp., Highland, Illinois*

21.23.1.2 *Figure 290 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.23.1.3 *Figure 279 by Carpenter & Patterson, Woburn, Massachusetts*

21.23.1.4 *Figure 35 manufactured by PHD Supports, Columbiana, Ohio.*

21.24 FORGED STEEL CLEVIS FOR PIPE HANGERS

21.24.1 Forged steel clevis', used in pipe hanger assemblies, shall be configured to Type 14 specifications in accordance with MSS SP-69. Clevis' rod sockets shall have ASME B1.1, UNC internal threads, Class 2B fit. Each clevis shall be furnished with a clevis pin having the same surface finish as the clevis and include type 316 stainless steel cotter pins for assembly. MSS Type 14 forged steel clevis' shall be:

21.24.1.1 *Figure B3201 by B-Line division of Eaton Corp., Highland, Illinois*

21.24.1.2 *Figure 290 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.24.1.3 *Figure 279 by Carpenter & Patterson, Woburn, Massachusetts*

21.24.1.4 *Figure 35 manufactured by PHD Supports, Columbiana, Ohio.*

21.25 TURNBUCKLES FOR PIPE HANGERS

21.25.1 Turnbuckles, used in pipe hanger assemblies, shall be configured to Type 13 specifications in accordance with MSS SP-69. Turnbuckles shall have ASME B1.1, UNC internal threads, Class 2B fit. MSS SP-13 turnbuckles shall be:

21.25.1.1 *Figure B3202 by B-Line division of Eaton Corp., Highland, Illinois*

21.25.1.2 *Figure 230 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.25.1.3 *Figure 132 by Carpenter & Patterson, Woburn, Massachusetts*

21.25.1.4 *Figure 960 manufactured by PHD Supports, Columbiana, Ohio.*

21.26 SWIVEL TYPE TURNBUCKLES FOR PIPE HANGERS

21.26.1 Swivel type turnbuckles, used in pipe hanger assemblies, shall be configured to Type 15 specifications in accordance with MSS SP-69. Swivel type turnbuckles shall have ASME B1.1, UNC internal threads, Class 2B fit. MSS SP-15 swivel type turnbuckles shall be:

21.26.1.1 *Figure B3224 by B-Line division of Eaton Corp., Highland, Illinois*

21.26.1.2 *Figure 114 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.26.1.3 *Figure 38 by Carpenter & Patterson, Woburn, Massachusetts*

21.26.1.4 *Figure 114 manufactured by PHD Supports, Columbiana, Ohio.*

21.26.1.5 *Figure 114 by Empire Industries, Manchester, Connecticut*

21.27 MALLEABLE IRON THREADED UPPER ATTACHMENT FOR PIPES

21.27.1 Cast-in-place concrete threaded structural upper attachments for pipe hanger rod shall be configured to Type 18 specifications in accordance with MSS SP-69 and listed by Underwriters Laboratory and Factory Mutual. The insert shall be constructed of cast malleable iron. Each insert shall be furnished with a serrated adjustable nut, having ASME B1.1, UNC internal threads, Class 2B fit for threaded rod position correction during hanger installation. MSS Type 18 malleable iron threaded structural upper attachments shall be:

21.27.1.1 *Figure B3014 by B-Line division of Eaton Corp., Highland, Illinois*

21.27.1.2 *Figure 282 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.27.1.3 *Figure 108 by Carpenter & Patterson, Woburn, Massachusetts*

21.28 FABRICATED STEEL THREADED UPPER ATTACHMENT FOR PIPE HANGERS

21.28.1 Cast-in-place concrete wedge-type threaded structural upper attachments for pipe hanger rod shall be configured to Type 18 specifications in accordance with MSS SP-69 and listed by Underwriters Laboratory and Factory Mutual. The insert shall be constructed of cast malleable iron. Each insert shall be furnished with an adjustable nut having ASME B1.1, UNC internal threads, Class 2B fit for position correction during hanger installation. MSS Type 18 wedge-type fabricated steel threaded structural upper attachments shall be:

21.28.1.1 *Figure B2500, 2503 or 2505 by B-Line division Eaton Corp., Highland, Illinois*

21.28.1.2 *Figure 281 or 285 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.28.1.3 *Figure 108 by Carpenter & Patterson, Woburn, Massachusetts*

21.29 WELDED CLEVIS UPPER STRUCTURAL ATTACHMENTS FOR PIPE HANGERS

21.29.1 Welded U-shaped upper structural attachments, used for attaching pipe hanger rod to structural steel, shall be configured to Type 22 specifications in accordance with MSS SP-69. The insert shall be constructed of ASTM A36 structural steel or equivalent.

