SECTION 23 3225

BAG-IN BAG-OUT HOUSINGS

CAUTION

This section requires technical updating; consult with POC and LANL HEPA SME prior to use.

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LANL MASTER SPECIFICATION

When editing to suit project, author shall add job‑specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). Edit this specification so that it only includes the information pertaining to the type of filter housing being specified. To seek a variance from applicable requirements, contact the ESM Mechanical [POC](http://engstandards.lanl.gov/POCs.shtml#mech).

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General requirements.

Information within “stars” is provided as guidance to the author responsible for revising the specification. Delete information within “stars” during editing. Information within [ ] needs to be edited for the specific project. Some of this information is also guidance that needs to be removed during editing. Superscripts refer to endnote guidance.

This specification serves as a template. The specification was prepared by an organization operating under a quality assurance program that meets the requirements of 10 CFR 830 (suitable for ML-1 through ML-4 projects). Implementation of this specification requires

modification to the specification to meet project‑specific requirements. Responsibility for application of this specification to meet project‑specific requirements lies with the organization modifying or implementing the specification. The organization modifying the specification shall apply a graded approach to quality assurance based on the management level designation of the project. When this specification is used with nuclear facilities subject to 10 CFR 830, modification to this specification must be performed by an individual or organization operating under a quality assurance program that meets the requirements of that CFR.

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PART 1 GENERAL

1. Summary
   * 1. Section Includes
        1. Fire Screens
        2. Prefilters
        3. Moisture Separators
        4. Chemical Adsorbers
        5. Filter Train
     2. Related Sections
        1. Section 23 4133 High-Efficiency Particulate Filtration
     3. Applicability
        1. This specification applies to filter trains to be installed in confinement ventilation systems for containing radioactive and other hazardous particles.
2. LANL PERFORMED WORK
3. LANL is responsible for having installed HEPA filers and chemical adsorbers in-place tested.

1. SUBMITTALS

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Submittal of QA plan is not necessary if filter housing manufacturer is on the current LANL IESL (See QA-PQ web site).

The Submittals as listed are required for ML-1, ML-2, and ML-3 filter housings. For ML-4 filter housings, the Submittals listed may be edited to include fewer requirements.

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1. Submit the following:
2. Fire Screen
3. Catalog data indicating materials of construction and mesh size.
4. Prefilters
5. Catalog data indicating the filter efficiency and pressure drop at rated capacity.
6. Certificate of Conformance (CoC) that the prefilter conforms to ASME AG-1, Section FB and to the purchase specifications. **[As of the date of this Master Spec there are no known prefilters that meet all of the requirements of ASME AG-1, Section FB. Therefore, until this changes, require that the CoC list which parts of ASME AG-1, Section FB are met.]**
7. Moisture Separator

1. Drawings giving outline and interface dimensions of the moisture separator.
2. Installation and maintenance instructions.
3. Storage and handling instructions.
4. Certificate of Conformance (CoC) that the moisture separator conforms to AG-1, Section FA and to the purchase specifications. **[As of the date of this Master Spec there are no known moisture separators that meet all of the requirements of ASME AG-1, Section FA. Therefore, until this changes, require that the CoC list which parts of ASME AG-1, Section FA are met.]**

1. Chemical adsorbers
2. Table or drawing giving outline dimensions of the cell.
3. Certified Material Test Reports (CMTRs) of materials used in construction (or Certificate of Conformance (CoC) with requester and QA approval if CMTR(s) are not available).
4. Adsorbent type with applicable test reports.
5. Welding procedures and procedure qualifications
6. All qualification reports (seismic and filling method).
7. Certification of performance (resistance and leak test).
8. Residence time.
9. Certification of the appropriate flow rate.

1. Filter Train
2. Catalog data.
3. Certification of Conformance (CoC) that unit meets the applicable ASME AG-1, Section HA [and DA](1) requirements. The CoC shall also state that the filter train as designed and delivered by the manufacturer meets the intent of DOE-HDBK-1169-2003 and specifically meets the applicable requirements for in-service testing as specified in ASME N511-2007.
4. Installation instructions.
5. Materials/part lists.
6. Shop drawings.
7. Test report of pressure decay leak test for the entire housing and each sub assembly.
8. Test report for the airflow distribution qualification test per this specification (e.g., Para 2.5.D.3).
9. Test report for the air-aerosol mixing uniformity test per this specification (e.g., Para 2.5.D.4).
10. Test report for sampling manifold qualification test per this specification (e.g., Para 2.5.D.4).
11. Warranties.
12. QUALITY ASSURANCE
13. Manufacture, inspect, test, and ship filter trains under a quality assurance program meeting the applicable requirements of 10 CFR 830.122 or ASME NQA-1.
14. PACKAGING AND SHIPPING
15. Package and ship filter trains in accordance with ASME AG-1, Article HA-7000
16. Package and ship chemical absorbers in accordance with ASME AG-1, Article FH-7000.
17. Package and ship prefilters and fire screens in accordance with ASME AG-1, Article FB-7000.
18. Package and ship moisture separators in accordance with ASME AG-1, Article FA-7000.
19. MAINTENANCE
20. Extra Materials: Furnish temporary prefilters to be used during construction.

PART 2 PRODUCTS

1. Fire Screen
2. Metal meshes from 8 to 16 openings per inch.
3. Frame size nominal 24 in. x 24 in. x 2 in., no gasket, all metal filter with stainless steel frame and screen media, initial pressure drop not to exceed 0.06 in. w.c. at 1000 cfm.
4. Manufacturer: Farr Co., Type S4S4. Filter not to be oiled.
5. Prefilter
6. Provide prefilters in accordance with ASME AG-1, Section FB. **[As of the date of this Master Spec there are no known prefilters that meet all of the requirements of ASME AG-1, Section FB. Until there are, suggest replacing with the following requirement: “Provide prefilters with glass fiber media with a bonded backing to support the media. Media shall be continuously sealed to frame with an adhesive to prevent bypass and ensure integrity up to a differential pressure of 10 in. w.c. Frame shall be of corrosion-resistant galvanized steel.”]**
7. Frame size nominal 24 in. x 24 in. x 6 in., no gasket, UL900 listed, MERV 11 per ASHRAE Standard 52.2, initial pressure drop not to exceed 0.20 in. w.c. at 1000 cfm.
8. Manufacturer: Camfil Farr, RIGA-FLO M11
9. Moisture Separator
10. Provide moisture separators in accordance with ASME AG-1, Section FA. **[As of the date of this Master Spec there are no known moisture separators that meet all of the requirements of ASME AG-1, Section FA. Suggest using the following description: “Provide moisture separators specifically designed for the removal of airborne moisture droplets. The moisture separator shall be constructed of layers of flat and serpentine metal screen media housed in a 16 gauge (min.) metal frame. The frame shall have a minimum of three 0.375 in. holes on the bottom for liquid drainage. When installed vertically, the moisture separator shall be 98% efficient on 20 micron size droplets when operating at a velocity of 500 fpm face velocity. Resistance to airflow shall not exceed 0.25 in. w.c. at 500 fpm.”]**
11. Frame size Nominal 24 in. x 24 in. x 4 in.
12. Manufacturer: Camfil Farr, ECO Moisture Separator, Stainless Steel construction.
13. HEPA Filter
14. See Section 23 4133 High-Efficiency Particulate Filtration
15. Chemical Adsorber

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The following is a sample specification of a chemical adsorber to adsorb organic radioiodides. Consult with IHS-CS and the user for specific criteria.

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1. Provide chemical adsorber in accordance with ASME AG-1, Section FH.
2. Type IV (V-Bed) adsorber with 2 in. thick bed of 8 x 16 mesh activated carbon made from coconut shell. Residence time 0.125 seconds at a flow of 1250 cfm. Construct adsorber frame of 14 gage Type 304 stainless steel with 26 gage Type 304 stainless steel perforated screens. Provide adsorber frame with 1/4 in. thick x 3/4 in. wide closed cell neoprene gasket on the upstream flange. Adsorber shall have a minimum mechanical efficiency of 99.9% when tested in accordance with IEST‑RP‑CC‑008 (latest edition). Adsorber nominal dimensions are 24 in. x 24 in. x 18 in.
3. Manufacturer: Flanders/CSC, Model No. AG-GG18-62-NS [gasket seal]

