**SECTION 23 51 00**

**BREECHINGS, CHIMNEYS, AND STACKS**

**BASED ON DFD MASTER SPECIFICATION DATED 5/1/17**

***This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes from you.***

**P A R T 1 - G E N E R A L**

**SCOPE**

This section includes specifications for all breechings, chimneys, stacks, emergency generator exhaust pipe, and automatic vent dampers. Included are the following topics:

PART 1 - GENERAL

 Scope

 Related Work

 Reference

 Reference Standards

 Quality Assurance

 Shop Drawings

 Design Criteria

Welder Qualifications

PART 2 - PRODUCTS

 Vents for Condensing Appliances

 Double Wall Type "B" Vents and Breeching

 Double Wall Positive Pressure Vents and Breeching

 Refractory Lined Metal Stacks and Breeching

 Breechings

 Emergency Generator Exhaust Vent Pipe

 Automatic Vent Dampers

PART 3 - EXECUTION

 Installation

 Cleaning and Protection

 Emergency Generator Exhaust Vent Pipe

 Automatic Vent Dampers

 Construction Verification Items

**RELATED WORK**

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 23 07 00 - HVAC Insulation

Section 23 08 00 – Commissioning of HVAC

**REFERENCE**

Applicable provisions of Division 1 govern work under this section.

**REFERENCE STANDARDS**

UL 959

ANSI/ASTM C64

ANSI/ASTM C105

ANSI/ASTM A525 Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dipped Process

ASTM A527 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dipped Process, Lock-Forming Quality

ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A234 Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

**QUALITY ASSURANCE**

Refer to division 1, General Conditions, Equals and Substitutions

**SHOP DRAWINGS**

Refer to division 1, General Conditions, Submittals.

Include materials of construction, dimensions, weight, support and layout of breechings. Where factory built units are used, submit layout drawings indicating plan view and elevations. Identify all methods of support and building structural members utilized for such support.

Submit manufacturer's installation instructions including required clearance to combustible materials.

**DESIGN CRITERIA**

Follow the requirements of NFPA 211 and State codes.

Factory built vents and chimneys used for venting natural draft appliances shall comply with NFPA 211 and be UL listed and labelled.

**WELDER QUALIFICATIONS**

Before any metallic welding is performed, the Contractor shall submit his Standard Welding Procedure Specifications, Procedure Qualification Records and Qualification Test Records for each Welder along with associated continuity records to demonstrate compliance with ASME Section IX, paragraph QW-322.

The Contractor shall maintain a complete set of welder qualification documents at the jobsite, including Test Records and Continuity Records for each welder.

The A/E or DFD reserves the right to test the work of any welder employed on the project, at the Contractor's expense. Testing will include a visual examination of the pipe and weld and may include radiography of any suspect welds. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project. Any welds deemed unacceptable will be repaired at the contractor’s expense.

**P A R T 2 - P R O D U C T S**

***Coordinate the vent type with the gas appliance specified. Boilers specified of the same type may require and/or allow different venting materials (CPVC vs AL29-4C). Verify boiler maximum return water temperature requirements with the boiler manufacturer.***

***Category I – Combustion Efficiency of 83% or Less. Use standard venting type B vent.***

***Category II – Combustion Efficiency over 83%. Use special condensing vent as specified by the appliance manufacture, usually double wall positive pressure vent or CPVC.***

***Category III- Positive Pressure Venting. Combustion Efficiency of 83% or Less. Use only pressurizable vent as specified by appliance manufacture, usually double wall positive pressure vent.***

***Category IV – Positive Pressure Venting. Combustion Efficiency over 87%. Use only pressurizable vent as specified by appliance manufacturer, usually double wall positive pressure vent or CPVC.***

**VENTS FOR CONDENSING APPLIANCES**

***Verify that materials of construction are suitable for flue gas temperatures of the specific appliance being served. Some Manufacturers will only allow AL29-4C grade of stainless steel, while others will allow CPVC or AL29-4C. The boiler manufacturer will have a maxium return water temp for use with CPVC (usually around 169 F). If the boiler will operate at any time with a higher return water temp, do not use a CPVC type of vent. CPVC installations will long lengths may require drain points to prevent joint failure. Coordinate maximum allowable horizontal piping lengths with the venting manufacturer.***

CPVC

Schedule 40 CPVC for use on condensing appliances or pressurized venting systems serving Category II, III or IV appliances and as allowed by the equipment manufacturer. The material used in the manufacture of the pipe shall be a rigid chlorinated polyvinyl chloride (CPVC) compound, Type IV Grade 1, with a Cell Classification of 23447 as defined in ASTM D1784, and be light gray in color.