21.29.2 Each attachment shall be drilled on all sides to accept hanger rod, nuts and cross bolts. Shop and field welding of brackets to structural shapes shall be in accordance with the Supplier's submitted and approved welding procedure specifications. MSS Type 22 wedge-type fabricated steel threaded structural upper attachments shall be:

21.29.2.1 *Figure B3083 by B-Line division of Eaton Corp., Highland, Illinois*

21.29.2.2 *Figure 66 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.29.2.3 *Figure 113A/B manufactured by Carpenter & Patterson, Woburn, Massachusetts*

21.29.2.4 *Figure 900-1 manufactured by PHD Supports, Columbiana, Ohio.*

21.30 SINGLE-LUG PLATE UPPER STRUCTURAL ATTACHMENTS FOR PIPE HANGERS

21.30.1 Fabricated single-lug plate upper structural attachments used for pipe hanger assemblies shall be constructed of ASTM A36 structural steel or equivalent. Fabricated single-lug plate structural upper attachments shall be:

21.30.1.1 *Figure B3084 by B-Line division of Eaton Corp., Highland, Illinois*

21.30.1.2 *Figure 47 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.31 CLEVIS PLATE UPPER STRUCTURAL ATTACHMENTS FOR PIPE HANGERS

21.31.1 Fabricated clevis plate upper structural attachments used for pipe hanger assemblies shall be constructed of ASTM A36 structural steel or equivalent. Fabricated clevis plate upper structural attachments shall be:

21.31.1.1 *Figure B3086 by B-Line division of Eaton Corp., WE, Illinois*

21.31.1.2 *Figure 49 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.31.1.3 *Figure 904 manufactured by PHD Supports, Columbiana, Ohio.*

21.32 ROD PLATE UPPER STRUCTURAL ATTACHMENTS FOR PIPE HANGERS

21.32.1 Fabricated rod plate upper structural attachments used for pipe hanger assemblies shall be constructed of ASTM A36 structural steel or equivalent. Fabricated rod plate upper structural attachments shall be:

21.32.1.1 *Figure B3085 by B-Line division of Eaton Corp., Highland, Illinois*

21.32.1.2 *Figure 52 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.32.1.3 *Figure 903 manufactured by PHD Supports, Columbiana, Ohio.*

21.33 C-CLAMP FOR BOTTOM OF STEEL BEAM STRUCTURAL ATTACHMENT

21.33.1 C-clamps used for steel beam bottom flange structural attachments, in pipe hanger assemblies, shall be configured to Type 23 specifications in accordance with MSS SP-69. C-clamps shall be constructed malleable iron or carbon steel and have capacity to accept up to $\frac{3}{4}$ inch threaded rods. The clamp shall have ASME B1.1, UNC internal threads, Class 2B fit. Furnish a retaining clip as necessary. C-type bottom beam flange clamp structural attachments shall be:

21.33.1.1 *Figure B3036L with retainer clips 3362 to 3365 by B-Line division of Eaton Corp., Highland, Illinois*

21.33.1.2 *Figure 86 with retainer clip Figure 89 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.33.1.3 *Figure 270 by PHD Supports, Columbiana, Ohio.*

21.33.1.4 *Figure 193 by Carpenter & Patterson, Woburn, Massachusetts*

21.33.1.5 *Figure 23L by Empire Industries, Manchester, Connecticut*

21.34 C-CLAMP FOR TOP AND BOTTOM OF STEEL BEAM STRUCTURAL ATTACHMENT

21.34.1 C-clamps used for top and bottom steel beam flange clamp structural attachments, in pipe hanger assemblies, shall be configured to meet Type 19 and 23 specifications in accordance with MSS SP-69. The clamp shall have ASME B1.1, UNC internal threads, Class 2B fit. C-clamps shall be constructed malleable iron or carbon steel and have capacity to accept up to $\frac{1}{2}$ inch threaded rods. C-type top and bottom beam flange structural attachments shall be:

21.34.1.1 *Figure B3031 by B-Line division of Eaton Corp., Highland, Illinois*

21.34.1.2 *Figure 92 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.34.1.3 *Figure 350 by PHD Supports, Columbiana, Ohio.*

21.35 C-CLAMP FOR TOP OF STEEL BEAM FLANGE STRUCTURAL ATTACHMENT

21.35.1 C-clamps used for steel beam bottom flange structural attachments, in pipe hanger assemblies, shall be configured to Type 19 specifications in accordance with MSS SP-69. C-clamps shall be constructed malleable iron or carbon steel and have capacity to accept up to $\frac{3}{4}$ inch threaded rods. The clamp shall have ASME B1.1, UNC internal threads, Class 2B fit. The clamp shall be furnished with a locknut and retaining clip as necessary. C-type top beam flange clamp structural attachments shall be:

21.35.1.1 *Figure B3033 by B-Line division of Eaton Corp., Highland, Illinois*

21.35.1.2 *Figure 94 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.35.1.3 *Figure 360 by PHD Supports, Columbiana, Ohio.*

21.35.1.4 *Figure 192 by Carpenter & Patterson, Woburn, Massachusetts*

21.36 CENTER BEAM CLAMP STRUCTURAL ATTACHMENT

21.36.1 Center beam clamps used for steel beam bottom flange structural attachments, in pipe hanger assemblies, shall be configured to Type 21 specifications in accordance with MSS SP-69, depending on the hinge configuration. Center beam clamps shall be constructed of carbon steel strip. MSS Type 21 center beam clamp structural attachments shall be:

21.36.1.1 *Figure B3050 by B-Line division of Eaton Corp., Highland, Illinois*

21.36.1.2 *Figure 134 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.36.1.3 *Figure 192 by Carpenter & Patterson, Woburn, Massachusetts*

21.36.1.4 *Figure 620 by PHD Supports, Columbiana, Ohio.*

21.36.1.5 *Figure 150-2 by Empire Industries, Manchester, Connecticut*

21.37 THREADED MALLEABLE IRON BEAM CLAMP STRUCTURAL ATTACHMENT

21.37.1 Threaded malleable iron steel beam clamps used for steel beam bottom flange structural attachments, in pipe hanger assemblies, shall be configured to Type 30 specifications in accordance with MSS SP-69. The clamp shall have ASME B1.1, UNC internal threads, Class 2B fit. MSS Type 30 threaded malleable iron beam clamp structural attachments shall be:

21.37.1.1 *Figure B3054 by B-Line division of Eaton Corp., Highland, Illinois*

21.37.1.2 *Figure 218 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.37.1.3 *Figure 82 by Carpenter & Patterson, Woburn, Massachusetts*

21.37.1.4 *Figure 630 by PHD Supports, Columbiana, Ohio.*

21.37.1.5 *Figure 218 by Empire Industries, Manchester, Connecticut*

21.38 THREADED STEEL BEAM CLAMP STRUCTURAL ATTACHMENT

21.38.1 Threaded steel beam clamps used for steel beam bottom flange structural attachments, in pipe hanger assemblies, shall be configured to Type 28 and Type 29 specifications in accordance with MSS SP-69, depending on the hinge configuration. The clamp shall have ASME B1.1, UNC internal threads, Class 2B fit. C-clamps shall be constructed of forged carbon steel and have capacity to accept up to 1 ½ inch threaded rods. MSS Type 28 and Type 29 threaded beam clamp structural attachments shall be:

21.38.1.1 *Figure 282 by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.38.1.2 *Figure 293 by Carpenter & Patterson, Woburn, Massachusetts*

21.39 STEEL BEAM CLAMP WITH WELDLESS EYE NUT STRUCTURAL ATTACHMENT

21.39.1 Weldless eye nut beam clamps used for steel beam bottom flange structural attachments, in pipe hanger assemblies, shall be configured to Type 28 and Type 29 specifications in accordance with MSS SP-69, depending on the hinge configuration. Weldless eye nut beam clamps shall be constructed of forged carbon steel and have capacity to accept up to 2 inch threaded rods. MSS Type 28 and Type 29 weldless eye nut beam clamp structural attachments shall be:

21.39.1.1 *Figure B329# by B-Line division of Eaton Corp., Highland, Illinois*

21.39.1.2 *Figure 292 and 292L (left hand threads) by Anvil International division Mueller Water Products, Portsmouth, New Hampshire*

21.39.1.3 *Figure 297 by Carpenter & Patterson, Woburn, Massachusetts*

21.39.1.4 *Figure 450R by Empire Industries, Manchester, Connecticut*

END OF SECTION

SECTION 40 05 57.10

MECHANICAL VALVE OPERATORS, DRIVES AND ACCESSORIES

22. GENERAL

22.1 DEFINITION OF TERMS

22.1.1 Terms defined below shall supplement those included in the General Conditions and apply to the technical content and services specified herein.

22.1.1.1 *Basic Drive – shall refer to non-rising stem (NRS) or outside-screw-and-yoke (OS&Y) drives, which are integral to gate and globe valves, upon which they're connected directly to the valve stem.*

22.1.1.2 *Intermediate Drive – shall refer to enclosed single and multi-stage bevel, spur or worm gear Drives mounted on the Basic Drive and applies torque directly to the valve stem or shaft. This term shall also apply to jack screw drives used with fixed-cone (Howell-Bunger) valves and multi-jet sleeve valves.*

22.1.1.3 *Operator – shall refer to AWWA standard 2 inch nut Operators and handwheel Operators used to manually position the valve disc from the Basic Drive directly connected to the valve stem, and for declutched operation through the power transmission system of a powered Actuator.*

22.1.1.4 *Actuator – shall refer to a powered driven device mounted directly on the Basic Drive and directly connected to the valve stem; or the powered actuator installed on the input shaft of an Intermediate Drive, which is mounted directly to the Basic Drive or connected directly to the input shaft. This combination may also include a manual handwheel Operator for declutched manual operation. The combination of all three components is call the "Actuator." This specification only applies to the intermediate drives and operators.*

22.1.1.5 *Supplier – shall refer to the valve manufacturer responsible for the purchase and mechanical integration of the Actuator with the valve.*

22.1.1.6 *Supplier's Field Installation Technician – shall refer to technicians and engineering personnel, who are employed by the Supplier and have been trained at the Supplier's factory for start-up and commissioning services at the Site.*