1. FILTER TRAIN
2. Manufacturers
3. Flanders/CSC [BG or BF or G or GRF] Series Containment Housings.
4. Camfil Farr [GB or FB or FB-R] Containment Housings.
5. AAF International Bag In/Bag Out Housing.
6. Filter Train Assembly Arrangement

Provide a [ ](2) high x [ ](2) wide filter train assembly with side access doors on [the left or right or both sides](3) looking in direction of air flow, transitions on both ends, and with housings assembled in direction of air flow as follows; [Bubble tight isolation damper, section for 2 in. fire screen, section for 6 in. prefilter, automatic water deluge fire spray head section with moisture separator downstream of spray heads, test section, manual water deluge fire spray head section, section for 12 in. HEPA filter, test section, section for 18 in. chemical adsorber, test section, section for 18 in. chemical adsorber, test section, section for 12 in. HEPA filter, test section, bubble tight isolation damper.] The filter train assembly shall be built up of factory leak tested subsection housings that are no larger than 1 high x 3 wide. Join housing sections together [vertically, in parallel and/or in series] to make up a filter train. Weld joints airtight and conform to standard welding procedures. [**Use this description for straight through airflow rectangular filter housings containing one or more filters per stage. Edit to suit the project requirements. Consult LANL Fire Marshal’s office for fire protection requirements**.]

[OR]

Arrangement: Provide [ ](4) in. diameter inlet and outlet on the circumference of the housing. The inlet centerline shall be located on the [back or side] of the housing at [ ](4) in. up from the bottom of the housing. The outlet centerline shall be [ ](4) degrees clockwise (as viewed from the top of the housing) from the inlet and be [ ](4) in. up from the bottom of the housing. The face of the inlet and outlet [flanges or end connection] shall be at [ ](4) in. from the centerline of the housing. The access door shall be located on the top of the housing. A mounting ring shall be located on the bottom of the housing. See Attachment A for additional details. [**Use this description for a single HEPA filter or chemical adsorber in a round filter housing. Will need to include a drawing showing the arrangement described and any additional details**.]

1. Containment Housing for [fire screens, prefilters, moisture separators, HEPA filters, and adsorbers]
2. Construction: Construct housing from [Type 304 and 304L](5) stainless steel with a 2B mill finish. Provide housing with 100% seam-welds in accordance with ASME AG-1, Article HA-6140 on joints across the pressure boundaries and reinforce to withstand up to [10 in.](6)(7) w.g. [positive] or [negative] or [positive and negative] pressure. Wire brush and clean welds to remove discoloration and weld splatter. Joints and seams which are part of the filter sealing surface [and knife edge], flange connections and bag-out rings shall be ground smooth and free of burrs and sharp edges. Factory weld housing sections, transitions, base [mounting ring], lifting lugs, and weather cap to form one unit. Provide Type 300 series stainless steel miscellaneous mechanical components. Manufacture housings in accordance with ASME AG-1, Section HA.
3. Access Doors: Provide removable, separate, access doors for each tier of filters [fire screens, prefilters, moisture separators, HEPA filters, and adsorbers]. Use solid silicone or neoprene gaskets that seal the door to the housing wall while maintaining clearance between the bag-out flange and the inside door surface. Door gasket shall be a molded gasket fitted to the door. Use door gasket material of ASTM D1056 grade SCE-45 or 30-40 Shore-A durometer. Provide stainless steel door latches that pivot away after release and remain attached to the housing or door. Use Type 300-Series stainless steel bolts with captive hand knobs made from aluminum. Metal pockets for instruction manuals are optional.
4. Smooth Inlet Design: On the upstream side of each filter position, provide a smooth inlet design with a minimum 3/4 in. deep recess around the upstream perimeter of the filter to limit the buildup of contaminants in crevices or filter frames.

