

SECTION 23 51 00
BREECHINGS, CHIMNEYS, AND STACKS
05-11

PART 1 - GENERAL:

1.1 DESCRIPTION:

This section specifies flue gas exhaust system and all accessories from the boiler outlet to the stack outlet to the atmosphere. Flue gas recirculation (FGR) ductwork (if required by burners furnished) is also specified.

1.2 RELATED WORK:

- A. Section 07 60 00, FLASHING and SHEET METAL: Roof Penetrations.
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- C. Section 23 05 51, NOISE and VIBRATION CONTROL FOR BOILER PLANT.
- D. Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION.
- E. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS. Requirements for commissioning, systems readiness checklists, and training
- F. Section 23 52 39, FIRE-TUBE BOILERS: Economizers

1.3 QUALITY ASSURANCE:

- A. Provide scale drawings showing nominal dimensions and weight of the systems.
- B. Boiler and burner manufacturer shall review complete system from boiler flue gas outlet to stack outlet to atmosphere and advise the Government of any changes required to meet boiler and burner performance requirements. Note the altitude of plant site.
- C. If a double wall, factory-fabricated, positive pressure breeching and stack system is provided, the manufacturer shall completely engineer the entire system and provide all components. Manufacturer's representative shall provide installation instructions prior to start of construction, train the installers and certify in writing to the Resident Engineer (RE) that the entire installation complies with the official standards of the manufacturer and with the project specifications.
- D. Flue gas recirculation ductwork shall be designed and provided by the burner manufacturer.
- E. Conform to NFPA 54 and NFPA 31 for installation of fuel burning equipment and appliances.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Design, materials, weights, construction, pressure and temperature limitations of breeching and stack systems, flue gas recirculation system.

- C. Drawings showing all components, system arrangement and dimensions.
- D. Design, construction, allowable movements, movement forces, pressure and temperature limitations of expansion joints.
- E. Damper design, construction, pressure and temperature limitations, pressure loss at design flow, and leakage of closed damper.
- F. Support designs, locations and loads for entire assembly.
- G. Written statement from boiler/burner manufacturer that the design of the system is satisfactory to achieve the required boiler/burner performance.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Institute of Steel Construction (AISC):
Steel Construction Manual, Thirteenth Edition
- C. ASTM International (ASTM):
 - A36/A36M-08.....Standard Specification for Carbon Structural Steel
 - A242/A242M-04(2009).....Standard Specification for High-Strength Low-Alloy Structural Steel
 - A307-07b.....Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - A563-07a.....Standard Specification for Carbon and Alloy Steel Nuts
 - A568/A568M-09a.....Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements For
- D. American Welding Society (AWS):
D1.1/D1.1M-2010.....Structural Welding Code-Steel
- E. Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS):
SP-58-2009.....Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation
- F. National Fire Protection Association:
 - NFPA 54-2006.....National Fuel Gas Code
 - NFPA 31-2006.....Standard for the Installation of Oil-Burning Equipment

PART 2 – PRODUCTS:

2.1 BREECHING, STACKS, FGR DUCTWORK:

- A. Refer to drawings for arrangement and dimensions, except FGR ductwork shall be designed by the burner manufacturer. Connections to boilers and economizers must comply with the written recommendations of the boiler and economizer manufacturers. Ninety-degree tee sections are not permitted. Intersections must be made with lateral tees.
- B. Service: Design for continuous 315 °C (600 °F), 12 kPa (50 inches WC) positive and negative internal pressure, wind-loading for outside stacks 120mph, exposure B, importance factor 1.15.
- C. Pre-engineered, Pre-Fabricated, Double-Wall System:
 - 1. Complete factory-built system, all components and installation engineered and provided by manufacturer of system.
 - 2. Provide double wall metal stacks, tested to UL 641 and UL listed, for use with building heating equipment, in compliance with NFPA 211.
 - 3. Corrosion-resistant steel, double-wall, circular cross section, positive pressure, blanket insulation between walls.
 - 4. Factory-built standard sections, connected in the field with joining system designed and provided by system manufacturer. Designed to be pressure and vacuum-tight, no deformation, at the service conditions specified.
 - 5. System manufacturer's engineered support system, attached to structural members of the building, with expansion joints between rigid supports. Thermal expansion shall be handled by expansion joints and variable spring hangers. Thermal expansion and weight of system shall not impose loads in excess of that allowed by manufacturer of boiler, economizer, or any other equipment, or exceed capabilities of building structure. Spring hangers shall conform to MSS SP-58, Type 51, variable spring.
 - 6. Inner Wall: Stainless steel, Type 304, 0.9 mm (0.035-inch) minimum thickness for diameters 900 mm (36 inches) and smaller and 1.2 mm (0.048 inches) minimum thickness for diameters greater than 900 mm (36 inches) and 1200 mm (48 inches) and less.
 - 7. Outer Wall: Aluminized or galvanized steel except 304 stainless steel outside of building, 0.6 mm (0.025 inch) minimum thickness for inner wall diameter 800 mm (32 inches) and less, 0.9 mm (0.034 inch) minimum thickness for inner wall diameter over 800 mm (32 inches) and 1200 mm (48 inches) and less.

8. Insulation Between Walls: Fiberglass or mineral wool, 315 °C (600 °F). Minimum thickness 50 mm (2 inches).
 9. Bands for Joining Sections: Same material as section being joined. Utilize sealant provided by system manufacturer.
 10. Roof and wall penetrations shall be manufacturer's standard ventilated thimble. Conform to Section 07 60 00, FLASHING and SHEET METAL.
 11. Stack Outlet: Provide as shown, double cone rain cap or other type termination designed by manufacturer of the stack system.
 12. Drain Section: Provide inside building below roof to drain rain water from stack. Extend drain pipe to floor drain.
 13. Guys: Provide stack guy wires above roof, with spring-loaded tensioners, in accordance with printed instructions of stack manufacturer.
- D. Custom-Designed, field-fabricated, steel single wall system:
1. Breeching and stack walls, carbon steel, ASTM A568, thickness 3.4 mm (0.1345 inch).
 2. Fabricate in welded sections with angle terminations for bolted connection of sections. Shapes and plate shall be ASTM A36.
 3. Welding shall comply with AWS D1.1.
 4. Comply with AISC Manual of Steel Construction, "Design, Fabrication, and Erection of Structural Steel." Design to be pressure and vacuum-tight, no deformation, at the service conditions specified.
 5. Provide 3.2 mm (1/8 inch) thick high temperature, non-asbestos gaskets between sections.
 6. Heavy hex ASTM A307 Grade B machine bolts. Heavy hex ASTM A563 Grade C nuts. Provide washers under bolts and nuts. Bolts, nuts and washers cadmium plated.
 7. Provide angle clips for attachment of insulation.
 8. Roof penetrations shall conform to Section 07 60 00, FLASHING and SHEET METAL.
 9. Rain cap shall be double cone arrangement, welded, supported by angles.
 10. Support with rigid and spring supports attached to the building structure. Supports shall be designed to completely support the system without overloading the connecting equipment or the building structure. Thermal expansion shall be accommodated by expansion joints and MSS SP-58, Type 51 variable spring hangers (if necessary).
 11. Provide guy wires on stacks with spring-loaded tensioners as shown on the drawings.

12. Clean all surfaces of rust, mill scale, and apply prime coat of heat and corrosion resistant paint. Apply finish coats of heat and corrosion-resistant paint to all exposed uninsulated surfaces. Select paint system compatible with maximum surface temperature. Refer to Section 09 91 00, PAINTING.