22.1.1.7 *Original Equipment Manufacturer (OEM) – shall refer to the Actuator manufacturer who shall be responsible for the design and manufacture of Actuators specified herein, to be purchased by the Supplier who shall mechanically integrate them on the valve.*

22.1.1.8 *OEM Installation Technician – shall refer to installation technicians and engineers employed by OEMs and trained to install, configure, and commission these devices in the field and perform training of the Owner's operations and maintenance personnel. The OEM Installation Technician shall only be allowed to perform their services under the supervision of the Supplier's Field Installation Technician.*

22.2 SCOPE OF WORK

- 22.2.1 The Work of this Section shall include all labor, materials, equipment, and incidentals required to design, manufacture, install and commission mechanical Operators, Drives and accessories as specified herein.
- 22.2.2 The Supplier shall be advised to read the detailed fabrication requirements included in this Section. These requirements shall be strictly enforced by the Engineer during execution of the Work.
- 22.2.3 The location of piping, connecting valves and Actuators are intended to be approximately correct to scale. The dimensions shown on the Supplier's approved Shop Drawings showing the Actuators configured on the valves shall be followed in every case.
- 22.2.4 The Work shall meet the intent and purpose of the system. All Work necessary to deliver a complete working system, within the limits of Work, ready for static testing and energized use at commissioning.

22.3 RELATED WORK

- A. The Work of mechanical fasteners and accessories used for valve assembly and mounting OEM accessories in the field, and their dimensional and finish requirements, are included in Section 05 43 00.
- B. The Work of surface treatment for stainless steel fabrications is included in Section 05 10 05.
- C. The Work of electric motor-driven valve actuators are included in Section 40 05 57.26.

22.4 SUBMITTALS

- 22.4.1 The Supplier shall submit Shop Drawings including Supplier cut-sheets, operation and maintenance data for valve Drives and Operators having printed text written in English, and all numerical data shall be in the foot-pound-second system of units. Cut-sheets for products specified herein shall be submitted with those required under the Specifications making reference to this Section.
- 22.4.2 The Supplier shall submit Shop Drawings including all data and information required for the manufacture of Actuators and accessories. All dimensions shall be based on the actual equipment to be furnished.

22.5 REFERENCED STANDARDS

- 22.5.1 American Society of Mechanical Engineers (ASME)
- 22.5.1.1 *ASME B1.1 – Unified Inch screw Threads, UN and UNR Thread Form*
 - 22.5.1.2 *ASME B1.20.1 – Pipe Threads, General Purpose (Inch)*
 - 22.5.1.3 *ASME B1.5 – ACME Screw Threads (Inch)*
 - 22.5.1.4 *ASME B18.2.1 – Square and Hex Bolts and Screws: Inch Series*
 - 22.5.1.5 *ASME B18.2.2 – Square and Hex Nuts*
 - 22.5.1.6 *ASME B18.22.1 – Plain Washers*
 - 22.5.1.7 *ASME B46.1 – Surface Texture, Surface Roughness, Waviness and Lay*
- 22.5.2 American Society for Testing and Materials (ASTM)
- 22.5.2.1 *ASTM A48 – Standard Specification for Gray Iron Castings*
 - 22.5.2.2 *ASTM A53 – Standard Specification for Pipe, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*

- 22.5.2.3 *ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes*
- 22.5.2.4 *ASTM A536 – Standard Specification for Ductile Iron Castings*
- 22.5.2.5 *ASTM A967 – Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts*
- 22.5.2.6 *ASTM A1040 - Standard Guide for Specifying Harmonized Standard Grade Compositions for Wrought Carbon, Low-Alloy, and Alloy Steels*
- 22.5.2.7 *ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings*
- 22.5.2.8 *ASTM B505 – Standard Specification for Copper Alloy Continuous Castings*
- 22.5.2.9 *ASTM D92 – Standard Specification for Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*
- 22.5.2.10 *ASTM D97 – Standard Specification for Standard Test Method for Pour Point of Petroleum Products*
- 22.5.2.11 *ASTM A967 - Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts*
- 22.5.2.12 *ASTM B130 – Standard Specification for Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test*
- 22.5.2.13 *ASTM D2270 – Standard Specification for Standard Practice for Calculating Viscosity Index from Kinematic Viscosity at 40 and 100°C*
- 22.5.2.14 *ASTM D4052 – Standard Specification for Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter*
- 22.5.2.15 *ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs*
- 22.5.2.16 *ASTM F594 – Standard Specification for Stainless Steel Nuts*
- 22.5.3 American Water Works Association (AWWA)
 - 22.5.3.1 *AWWA C542 – Electric Motor Actuators for Valves and Slide Gates*
- 22.5.4 International Organization for Standardization
 - 22.5.4.1 *ISO 9001 – Quality management systems—Requirements*
- 22.5.5 Manufacturer's Standardization Society (MSS)
 - 22.5.5.1 *MSS SP-101 – Part-Turn Valve Actuator Attachment – Flange and Driving Component Dimensions and Performance Characteristics*
 - 22.5.5.2 *MSS SP-102 – Multi-Turn Valve Actuator Attachment – Flange and Driving Component Dimensions and Performance Characteristics*
- 22.5.6 National Electrical Manufacturers Association (NEMA)
 - 22.5.6.1 *NEMA 250 – Enclosures for Electrical Equipment (1000V Maximum)*
 - 22.5.6.2 *NEMA MG1 – Motors and Generators*
- 22.5.7 Society of Automotive Engineers (SAE)
 - 22.5.7.1 *SAE J534 – Lubrication Fittings*
- 22.5.8 Underwriters' Laboratories (UL)
 - 22.5.8.1 *UL 758 – Appliance Wiring Material*