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Gasket sealed filter housings should be used for most applications. Fluid sealed filter housings are normally only specified for outdoor installations where the housing will experience varying solar loading which can cause the housing to warp slightly. The fluid seal seems to provide a better seal for these conditions. Fluid seal type filter housings are also not recommended for housings more than one filter wide due to the fluid sometimes sticking to the knife edge and being difficult to remove while working through a bag. Round filter housings can only use fluid seal type filters due to their design constraints.

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1. Gasket Seal Filter Housing: The filter housing shall have a flat sealing surface that mates with the gasket face of each HEPA filter [and chemical adsorber] Prior to leaving the factory, each sealing surface shall be checked with a flatness gage to insure proper mating with the filter. Each tier of filters shall be provided with a removable filter clamping mechanism on the downstream side of the HEPA filter [and chemical adsorber] that is operated from outside the housing. The filter clamping mechanism shall include independent pressure bars for each filter. Each pressure bar shall have pre-loaded springs that exert a minimum sealing force of 1400 lbs. per 24 in. by 24 in. filter (per DOE-HDBK-1169-2003, Section 4.4.6) applied as an even, uniform load along at least 80% of the top and bottom of each filter frame. The ends of each pressure bar shall be chamfered to prevent holdup of filters being installed or removed. All mechanical components of the filter clamping mechanism shall be Type 300-Series stainless steel except for the pivot blocks which can be made from brass. [This type of sealing mechanism is not suitable for round filter housings.]

[OR]

Fluid Seal Filter Housing: The filter housing shall have a knife edge that mates into the fluid seal channel of the face of each HEPA filter [and chemical adsorber]. Prior to leaving the factory, each knife edge shall be checked with an alignment gage to insure proper alignment with each filter. Each tier of filters shall be provided with a removable filter locking mechanism on the downstream side of the HEPA filter [and chemical adsorber] that is operated through the change-out bag by a locking handle. The filter locking mechanism shall be designed such that the access door cannot be installed unless the filters are correctly seated in the housing. The mechanism shall exert equal force at the top and bottom edge of the filter when engaging or disengaging the filter from the knife edge and provide a total clamping load sufficient to resist displacement of the filter under normal operating filter resistance and the pressure produced by shock loadings in the system (per DOE-HDBK-1169-2003, Section 4.4.6). All mechanical components of the filter locking mechanism shall be Type 300-Series stainless steel