Size vents in strict accordance with appliance manufacturer's requirements.

Double Wall Positive Pressure Vent

Double-wall, factory-built type for use on condensing appliances or pressurized venting systems serving Category II, III or IV appliances or as specified by the equipment manufacturer.

Maximum temperature shall not exceed 550°F (288°C). Vent shall be constructed with an inner and outer wall, with a 1” annular insulating air space. The inner wall (vent) shall be constructed of AL29-4C stainless steel. The outer wall (casing) shall be constructed of aluminized steel.

**DOUBLE WALL TYPE "B" GAS VENTS AND BREECHING**

***Use these vents for low heat, gas fired, natural draft applications only. Do not use with forced draft burner applications due to the possibility of products of combustion entering the building through leaks in the vent.***

Manufacturer: Selkirk Metalbestos, Metal-Fab, Air-Jet, Hart & Cooley, General Products Co., or approved equal.

Vent pipe, breeching, and accessory fittings to be UL listed type "B".

Fabricate inner pipe of sheet aluminum or stainless steel, and outer pipe of galvanized sheet steel, tested in compliance with UL 441. Minimum thickness of inner and outer pipes to be as follows:

 Thickness Thickness

 Pipe Size Inner Pipe Outer Pipe

 Round, up to 6" 0.012" 28 gage

 Round, 7" to 18" 0.014" 28 gage

 Round, 20" to 24" 0.018" 26 gage

 Oval, up to 4" 0.012" 28 gage

 Oval, 5" and 6" 0.014" 28 gage

Provide all necessary accessories including flashing, counter flashing, storm collar, insulated thimble, rain cap with bird screen, clean out, fittings and all necessary supports.

**DOUBLE WALL POSITIVE PRESSURE VENTS AND BREECHING**

***These vents should be used for gas, or gas/oil applications where forced draft burners are used. Note that a stainless steel inner liner is needed since flue gas from oil firing could exceed the melting point of aluminum. Do NOT use this type of stack for wood burning applications. Creosote buildup in stack, if ignited, will burn at temperatures (2300 degrees F.), far in excess of stack rating.***

Manufacturers: Selkirk Metalbestos, Metal-Fab, Van Packer, Stacks Inc., General Products Co., or approved equal.

Stack, breeching, and accessory fittings to be double wall type with minimum 1" air space between walls, and U.L. listed for continuous operation at 1400°F under positive pressure.

Inner pipe to be type 304 stainless steel of 0.035" minimum thickness for sizes through 36" ID and minimum thickness of 0.048" for sizes over 36" ID.

***Use type 316 stainless steel if fuels high in sulfur or chlorine are to be burned. It provides a higher degree of corrosion resistance.***

Construct outer jacket of aluminized steel where located inside building, and Type 304 stainless steel where located outside building. Minimum thickness of outer jacket to be 24 gage for sizes 10 inches to 24 inches and 20 gage for sizes 28 inches to 48 inches.

Join sections with high temperature acid-resistance joint cement and steel drawbands. Stacks to be self supporting and mounted on a concrete foundation. Allow for expansion of stacks from -20°F. to 1100°F.

Provide all necessary accessories including flashing, counter-flashing, cable guys where required, cleanout, drain, exit cone, roof thimble and necessary supports. Coat all external welded joints and seams with galvanized paint. Provide expansion guides for stacks over 40 feet in height.

**REFRACTORY LINED METAL STACKS AND BREECHING**

***These stacks can be used for gas, oil, or solid fuel applications. Typical uses include steam boilers operating over 50 psig and incinerators.***

Manufacturer: Van-Packer, Metal-Fab, Power Pac, Stacks Inc., or approved equal.

Construct casing of 11 gage galvanized steel with welded seams and joints.