2.2 EXPANSION JOINTS

- A. Provide sufficient types, quantities, and locations of expansion joints to completely absorb all thermal expansion of the system without imposing excessive loads on equipment or building structure. Fabric joints shall be used on single-wall stack and breeching system. On factory-fabricated double wall stack or breeching system, use slip-type, bellows-type, or fabric expansion joints engineered by designer of the stack and breeching system.
- B. Service: Design for 300 °C (575 °F), 5 kPa (20 inches) WC positive and negative internal pressure, continuous duty.
- C. Construction, Fabric Joints:
 1. Fabric: High strength, designed for dewpoint service.
 2. Internal Baffles: Carbon steel with stiffeners. Designed to protect interior surfaces of fabric from wiping action of the flue gases.
 3. Welded frame, 6 mm (1/4 inch) thick ASTM A568 steel with 100mm (4 inch) minimum flange height, flat-belt design, fabricated by expansion joint manufacturer. Fabric element bolting, 9 mm (3/8 inch) diameter, 150 mm (6 inch) maximum centers.
- D. Construction, Factory-Fabricated Double-Wall System Joints:
 1. Materials: Same as factory-fabricated breeching system.
 2. Packing Gland: High temperature rating. Provide seal between sliding and fixed portions of joint.

2.3 ACCESSORIES

- A. Drains: Provide threaded pipe connection to allow drainage at all low points and drain connections in stack and breeching systems. Slope piping system to the drain. Pipe size shall be 25 mm (1 inch) minimum.
- B. Instrument Ports: Locate on individual stack or breeching serving each boiler. Locate in non-turbulent zone within 3600 mm (12 feet) of boiler room floor between boiler and economizer (when economizer is provided) or locate accessible from platform. Provide separate ports for the following:
 1. Flue gas oxygen analyzer: Coordinate with analyzer furnished.
 2. Opacity monitor: Coordinate with sensor furnished. Locate downstream from oxygen analyzer.
 3. Stack temperature sensor: Coordinate with sensor furnished.

4. Draft gauge: 25 mm (1 inch) diameter coupling, plugged.
5. Test instruments: 25 mm (1 inch) diameter coupling, plugged.
- C. Access Doors: Bolted, gasketed, insulated, with handles. Provide where shown. Minimum opening 400 mm x 400 mm (16 inches x 16 inches).

2.4 TYPE B DOUBLE WALL GAS VENTS

- A. Fabrication: Inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, tested in compliance with UL 441.

PART 3 - EXECUTION

3.1 INSTALLATION - PRE-ENGINEERED, PRE-FABRICATED DOUBLE WALL SYSTEM

- A. Supports: Completely support all systems from the building structure without overloading the building structure or the connected equipment. Support system shall be engineered by the system manufacturer and shall accommodate thermal expansion.
- B. Factory-Fabricated Stack or Breeching System:
 1. Install in accordance with manufacturer's printed instructions, NFPA 54 and NFPA 31.
 2. Deliver a copy of the instructions to the RE/COTR prior to commencing the installation.
 3. Representative of manufacturer shall provide field training on all installation techniques to all installers.
- C. Connect 25 mm (1 inch) minimum pipes with ball valves to breeching and stack drains. Extend to floor drain.
- D. Boiler or Economizer Outlet Dampers: Locate so that there is no restriction in the flow of flue gas recirculation (if provided).
- E. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.

3.2 INSTALLATION - CUSTOM-DESIGNED, FIELD-FABRICATED, STEEL SINGLE WALL SYSTEM

- A. Supports: Completely support all systems from the building structure without overloading the building structure or the connected equipment. Support system shall be as shown on the drawings.
- B. Joints: Provide continuous weld between boiler outlet and connecting transition, breeching or stub stack and at connections to economizers, when recommended by manufacturer of economizer or boiler. Securely bolt all remaining joints and provide gaskets rated for service at 315 °C (600 °F).
- C. Field-Applied Insulation: Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.
- D. Connect 25 mm (1 inch) minimum pipes with ball valves to breeching and stack drains. Extend to floor drain.

- E. Boiler or Economizer Outlet Dampers: Locate so that there is no restriction in the flow of flue gas recirculation (if provided).
- F. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.
- G. Install in accordance with NFPA 54 and NFPA 31.

3.3 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

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