23. PRODUCTS

23.1 GENERAL REQUIREMENTS

- 23.1.1 Mechanical Operators and Drives shall be positioned and have the ability for re-orientation in the field where adjustments are necessary. All valves shall OPEN LEFT (counterclockwise). Each Operator shall have cast or engraved thereon the word "OPEN" and an arrow indicating the direction to open the valve.
- 23.1.2 Mechanical Operators and Drives shall be furnished and installed by the valve Manufacturer on each production valve in the valve manufacturer's facility wherever possible. It is the valve Manufacturer's responsibility to coordinate torque output and cycle time with the actuator manufacturer.
- 23.1.3 Enclosed gear drives for valves installed in underground manholes and vaults subject to flooding shall be furnished with permanently lubricated housings and coatings suitable for below grade installation. The maximum input to the Operator, necessary to unseat the valve, shall be 40-lb rim pull using a 24 inch long handle on an 2 inch nut T-Wrench.
- 23.1.4 All exterior fasteners shall be constructed of stainless steel. Hex head and socket head cap screws, studs, hex head bolts, and stud bolts used by the OEM to assemble the Operators, Drives and Actuators and mount them to valves shall meet the dimensions of ASME B18.2.1 and have ASME B1.1, UNC or UNF threads. Washers shall have dimension in accordance with ASME B18.22.1.
- 23.1.5 Cap screws and bolts shall be manufactured of Type 316 stainless steel meeting ASTM F593, Alloy Group 2, condition CW, Supplementary Condition S8.
- 23.1.6 Hex nuts shall meet the dimensions of ASME B18.2.2 and have ASME B1.1, UNC threads, Class 2B fit. Hex nuts shall be manufactured of Type 316 stainless steel meeting ASTM F594, Alloy Group 2.
- 23.1.7 Stainless steel exterior fasteners shall be furnished chemically passivated in accordance with the Nitric 1 or Nitric 2 process in accordance with ASTM A967. Surface finish shall be 63 pinch RMS all over in accordance with ASME B46.1, as a minimum.

23.2 BEVEL GEAR DRIVES

- 23.2.1 Enclosed bevel gear Drives shall be furnished for valves having manual and/or powered operation. Bevel gear Drives have a gear case constructed of ASTM A48, Class 35B or 40B gray cast iron or ASTM A536, Grade 65-45-12 ductile iron. The gear case shall be permanently lubricated and sealed with O-ring gaskets constructed of Nitrile (Buna-N) rubber. Enclosed gear Drives for valves installed in underground manholes and vaults subject to flooding shall be furnished with sealed permanently lubricated housings and coatings suitable for direct burial installation.
- 23.2.2 Gear shafts shall be constructed of A576, Grade 1010 or 4340 steel. The spur and bevel gears shall be constructed of ASTM A536, Grade 100-70-03 ductile iron, or equivalent. Shaft sleeve and thrust bearings shall be constructed of ASTM A576, Grade 1023/1040/1055 carbon steel, or equivalent.
- 23.2.3 Thrust and sleeve bearings shall be angular contact anti-friction ball bearings. The output sleeve shall be constructed of ASTM B505, alloy C95800 aluminum bronze or A576, Grade 1023 steel.

- 23.2.4 Bevel gear Drives shall be furnished with stem covers constructed of ASTM A53, Grade B welded steel pipe, having Schedule 40 wall thickness, covered with a pipe cap internally threaded with NPT threads in accordance with ASME B1.20.1.
- 23.2.5 The maximum input to the Operator, necessary to unseat the valve, shall be 40-lb rim pull using a 24 inch long handle on an AWWA 2 inch nut T-Wrench.
- 23.2.6 Enclosed bevel gear Drives for use with manual Operators shall be:
- 23.2.6.1 *HOB Range; IB Range manufactured by Rotork Gears, Houston, Texas.*
 - 23.2.6.2 *Limitorque Model B320 manufactured by Flowserve, Lynchburg, Virginia*
 - 23.2.6.3 *Model CML manufactured by Mastergear Worldwide, Clinton, Wisconsin.*
 - 23.2.6.4 *Dynatorque BG Series manufactured by Cameron, Houston, Texas.*
 - 23.2.6.5 *Star Gears manufactured Powell Valve*
- 23.2.7 Enclosed bevel gear Drives used for powered operation shall be:
- 23.2.7.1 *Model IB manufactured by Rotork Gears, Houston, Texas.*
 - 23.2.7.2 *Limitorque Model B320 manufactured by Flowserve, Lynchburg, Virginia*
 - 23.2.7.3 *Model CML manufactured by Mastergear Worldwide, Clinton, Wisconsin.*
 - 23.2.7.4 *Dynatorque BG Series manufactured by Cameron, Houston, Texas.*
 - 23.2.7.5 *Star Gears manufactured Powell Valve*

23.3 WORM GEAR DRIVES

- 23.3.1 Worm gear Drives shall have a gear case constructed of ASTM A48, Class 35B or 40B gray cast iron or ASTM A536, Grade 65-45-12 ductile iron. The gear case shall be sealed with O-ring gaskets constructed of Nitrile (Buna-N) rubber. The worm shaft shall be constructed of ASTM A576, Grade 1010 steel or equivalent. The worm shall be constructed of ASTM B505, alloy C95800 aluminum bronze. The worm gear shall be constructed of ASTM A536, Grade 100-70-03 ductile iron, or equivalent. Shaft sleeve and thrust bearings shall be constructed of ASTM A576, Grade 1023/1040/1055 carbon steel. Thrust and sleeve bearings shall be angular contact anti-friction ball bearings.
- 23.3.2 Worm gear Drives can be combined with spur gear Drives to achieve the required maximum output torque. Worm gear Drives shall have a gear case constructed of ASTM A48, Class 35B or 40B gray cast iron. Spur gears shall be constructed of ASTM A536, Grade 100-70-03 ductile iron, or equivalent. The output sleeve shall be constructed of ASTM B505, alloy C95800 aluminum bronze or ASTM A576, Grade 1023 steel.
- 23.3.3 Worm gear Drives for valves installed in underground manholes and vaults subject to flooding shall be furnished with permanently lubricated housings and coatings suitable for below grade installation.
- 23.3.4 Worm gear Drives for use with manual Operators shall be:
- 23.3.4.1 *Model IW manufactured by Rotork Gears, Houston, Texas.*
 - 23.3.4.2 *HBC Series*
 - 23.3.4.3 *Models WO and WB manufactured by EIM Controls, Missouri City, Texas.*
- 23.3.5 Worm gear Drives for use with manual Operators shall be:
- 23.3.5.1 *Model IW manufactured by Rotork Gears, Houston, Texas.*
 - 23.3.5.2 *HBC Series*
 - 23.3.5.3 *Models WO and WB manufactured by EIM Controls, Missouri City, Texas.*

23.4 SPUR GEAR DRIVES

- 23.4.1 Enclosed spur gear Drives shall have gear cases constructed of ASTM A48, Class 35B or 40B gray cast iron or ASTM A536, Grade 65-45-12 ductile iron. The gear case shall be grease lubricated and sealed with O-ring gaskets constructed of Nitrile (Buna-N) rubber.
- 23.4.2 The bearing housing shall be drilled and tapped with a minimum ¼ inch FNPT threads in accordance with ASME B1.20.1, for installation of Type 316 stainless steel high-pressure grease injection and relief fittings meeting SAE J534. The location of lubrication connections and selection of fitting types shall be by the OEM. The location shall allow ease of lubrication with commercially available manual grease guns.
- 23.4.3 The spur gears shall be constructed of ASTM A536, Grade 100-70-03 ductile iron, or AISI/SAE 4340 steel. Gear shafts shall be constructed of ASTM A576, Grade 1010 or 4340 steel. Shaft sleeve and thrust bearings shall be constructed of ASTM A576, Grade 1023/1040/1055 carbon steel or equivalent. Thrust and sleeve bearings shall be angular contact anti-friction ball bearings. The output sleeve shall be constructed of ASTM B505, alloy C95800 aluminum bronze or A576, Grade 1023 steel or equivalent.
- 23.4.4 Enclosed gear Drive manufacturer shall be:
- 23.4.4.1 *Model IW manufactured by Rotork Gears, Houston, Texas.*
 - 23.4.4.2 *Model SG manufactured by Mastergear Worldwide, Clinton, Wisconsin.*

23.5 JACK SCREW DRIVES

- A. *Jack screw drives used with linear energy dissipating valves, requiring synchronized operation of parallel drives, shall be the machine screw type, flange-mounted, designed with a gear housings constructed of ASTM A351, Grade CF8M, Type 316 stainless steel.*

The gearing shall be comprised of a driven worm and worm gear. The worm shall be constructed of ASTM A 276, Type 316 stainless steel. The worm gear shall be constructed of ASTM B505, alloy C95800 aluminum bronze, or equivalent. The jack screw shall be configured with ASME B1.5, 29 degree ACME threads. Jack screw drives shall be:

- 1. Model DM9006 manufactured by Duff-Norton division of Columbus-McKinnon, Charlotte, North Carolina.*
- 2. Or equal.*

23.6 HANDWHEEL OPERATORS

- 23.6.1 Handwheels shall be constructed of cast aluminum, ductile iron, or fabricated steel. Handwheel Operators shall be furnished with a secure field locking device capable of locking using lock-out/tag out hasps. Locking devices shall be constructed of coated or zinc plated carbon steel. Gearing shall be designed to require no greater than a 40 pound rim pull on the handwheel to operate the valve.
- 23.6.2 Iron handwheels shall be constructed of ASTM A536, 65-45-12 ductile iron. The handwheel shall receive the same liquid epoxy protective coating system applied to the valve or actuator; or fusion-bonded epoxy.

23.6.3 Aluminum handwheels shall be constructed of ASTM B85, Grade G8A die cast aluminum or equivalent. Handwheels shall receive a Type A anodized engineering hard coat finish in accordance with ASTM B580. Coating thickness shall be no less than 0.002 inches.

23.6.4 Fabricated steel handwheels shall be constructed of ASTM A513, Grade 1040 welded carbon steel mechanical tube. The handwheel shall receive the same liquid epoxy protective coating system applied to the valve or; or fusion-bonded.

23.7 CHAIN WHEEL OPERATORS

23.7.1 Operators and Drives installed more than 6 feet above the operating floor shall be equipped with chain wheel Operator assemblies attached. Chain wheels shall be the same diameter as the handwheel.

23.7.2 Chain wheel attachments for ductile iron and fabricated steel valve hand wheel Operators shall be constructed of ASTM A536, 25-45-12 cast ductile iron. The handwheel shall receive the same liquid epoxy protective coating system applied to the valve or actuator; or fusion-bonded epoxy. Attachment sets for ductile iron chain wheels shall be constructed of ASTM A276, Type 304 stainless steel and furnished stainless steel hardware in accordance with Section 05 43 00.

23.7.3 Chain wheel attachments for aluminum handwheels shall be constructed of ASTM B85, Grade G8A die cast aluminum or equivalent. Handwheels shall receive a Type A anodized engineering hard coat finish in accordance with ASTM B580. Coating thickness shall be no less than 0.002 inches.

23.7.4 Chain wheel attachments for handwheel Operators shall be:

23.7.4.1 *Model DIRG-X manufactured by Babbitt Steam Specialty Company., New Bedford, Massachusetts.*

23.7.4.2 *E-Series manufactured by Roto Hammer Industries, Tulsa, Oklahoma.*

23.7.4.3 *Or equal.*

23.8 LEVER OPERATORS

23.8.1 Lever type manual actuators for quarter turn valves 3-inch to 6-inch diameter valves shall be constructed of break-formed stainless steel, carbon steel or cast ductile iron. The Operator shall include a direction arrow having the words "OPEN" and "CLOSED" in their designated positions.

23.8.2 Break-formed carbon steel levers shall be zinc plated by electroplating process with a Type III supplemental clear chromate satin finish, Class SC3 thickness, in accordance with ASTM B633. The lever handle shall be encapsulated in a vinyl or other soft plastic material.

23.8.3 Stainless steel quarter turn valves shall be furnished with stainless steel levers. Break-formed stainless steel levers shall be constructed of ASTM A276, Type 316 stainless steel sheet. The lever handle shall be encapsulated in a vinyl or other soft plastic material.

23.8.4 Iron levers shall be constructed of ASTM A536, 65-45-12 ductile iron. The lever shall receive the same protective coating system applied to the valve.

23.8.5 Where called out in the valve schedule the Operator shall have an integral locking mechanism to hold the lever in any position between fully opened closed for an indefinite period without vibration or chattering. A lock release shall be incorporated into the lever allowing the lever lock to be manually disengaged.

23.9 AWWA 2-INCH SQUARE NUT OPERATORS

23.9.1 Valves to be furnished with an AWWA 2-inch square nut Operator shall be furnished with one of the three Drive mechanisms specified below and noted in the Valve Schedule comments column.

23.9.1.1 Nut Operators shall be constructed of AISI 1018 steel. The nut shall be attached to the input shaft to the Drive using a Type 316 stainless steel spring pin or equivalent.

23.9.1.2 All extended-shafts furnished for gate valves shall be Type 316 stainless steel, with stainless steel cotter pins installed through the input shaft pin at the Drive. Universal joints used for shaft offsets shall be constructed of Type 316 stainless steel.

END OF SECTION

APPENDIX B

Signature Page

Price Proposal Form

SIGNATURE PAGE

CITY OF TACOMA TACOMA WATER PORTLAND AVENDUR ISOLATION VALVE

All submittals must be 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 Bid 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 TW23-0025N

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 Person Authorized to Enter
into Contracts for Bidder/Proposer

Date

Address

Printed Name and Title

City, State, Zip

(Area Code) Telephone Number / Fax Number

Authorized Signatory E-Mail Address

State Business License Number

in WA, also known as UBI (Unified Business Identifier) Number

E.I.No. / Federal Social Security Number Used on Quarterly
Federal Tax Return, U.S. Treasury Dept. Form 941

State Contractor's License Number
(See Ch. 18.27, R.C.W.)

E-Mail Address for Communications

Addendum acknowledgement #1_____ #2_____ #3_____ #4_____ #5_____

THIS PAGE MUST BE SIGNED AND RETURNED WITH SUBMITTAL.



Price Proposal
Specification No. TW23-0025N

Vendor Name: _____

Bidder agrees to furnish the following FOB Destination freight prepaid and allowed, City of Tacoma, Tacoma Water, 3506 South 35th Street, Tacoma, WA 98409.

Enter the cost (Unit Price) for each item below. The unit price and total cost must be shown in the space provided. Total cost shall be determined by multiplying the unit price by the estimated quantity (Quantity). Unit costs shall be all-inclusive and include all components needed for the delivery of the goods and services as described in this solicitation. Please identify the manufacturer and model number for the valve you are bidding.

Item	Description	Quantity	UoM	Cost	Total Cost
1	AWWA 507 Metal-Seated Ball Valve	1	Ea	\$	\$
2	Manufacturer's Field Services	1	Ea	\$	\$
		Base Bid	\$		
		Sales Tax @ 10.3%	\$		
		Total			

Successful supplier can deliver materials within _____ Days/Months after receipt of purchase order.

Prompt payment discount _____ days, net 30.

Supplier agrees to furnish the City with a warranty against defects in material and workmanship, under normal use and service for a period of _____ months.

Does your company accept a procurement card? Yes ☐ No ☐

If yes, provide a statement regarding your ability to meet the City's credit card requirements (below) as well as identifying your reporting capabilities (Level I, II, or III). This information is not a consideration in the evaluation process.

APPENDIX C

Sample Contract

CONTRACT

Resolution No. [#####]

Contract No. [#####]

This Contract is made and entered into effective as of [Month], [Day], [Year] ("Effective Date") by and between the City of Tacoma, a Municipal Corporation of the State of Washington ("City"), and [supplier name as it appears in Ariba, including dbas or trade names] ("Contractor"). [Contract date should match date of award letter and month should be formally spelled out]

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. [Spec Number] [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. [Spec Number] [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 III and sub-bullets #1 and #2 if there are no additional attachments to the contract (attachments would be things other than a spec, contract, or bonds)]

- II. If federal funds will be used to fund, pay or reimburse all or a portion of the services provided under the Contract, the terms and conditions set forth at this Appendix A are incorporated into and made part of this Contract and CONTRACTOR will comply with all applicable provisions of Appendix A and with all applicable federal laws, regulations, executive orders, policies, procedures, and directives in the performance of this Contract.

If CONTRACTOR's receipt of federal funds under this Contract is as a sub-recipient, a fully completed Appendix B, "Sub-recipient Information and Requirements" is incorporated into and made part of this Contract.

- III. 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, inclusive of Appendices A and B.
2. List remaining Contract Documents in applicable controlling order. [If the only contract documents are the specification and submittal and no exceptions are taken in the submittal, this section should be deleted]

- IV. The Contract terminates on xxxxx, and may be renewed for xxxxxxxx [Complete as needed and as stated in the specification]

- V. The total price to be paid by City for Contractor's full and complete performance hereunder, including during any authorized renewal terms, may not exceed: \$[Dollar Amount], plus any applicable taxes.

- VI. 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.

- VII. 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.
- VIII. 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 the insurance requirements contained in the Contract Documents shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- 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.
- 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 this Contract, as of the Effective Date stated above, which shall be Effective Date for bonding purposes as applicable.

CITY OF TACOMA:

Signature:

Name:

Title:

CONTRACTOR:

Signature:

Name:

Title:

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

Director of Finance: _____

Deputy/City Attorney (approved as to form): _____

Approved By: _____

Approved By: _____

Approved By: _____

Approved By: _____

Approved By: _____

Approved By: _____



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

By: _____

Surety:

By: _____

Agent's Name: _____

Agent's Address: _____



PAYMENT 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 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 waives 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.

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: _____

SAMPLE

GENERAL RELEASE TO THE CITY OF TACOMA

The undersigned, named as the contractor for _____
between _____ and the City of Tacoma,
dated _____, 20____, hereby releases the City
of Tacoma, its departmental officers and agents from any and all claim or
claims whatsoever in any manner whatsoever at any time whatsoever arising
out of and/or in connection with and/or relating to said contract, excepting only
the equity of the undersigned in the amount now retained by the City of
Tacoma under said contract, to-wit the sum of \$ _____.

Signed at Tacoma, Washington this _____ day of _____, 20____.

Contractor

By _____

Title _____

APPENDIX D

City of Tacoma Insurance Requirements



CITY OF TACOMA

INSURANCE REQUIREMENTS FOR CONTRACTS

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



CITY OF TACOMA

INSURANCE REQUIREMENTS FOR CONTRACTS

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.



CITY OF TACOMA

INSURANCE REQUIREMENTS FOR CONTRACTS

- 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.

4.3 Workers' Compensation

- 4.3.1 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.



CITY OF TACOMA

INSURANCE REQUIREMENTS FOR CONTRACTS

4.4 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.

4.5 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.