

1. **SCOPE:** This specification has been prepared for the procurement of quantity four (4) tubular silencers for use in a Heating, Ventilation, and Air Conditioning (HVAC) application.

2. APPLICABLE DOCUMENTS

2.1 **Government Documents:** The following documents form a part of this document to the extent specified herein.

2.1.1 FED STD 313; Material Safety Data, Transportation Data, and Disposal Data for Hazardous Materials Furnished to Government Activities

2.2 **Non-Government Documents:** The following documents form a part of this document to the extent specified herein.

2.2.1 ASTM A 240; Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

2.2.2 AWS D1.6; Structural Welding Code - Stainless Steel

3. REQUIREMENTS

3.1 **Operating Environment:** The silencer shall be capable of continuous operation in an outdoor, dust laden marine environment with exposure to sun, wind, rain, ice, and snow. Ambient temperature range for the silencer shall be 25° F to 100° F up to 100% relative humidity. Normal process air stream for the silencer is between 85° F at 30% relative humidity and 55° F at 90% relative humidity at 6,000 CFM.

3.2 **General Requirements:** All materials and parts procured shall be new, of current design and manufacture, and shall not have been in prior service except as required for factory testing. Standard, off-the-shelf components with proven reliability shall be used wherever possible to increase performance, reliability, reduce initial costs, and ensure availability of replacement parts.

3.2.1 **Workmanship:** Workmanship of the equipment to be furnished shall be commensurate with the requirements of this specification and of such quality that denotes the performance of skilled and experienced personnel trained in the field of work performed.

3.2.2 **Welding:** All welding shall be in accordance with AWS D1.6. All pressure boundary seams and lifting padeyes shall have full length welds.

3.2.3 **Hazardous Material Exclusions:** Supplies being used in the performance of this contract or materials being provided as part of the equipment shall be free of known hazardous materials. Definitions of hazardous materials are specified in the latest version of FED STD 313.

3.2.3.1 In addition to hazardous materials already identified in FED STD 313, materials containing asbestos or polychlorinated biphenyls (PCB's) are prohibited.

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- 3.3 **Silencer Requirements:** The silencer specified herein shall include, but is not limited to, the following components, attachments, and accessories. The duct silencer shall meet the following specifications:
- 3.3.1 Silencer shall be a double-wall tubular duct silencer with sound attenuating/acoustic media.
- 3.3.2 **Materials of Construction:**
- 3.3.2.1 The silencer, excluding its sound attenuating/acoustic media, shall be constructed of ASTM A 240 type 304 stainless steel. Unless otherwise specified, sheet metal shall be 18 gauge or thicker.
- 3.3.2.2 Sound attenuating/acoustic media shall be 4# mineral wool insulation (FIBREX Insulations Inc) or equivalent, covered with fiberglass cloth layer to prevent the wool's erosion into the airstream.
- 3.3.3 **Flanges:** The silencer shall have 1 1/2" wide, 3/16" thick, flat flanges that turn outside of the airstream on each end of the silencer. Flange standoff shall be 3" for the inlet and 5" for the outlet. The flanges shall be continuously welded and left blank.
- 3.3.4 **Lifting and Handling:**
- 3.3.4.1 Total weight of silencer shall not exceed 320 pounds.
- 3.3.4.2 **Rigging:** The silencer shall be equipped with two (2) ASTM A 240 type 304 stainless steel gross weight lifting padeyes correctly spaced for even and level lifting by a single crane hook without spreader bar(s). The padeyes shall be designed, tested, and certified per the following requirements:
- 3.3.4.2.1 The padeyes shall be designed such that the two padeyes (similar to the padeye dimensions shown in **Figure 1**) can support the weight of the expected load plus 10% for unexpected growth in the weight of the load. The resulting value shall be further increased to reflect the loads induced by the angle of the lifting slings. The value calculated accordingly is considered the Working Load Limit (WLL) for the padeyes. The padeyes shall be oriented so that the slings do not pull out of the plane of the individual padeyes by more than 5 degrees.
- 3.3.4.2.2 The structure supporting the padeyes shall be designed to sustain the various lateral loads imparted by the arrangement of the lifting attachments and the induced sling loads.
- 3.3.4.2.3 The allowable bending strength shall be based on 1/3 of the yield stress or 1/5 of the ultimate strength, whichever is most conservative, of the padeye material.
- 3.3.4.2.4 The allowable shear strength shall be based on the von Mises factor of $(1/3)^{1/2}$ (or approximately 0.577) times the allowable design bending strength. $F_s = F_y/3/\sqrt{3}$ or $F_s = F_u/5/\sqrt{3}$.

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- 3.3.4.2.5 The allowable bearing strength shall be based on 1/5 of 150% of the ultimate strength of the padeye material based on Roark's Formulas for Stress and Strain.
 $F_{br} = 1.5F_u/5$.
- 3.3.4.2.6 The contractor shall provide load calculations as required by para 3.3.4.2.3, para 3.3.4.2.4, and para 3.3.4.2.5 and associated weld analysis for the initial technical review.
- 3.3.4.3 **Padeye Proof Load Test:**
- 3.3.4.3.1 Prior to load test:
- 3.3.4.3.1.1 Visually inspect the welds associated with each padeye per paragraph 3.2.2. Verify all welds are the required size, and are free of defects such as cracks, incomplete fusion, slag inclusions, or undercut.
- 3.3.4.3.1.2 Visually inspect the padeye base material associated with each padeye. There shall be no apparent deformation or apparent damage such as cracked, broken, worn, distorted, corroded, binding, or loose parts.
- 3.3.4.3.2 Proof load test each padeye by applying a load of 200% (+5%, -0%) of the WLL (determined per paragraph 3.3.4.2.1) for two minutes minimum. The load test shall be aligned with the plane of the padeyes.
- 3.3.4.3.3 Following the load test, visually inspect the welds and padeye base material associated with each padeye per paragraph 3.3.4.3.1.1 and 3.3.4.3.1.2.
- 3.3.4.3.4 Following a satisfactory load test, permanently label each padeye near its base with the WLL and test date.
- 3.3.4.3.5 The contractor will provide written load test certification at the time of delivery.
- 3.3.5 Dimensions shall be 22" ID x no greater than 34" OD X 44" long. See **Figure 1** for overall dimensions.
- 3.3.6 The silencer shall be designed for a minimum airflow of 6,000 CFM at 2" w.g. static pressure.
- 3.3.7 Total static pressure loss through the silencer shall be equal to or less than 0.2 inch w.g. for 6,000 CFM airflow.
- 3.3.8 **Dynamic Insertion Loss (DIL):** The silencer shall meet or exceed the following values for the eight frequency bands centered at 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz.

Octave Band Center Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
DIL (dB)	2	8	14	27	29	23	17	13

4. QUALITY ASSURANCE PROVISIONS

- 4.1 **Initial Technical Review:** After a contract is awarded, the vendor submittal shall be reviewed by the Puget Sound Naval Shipyard cognizant technical Code 2370.26. Descriptive literature shall be furnished in sufficient detail to show that the proposed design will meet the requirements of this specification. As a minimum, the vendor submittal shall include the following:
- 4.1.1 Technical specifications of the silencer being submitted.
 - 4.1.2 Load calculations and weld analysis as required by paragraph 3.3.4.2.6.
 - 4.1.3 Statement that the silencer will meet or exceed the performance criteria contained in this specification. Any silencer that does not meet or exceed the requirements of this specification shall be rejected.
- 4.2 **Delivery:**
- 4.2.1 **Packaging:** The silencer shall also be packed in accordance with normal commercial practice. The packing shall be designed to protect each silencer from damage during shipment and insure delivery at destination and maintain internal cleanliness during transport (provide weather light inlet and outlet covers).
 - 4.2.2 **Working Hours** – Normal PSNS working hours are 0720-1602, Monday through Friday, excluding Federal Holidays. Deliveries and correspondence shall be arranged to coordinate with normal hours.
- 4.3 **Quality Assurance at Destination:**
- 4.3.1 The silencers delivered shall be inspected by PSNS to verify dimensions, padeye labels (paragraph 3.3.4.3.4), and for any damage incurred during shipment
 - 4.3.2 Contractor needs to provide load test certification required by paragraph 3.3.4.3.5.

FOR TECHNICAL QUESTIONS, COMMENTS, OR CLARIFICATIONS; CONTACT:

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