Apply heat resistant paint to each stack section and accessory. Complete surface preparation and prime coat in accordance with paint manufacturer's recommendations. Where painting is completed in the factory, provide touch‑up or refinishing in field.

Refractory lining to be UL 959 listed to withstand 2000 degrees F without fusion, minimum 2 inch thickness material meeting ANSI/ASTM C64, have maximum acid extraction of 0.2 percent, and minimum 3200 psi cold crush strength. Positively bond refractory to steel jacket and seal joints with ANSI/ASTM C105 mortar.

Provide stack sections as well as all necessary accessories required for a complete installation.

Use a base section with cast iron anchor lugs for securing stack to foundation. Coat anchor lugs for acid resistance.

Cleanout sections must be smoke tight, gasketed and bolted, with neck welded to stack section.

Tee and wye sections to be smoke tight with welded joints, refractory lining, finished with a smooth transition, and no exposed metal on the inside.

Fabricate all components with centrifugally cast refractory lining.

Provide necessary components and accessories to allow for support, expansion, and contraction.

Fabricate breeching with lugs for attachment to building structure so excessive loads are not placed on appliance or stack connections.

**BREECHINGS**

***For normal applications or where horizontal breeching is of great length, use breeching construction same as stack construction. For gas or gas/oil applications where breeching is relatively short, the following breeching specification may be used.***

Construct breechings 12 inches in diameter or less of lock forming quality galvanized steel with ANSI/ASTM A525 G90 zinc coating. Fabricate with groove seams (pipe lock or flat lock), end joints beaded and crimped.

Construct breechings over 12 inches in diameter of 14 gauge ASTM A527 galvanized steel with ANSI/ASTM A525 G90 zinc coating. All longitudinal seams to be welded. End to end joints may be made with welded connections or companion flanges. Coat all external welded joints and seams with galvanized paint.

Provide adjustable self‑actuating barometric draft dampers, where indicated, full size of breeching.

***Barometric dampers to be used for atmospheric burners only!***

Provide cleanout doors where indicated on plans. Doors to be same gauge as breeching,

Fabricate breeching fittings to match adjoining breechings. Fabricate elbows with center‑line radius equal to 1.5 times breeching diameter. Limit angular tapers to 20 degrees maximum.

**EMERGENCY GENERATOR EXHAUST VENT PIPE**

ASTM A53, schedule 40, black steel pipe with ASTM A234 150 lb butt welded fittings. Provide drain, roof flashing, counter-flashing and necessary supports.

***It may be necessary to detail the supports on the drawings.***

**AUTOMATIC VENT DAMPERS**

***These are only needed for atmospheric burner applications.***

Dampers to be electric/mechanical type, constructed of corrosion resistant materials, AGA certified, UL listed and complete with fail-safe safety features.

Control damper so it is completely open before the burner cycle can start; also allow it to open on loss of power or gas valve failure. Close damper when burner cycle ends and flow of fuel has stopped.

**P A R T 3 - E X E C U T I O N**

**INSTALLATION**

Condensing appliance vents:

***Coordinate the maximum length of horizontal venting piping with the venting manufacturer. Drains located in the horizontal piping installation may be required where long lengths of are installed.***

CPVC

Provide vents, fittings, and accessories in accordance with appliance manufacturer's recommendations.

Size vents in strict accordance with appliance manufacturer's requirements. Use CPVC only on appliances allowed by the manufacturer and where the appliance operating conditions allow its use.

Pitch exhaust vents up from appliance to point of termination outside building. Provide drain points as indicated and per the manufactures recommendation to allow proper draining of condensate. Provide Flue Gas Condensate pH Neutralization at each drain piping termination point.

Locate exhaust termination and combustion air intake in accordance with appliance manufacturer's recommendations to prevent re-entry of products of combustion.

Termination of exhaust within 10 feet of operable windows, other building openings, or air intakes will not be accepted.

***Locate these terminations with respect to normal wind direction so that the products of combustion are not likely to enter the building, regardless of the distance from the vent to the building openings or air intakes.***

Pitch combustion air vents from intake down toward appliance connection.

All joints of combustion air and exhaust vents shall be solvent welded and leak tight. Provide drain connection at base of exhaust vent, and pipe to nearest open site drain. Provide Condensate pH neutralization for all vent piping to drain.