1. Filter Rails: Provide filter rails in the fire screen, prefilter, and moisture separator housings, 2 1/8 in. wide for the fire screen,6 in. wide for the prefilter, and 4 in. wide for the moisture separator.
2. Filter Removal Rod: Provide housings with two or more filters per access door with a replaceable removal rod to draw the filters to the change-out position. The removal rods shall be operated from inside the change-out bag.
3. Bag In/Out: Provide each filter access door with a bag-out port inside the access door which is hemmed on its outer edges to prevent tearing of the bag. Provide two continuous ribs on the outside of the port to hold the bag’s elastic shock cord and the safety strap during the bag-out operation. The turned edge on the port is not considered a rib. Provide each housing with [one](8), 8 mil, transparent PVC change-out bags for each bag-out port. Three glove sleeves shall be built into the bag to facilitate handling of the filter during change-out. Provide bag with stock number rolled into the hem for easy identification when reordering. Provide bag with a smooth finish to prevent from sticking to itself. The elastic shock cord shall be hemmed into the mouth of the bag so that it fits securely when stretched around the bagging ring. Provide a nylon safety strap with each bag-out port to prevent the bag from slipping off during the bag-out procedure. Provide a cinching strap with each bag-out port to tie off the slack in the bag while the exhaust system is operating. Provide a banding kit to facilitate in the secure clamping off of the bag between the housing and the spent filter.
4. Filter Removal Tray: Provide one filter removal tray for each size of HEPA filter [and chemical adsorber] to aid in the change-out operation.
5. Test Sections:
6. Construct test section in such a manner that adjoining test chambers are isolated from each other to permit individual testing of each HEPA filter [and chemical adsorber].
7. Provide test section with separate aerosol mixing devices, sample ports, and injection ports to allow individual in-place testing of the HEPA filters [and chemical adsorbers]per ASME N511-2007. Test sections shall be designed and qualified to the applicable parts of ASME AG-1, Sections HA and TA. Upstream sampling sections, and downstream sampling sections that require the use of external power, e.g., compressed air, are not acceptable. The pressure drop through each test section during testing and normal operation is not to exceed 0.5 in. w.g. at 1000 scfm per filter. Identify each test section with a model number and label all test equipment such as operational handles, injection and sample ports.
8. Airflow distribution qualification tests shall be performed in the shop prior to shipment in accordance with ASME AG-1, Article TA-4600 to provide assurance that manufacturer’s design provides uniform air distribution. Shop tests shall simulate actual field entrance and exit duct connections as closely as possible. Acceptance criteria shall be in accordance with TA-4600. Filter trains which are duplicates in design, layout, and fabrication to other units which have been successfully tested and documented, need not be shop tested for airflow distribution. Results of airflow distribution tests shall be documented and submitted to the owner.
9. Air-aerosol mixing uniformity tests shall be performed in the shop for each manifold which is provided by the manufacturer to be mounted within the filter housing in accordance with ASME AG-1, Article TA-4600. Acceptance criteria shall be in accordance with TA-4600. Sampling manifolds shall be qualified in accordance with ASME AG-1, Article HA-5800 including Nonmandatory Appendix HA-D. Filter trains and test manifolds which are duplicates in design, layout, and fabrication to other air-cleaning units which have been successfully tested and documented need not be shop tested for air-aerosol mixing uniformity. Results of the tests shall be documented and submitted to the owner.
10. Pressure Decay Leak Test:
11. Factory leak test each subsection housing and the completed filter train assembly by the pressure decay method to [plus 10 in. w.g.](7) or [minus 10 in. w.g.](7) or [minus and plus 10 in. w.g.] (7) in accordance with ASME AG-1, Mandatory Appendix TA-III. Leak test to acceptance criteria of a maximum of [0.2 percent of housing volume per hour](9) or [0.0005 scfm per cubic foot of housing volume](9) at [design pressure](7). Rectify and retest any deficiency and work affected by such deficiency. Submit certifications of leak test.
12. Miscellaneous
13. Static Pressure Ports: Locate static-pressure ports on the front or top of the housing upstream and downstream of each filter bank. Provide each tier of a filter bank with a port. Provide 1/4 in. NPT type 304 stainless steel ports with a cap. [Delete the cap if pressure differential gages are included.]
14. [Differential Pressure Gages: Provide Magnehelic® analog differential pressure gages connected to the static pressure ports using 300 series stainless steel fittings and tubing through a calibration test manifold similar to the Anderson Greenwood 3-way manifold (Model MM1RDB-2). Provide valving to allow the differential pressure of each tier of a filter bank to be monitored separately and combined. Mount gages on the housing so that they are easily readable from the working side of the housing. Label each gage indicating which filter bank it is connected to. For outdoor installations, mount gages in a metal cabinet that has a latching hinged cover.](10)
15. Base: Provide a [6 in.](11) high stainless steel channel base on four sides welded to the unit and with predrilled mounting holes. [Use for straight through airflow rectangular filter housings.]

[OR]

Housing Mounting Ring: Provide a 3/16 in. thick mounting ring welded to the bottom of the housing. See Attachment A for additional details on dimensions and bolt hole locations. [Use for round filter housings. Alternate mounting types are also acceptable.]

1. [Drains: ](12)
2. Quality Assurance: Comply with ASME NQA-1.
3. Lifting Lugs: Provide type 304 stainless steel lifting lugs with a 2 in. diameter lifting eye. Design lugs and attachment point to prevent pull out or distortion of both the lug and the securing member.
4. Custom-Engraved Plates: Include plates with the housing model number, and the original order number with minimum 1/8 in. letter height. Fabricate custom-engraved plates from polished stainless steel and be permanently welded to the operating side of the housing at or near eye level.
5. Seismic Qualification: [Consult with the design team structural engineer for the specific project requirements that will govern the seismic criteria to be used.]
6. Weather/Housekeeping Cap: Provide a continuously welded weather cap to the top of each filter housing that is sloped to prevent accumulation of liquids. [This is not applicable for round filter housings.]
7. Transition to Ductwork: Provide [24 or 36 in. long](13) inlet and outlet transitions welded or bolted to the housing with a 1 1/2 in. x 1 1/2 in. x 3/16 in. minimum x [ ]I.D.(14) angle ring flange with predrilled mounting holes and shipped with gaskets. If the transition is bolted, the spacing shall be the manufacturer’s standard bolt-hole pattern, not to exceed 4 in. between bolt holes on center. Transition to be capable of withstanding up to [10 in. w.g. negative or positive](6) pressure. Provide gasket materials of closed cell neoprene, 1/4 in. thick, ASTM D1056 Specification for Flexible Cellular Materials - Sponge or Expanded Rubber, Grades 2C3 or 2C4, or 30-40 Shore-A durometer. [Use for straight through air flow rectangular filter housings.]

[OR]

Inlet and Outlet Connections: [Describe inlet and outlet connects for round filter housings.](15)

PART 3 - EXECUTION

1. EXAMINATION
2. Field Conditions: Examine areas and conditions under which air filters and filter housings will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
3. INSTALLATION
4. Filter Train: Install per manufacturer’s instructions and structural design requirements.
5. Cleaning: Vacuum clean inside of filter train. Wipe down exterior of filter train to remove construction grit.
6. Filters: Install in accordance with manufacturer’s instructions and recognized industry practices.
7. Fan Operation: Do not operate fan system until filters are in place. Replace temporary filters used during construction.

[PART 4 – ATTACHMENTS

1. Attachment A – Round Filter Housing Reference Drawings]

END OF SECTION

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Do not delete the following reference information:

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FOR LANL USE ONLY

This project specification is based on LANL Master Specification 23 3225, Rev. 2, dated November 3, 2011.

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Endnotes for Author tied to Superscripts above

(1) Include DA if filter train includes isolation dampers.

(2) The maximum height of a housing is 3 tiers high and the maximum width is 3 filters wide.

(3) Specify doors on both sides when there are more than 3 filters wide in a bank.

(4) Edit to suit job requirements.

(5) Specify Type 316 and 316L stainless steel for highly corrosive air stream.

(6) Consult with the manufacturer if a higher system pressure (greater than ± 10 in. w.g.) is required since additional bracing may be necessary.

(7) Edit operation pressure to suit. The plenum must be tested at the maximum pressure it could possibly see during service. A housing that is normally under a negative pressure but could see a positive pressure during an upset condition, e.g., fan failure, must be tested for both a positive and a negative pressure of the expected magnitude. As a minimum, use a test pressure of ±10 in. w.g.

(8) One bag per access door is the minimum number of bags needed to put the housing into service.

(9) The 0.2 percent of housing volume per hour requirement is a very low leakage requirement that had been listed in ERDA 76-21, Table 4.5 for an all-welded man-entry steel housing. This requirement is not included in DOE-HDBK-1169-2003, Chapter 4. Consult with Rad Engineering (RP-3) on what value to use on a case-by-case basis.

(10) Specify gage ranges per LANL Standard Detail ST-D3040-5. Minimum resolution for all gages is 0.1 in. w.g. These gages have a plastic face which is damaged by prolonged exposure to UV light.

(11) 6 inches is the minimum. Higher bases can be specified. Consult with the design team structural engineer for the specific project requirements for the base channel.

(12) Provide drains on the bottom of housings where the build-up of water in the housing is a possibility. Drain size and location is to be determined on a case-by-case basis. Fire protection water discharge into plenums will usually be the driver for drain sizing. Need to provide sufficient information so that the housing manufacturer understands the specific requirements for the project. In general the drains need to be sized to keep water from rising more than 10 in. in height. The drains and discharge piping must be located such that they do not interfere with in-place testing and filter change-out activities.

(13) Specify 36 in. long transitions for 3 high x 3 wide assemblies and 24 in. long transition for assemblies less than 3 high x 3 wide.

(14) Edit to suit when upstream or downstream duct sizes are different or if rectangular duct is used.

(15) The connections must meet the applicable requirements of ASME AG-1, Sections HA and/or SA.

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