Double Wall Positive Pressure Vent

Install stack, breeching, and accessories in accordance with the manufacturer's recommendations, maintaining minimum clearances from combustibles specified in UL listing.

Support breechings from building structure with suitable ties, braces, hangers and anchors to hold shape and prevent buckling. Minimum support for vertical sections shall be at all floor penetrations. Support from floor structure, roof structure, or adjacent structural surfaces. Verify load bearing capacity of support points with Architect/Engineer.

Install breechings with a minimum of joints. Align connections accurately and maintain smooth internal surfaces.

Install concrete inserts for support of breechings, chimneys, and stacks in coordination with formwork.

Maintain UL listed minimum clearances from combustibles.

Install stacks plumb. Pitch breeching upward from fuel‑fired equipment to chimney or stack.

Provide drain points as shown and per the manufactures recommendation to allow proper draining of condensate. Provide Flue Gas Condensate pH Neutralization at each drain piping termination point.

Clean breechings, chimneys, and stacks during installation, removing dust and debris.

At appliances, provide slip joints to allow removal of appliances without removal or dismantling of breechings, chimneys, or stacks.

Seal all joints of positive pressure stacks and breeching in accordance with manufacturer's recommendations, using only sealants recommended by stack manufacturer.

Double wall metal stacks and breeching:

***Applies to both type "B" vents and positive pressure double wall vents. Edit material where only one of these types is used.***

Install stack, breeching, and accessories in accordance with the manufacturer's recommendations, maintaining minimum clearances from combustibles specified in UL listing.

Support breechings from building structure with suitable ties, braces, hangers and anchors to hold shape and prevent buckling. Minimum support for vertical sections shall be at all floor penetrations. Support from floor structure, roof structure, or adjacent structural surfaces. Verify load bearing capacity of support points with Architect/Engineer.

Install breechings with a minimum of joints. Align connections accurately and maintain smooth internal surfaces.

Install concrete inserts for support of breechings, chimneys, and stacks in coordination with formwork.

Maintain UL listed minimum clearances from combustibles.

Install vent dampers at draft hood outlet. Secure damper to draft hood collar and breeching.

***Use the above item for natural draft applications only.***

Install stacks plumb. Pitch breeching upward from fuel‑fired equipment to chimney or stack.

Clean breechings, chimneys, and stacks during installation, removing dust and debris.

At appliances, provide slip joints to allow removal of appliances without removal or dismantling of breechings, chimneys, or stacks.

Seal all joints of positive pressure stacks and breeching in accordance with manufacturer's recommendations, using only sealants recommended by stack manufacturer.

Refractory lined stacks and breeching:

Assemble and erect stack sections and accessories in accordance with manufacturer's recommendations and in compliance with UL listing. Connect base section to foundation using anchor lugs of size and number recommended by stack manufacturer.

Erect stacks and chimneys plumb, maintaining minimum clearances to combustible materials specified in UL listing.

Join sections with acid resistant joint cement to provide a continuous joint with smooth interior surface. Weld joints in metal jacket.

Pitch breeching upward from appliance to stack. Install a condensate drain piped to nearest open site drain.

Touch up or refinish sections or accessories that are scratched or marred during shipping and handling, or require touch up after welding.

Anchor breeching to building structure with bolts, concrete inserts, steel expansion anchors, welded studs or beam clamps. Lead shield expansion anchors will not be accepted.

Support horizontal breeching at 8 foot intervals for sizes up to 40" diameter and at 4 foot intervals for sizes over 40".

**CLEANING AND PROTECTION**

Clean breeching internally during installation to remove dust and debris. Clean external surfaces to remove welding slag and mill film.

At ends of breeching and chimneys which are not completed or connected to equipment, provide temporary closure which will prevent entrance of dust and debris until final connections are made.

**EMERGENCY GENERATOR EXHAUST VENT PIPE**

Install vibration isolation and muffler furnished by the Electrical Contractor. Install vent pipe with proper pitch for drain.

**AUTOMATIC VENT DAMPERS**

Install damper as shown on the drawings and according to the manufacturer's installation instructions. Provide all necessary wiring and interlocks for the system. If draft hood is used, install damper as close to draft hood as possible.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION