

DIVISION 23
SECTION 23 31 13
METAL DUCTS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all the sheet metal ductwork used for the HVAC system, as specified herein, as shown on the Drawings and as needed for a complete and proper installation.

1.02 RELATED SECTIONS

- A. Related Sections:

1. Section 01 51 23 - Temporary Heating
2. Section 23 05 00 – Common Work Results For HVAC
3. Section 23 05 13 - Common Motor Requirements For HVAC Equipment
4. Section 23 05 23 - General Duty Valves For HVAC Piping
5. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
6. Section 23 05 53 - Identification for HVAC Piping and Equipment
7. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC
8. Section 23 07 00 - HVAC Insulation
9. Section 23 09 13 - Instrumentation and Control for HVAC
10. Section 23 09 14 - Natural Gas and CO Gas Leak Detection Equipment
11. Section 23 09 23 - Control Dampers
12. Section 23 09 24 - Steam Flow Meters
13. Section 23 22 13 - Steam and Condensate Heating Piping
14. Section 23 25 19 - Water Treatment for Steam System Feedwater
15. Section 23 31 13 - Metal Ducts
16. Section 23 33 00 - Air Duct Accessories
17. Section 23 34 16 - Boiler Room Combustion Air Makeup And Ventilation System
18. Section 23 51 00 - Chimney Liner
19. Section 23 51 16 - Prefabricated Breechings and Accessories
20. Section 23 51 23 - Gas Vents
21. Section 23 52 39 - Firetube Boilers
22. Section 23 53 12 - Vacuum Condensate Pumps
23. Section 23 53 13 - Boiler Feedwater Pumps

1.03 SUBMITTALS

- A. Product Data

1. Submit Shop Standards for metal ductwork including gages, materials, type of joints, sealing requirements, method of fabrication and reinforcing. Shop standards shall be in accordance with the SMACNA HVAC Duct Construction Standards, 2005 Edition.

- B. Shop Drawings:

1. Submit scaled layout drawings (3/8"=1') of metal ductwork and fittings including but not limited to duct sizes, locations, elevations, slopes of horizontal runs, wall and floor penetrations, and connections, including location of connections. Show modifications of indicated requirements, made to conform to local shop practice and how those modifications ensure that free area, materials and rigidity are not reduced.
 - a. Layouts should include all the room plans, mechanical equipment rooms and penthouses.
2. Method of attachment of duct hangers to building construction with all the support details including methods for vibration isolation, cable hanging systems and seismic restraints. For expansion bolts installed in concrete, submit ICC certification for use in cracked concrete.
3. Coordinate Shop Drawings with related trades prior to submission. HVAC Contractor shall provide shop drawings for all roof openings required for installation of HVAC systems. Roof opening shop drawings shall be dimensioned from the centerline of the nearest structural column and coordinated with the approved HVAC equipment, sheet metal shop drawings, framing plan, etc.

1.04 QUALITY ASSURANCE

A. Codes and Standards:

1. SMACNA Standards: Comply with SMACNA's HVAC Duct Construction Standards Metal and Flexible Third Edition-2005 for fabrication and installation of metal ductwork.
2. NFPA Compliance: Comply with the NFPA 96-1984 as amended by Section MC 506 of the 2014 NYC Mechanical Code.
3. Comply with the 2014 New York City Mechanical Code.
4. All appliances regulated by the New York City Construction Codes shall be listed and labeled (reference Sections MC 301.4 and MC 301.6). Testing of material shall be in accordance with Section §28-113 of the NYC Administrative Code (reference Section MC 301.5). Whenever the NYC Construction Codes or the Rules of the Department of Buildings requires that material be listed or labeled and material proposed to be used is not so listed or labeled, the use of such material shall be subject to prior approval by the Commissioner (Office of Technical Certification and Research OTCR) and such material shall be used only to the extent set forth in such approval. Materials that were previously approved by the Board of Standards and Appeal (BSA) or by the Department (MEA) before the effective date of the NYC Construction Codes may continue to be used, but only to the extent set forth in such approval, and only if such approval is not specifically amended or repealed by the Commissioner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sheet Metal

1. Galvanized Steel: Lock-forming quality; ASTM A653 G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
 2. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- B. Gages of Metal for galvanized rectangular duct: Gages of metal shall be in accordance with Tables 2.1 through 2.28 of SMACNA HVAC Duct Construction Standards Third Edition - 2005. Duct shall be constructed to the pressure shown on the on the Drawings. The duct pressure classification shall default to the equipment external static pressure if the pressure levels are not shown on the Drawings.
- C. Hangers and Supports
1. Rod Type Hangers and Angles: Hot dip galvanized steel with 2 locking nuts in place.
 2. Strap Hangers: Same material as ducts except that galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
 3. Trapeze and Riser Supports: Steel shapes complying with ASTM A36. Same material as ducts.
 4. Strap and Rod Sizes: Comply with SMACNA for sheet width and thickness and for rod diameters.
 5. For ducts with a cross sectional area of 2 square feet or less, hangers shall be constructed of at least 1" by 1/16" steel strap. For ducts with a cross sectional area of over 2 square feet, hangers shall be constructed of at least 1" by 1/8" steel strap.
 6. Expansion bolts for use in existing and new reinforced stone concrete slabs and concrete deck shall be as follows: Fully threaded, torque-controlled, wedge-type expansion anchor consisting of a high-strength threaded stud body, stainless steel expansion elements (clip, wedge), nut and washer. Expansion Bolts installed in concrete shall be in accordance with Appendix D of ACI 318 as modified by Sections 1908.1.9 and 1908.1.10 as per Section BC 1912 of the 2014 NYC Building Code.
 - a. All adhesives and sealants used on the construction of ductwork shall comply with the South Coast Air Quality Management District (SCAQMD) Rule #1168; VOC limits shall comply with the limits indicated in LEED Version 4.0, Indoor Environmental Quality Section, Credit for Low Emitting Materials. Those limits correspond to the SCAQMD Rule #1168, and the most recent Rule Amendment date of October 6, 2017.
 7. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork in accordance with Article 2.02.A.3.
 - a. All adhesives and sealants used on the construction of ductwork shall comply with the South Coast Air Quality Management District (SCAQMD)

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8. Welds: Weld material shall match ductwork material. Galvanized ductwork welds to be cleaned and painted with galvanizing repair paint conforming to ASTM A780.

2.02 FABRICATION - GENERAL

- A. Fabricate ductwork from galvanized sheet metal of the gages specified in SMACNA HVAC Duct Construction Standards Third Edition - 2005 except as follows:
 1. Joints, Seams and Connections: Per Section MC 603.9, all longitudinal and transverse joints, seams and connections in ducts shall be constructed as specified in SMACNA HVAC Duct Construction Standards—Metal and Flexible. All joints; and longitudinal and transverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes. Per Section C403.2.9.1.3 of the 2020 NYCECC, ductwork and all plenums with pressure class ratings shall be constructed to Seal Class A, duct leakage class 4. All connections shall be sealed, including, but not limited to, spin-ins, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed. Closure systems used to seal ductwork listed and labeled in accordance with UL 181A shall be marked “181A-P” for pressure-sensitive tape, “181 A-M” for mastic or “181 A-H” for heat-sensitive tape. Closure systems used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked “181B-FX” for pressure-sensitive tape or “181B-M” for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked “181B-C.” Closure systems used to seal metal ductwork shall be installed in accordance with the manufacturer’s installation instructions. Unlisted duct tape is not permitted as a sealant on any metal ducts.
- B. Dissimilar Metals: Separate dissimilar metals used for ductwork with vinyl, neoprene or silicon rubber coated woven fiberglass or woven nylon/polyester blend duct connector fabric by Duro Dyne. No separation is required between screws or rivets and the materials they are inserted in.
- C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated on the Drawings, fabricate elbows with centerline radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for diverging concentric transition and 60° for converging concentric transition unless otherwise shown on the Drawings.

- D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Ductwork Accessories: Section 23 33 00 for accessory requirements and for fire damper requirements.
- E. The penetration of fire rated walls with fire dampers shall be installed per New York City Construction Codes. Refer to Section 23 33 00.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install ductwork to allow maximum headroom. Properly seam, brace, stiffen, support and render ducts mechanically airtight. Adjust ducts to suit job conditions. Dimensions may be changed as approved, if cross sectional area is maintained.
- B. Provide necessary transformation pieces, and flexible fabric connections (Refer to Section 23 33 00: Air Duct Accessories) for ductwork connected to air handling units or air inlet and outlet devices.
- C. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated or factory-fabricated work to accommodate installation requirements.
- D. Routing: Locate ductwork runs, except as otherwise indicated on the Drawings, vertically and horizontally and avoid diagonal runs wherever possible. Drawings are essentially diagrammatic. Provide offsets, rises, drops, all other items, accessories and necessary work as required to fit structure, avoid obstruction, and retain clearances, headroom openings and passageways. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Install parallel to or at right angles to walls and partitions, parallel to ceilings, level and plumb, unless shown otherwise. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown on the Drawings. Coordinate layout with suspended ceiling and lighting fixtures and similar finished work. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- E. Hangers and Supports
 - 1. All ducts shall be as close to the ceiling as possible except where pipes or electric conduits are indicated as passing above them. They shall be installed within the enclosing work (hung ceiling or furring) and shall not interfere with its construction. Where one duct is run below another duct of greater width, the lower duct shall be hung from the support of the upper duct. The support of the upper duct shall be increased in thickness in such cases.
 - 2. When the floor and/or roof slab construction for the Project is of conventional reinforced poured concrete type, the following directions apply: Overhead ductwork shall be supported by hangers secured to MSS Type 18 inserts before

the floor slabs are poured or expansion type concrete anchors and fasteners, ITW Ramset/Red Head, Hilti, Powers Fasteners or approved equal after the floor slabs are poured and the forms have been removed.

3. Provide concrete inserts, expansion bolts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached. When used, install powder-actuated concrete fasteners and expansion bolts after concrete is placed and completely cured and metal deck has been erected. Powder-actuated concrete fasteners may be used for standard-weight aggregate concrete and for lightweight-aggregate concrete of not less than 3,000-psi strength. Do not use powder actuated fasteners for slabs less than 4" thick or for seismic restraints.
 4. Metallic fasteners installed with electrically operated or powder-actuated tools used as upper hanger attachments shall be in accordance with the SMACNA Manual, with the following exceptions: Do not use powder-actuated drive pins or expansion nails. Do not attach powder-actuated or welded studs to structural steel less than 3/16" thick. Do not support a load, in excess of 250 lbs from any single welded or powder-actuated stud unless it is tested in place and confirmed by the manufacturer.
 5. Expansion bolts shall be installed in snug fitting smoothly drilled holes after concrete is placed and completely cured and metal deck has been erected in accordance with the bolts manufacturer's installation instructions. Expansion bolts shall be installed so that the load acts on the bolts in shear and withdrawal. Expansion bolts shall be carefully located in order to eliminate the risk of damage to concrete, steel reinforcement, electrical conduits and any other embedded items. Install in concrete after concrete is placed and completely cured
- F. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.
- G. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1 1/2".
- H. Coordination: Coordinate duct installations with installation of accessories, dampers, air handling unit, controls and other associated work of the ductwork system. Coordinate work of other trades affecting the ductwork. Penetrations made by all trades are to be sealed to an air-tight condition. Testing of ductwork shall be performed after all penetrations have been made, or redone if made after original testing.
- I. Where the corner of an angle iron brace or joint member projects into a walking passage, the corner shall be mitered and shall be padded with 1/2" minimum thickness flexible foamed plastic material to minimize the possibility of injury to personnel.
- J. Per Section MC 607.1.1.1, the space around a duct penetrating a nonfire-resistance-rated floor assembly shall comply with Section BC 716.6.3.

3.02 HANGER ATTACHMENTS

Reference: SMACNA HVAC Duct Construction Standards, Third Edition-2005 Figures 4-1, 4-2, 4-3.

A. General

1. Secure upper hanger attachments to structural steel wherever possible.
2. Do not attach hangers to steel decks.
3. Metallic fasteners installed with electrically operated or powder driven tools may be used as hanger attachments in accordance with the SMACNA HVAC Duct Construction Standards, Third Edition-2005.

B. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by ductwork support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of 5.

1. Do not drill holes in structural steel members.

C. Attachment to Cast-in-Place Concrete:

1. Secure hangers to overhead construction with expansion bolts.
2. Secure hanger attachments required to be supported from wall or floor construction with single unit expansion bolts.

3.03 HANGERS FOR DUCTS, 2 INCH WC AND UNDER

- A. Install hangers for ducts as specified in the SMACNA HVAC Duct Construction Standards, Third Edition-2005 .
- B. Prime coat plain steel rods threaded at the site immediately after installation. Galvanized rods shall not be primed.

3.04 HANGERS FOR DUCTS OVER 2 INCH WC

- A. Install trapeze hangers for ducts as specified in the SMACNA HVAC Duct Construction Standards Third Edition-2005. Strap hangers shall not be used in this application.

3.05 DUCT RISER SUPPORTS

- A. Support vertical round ducts and vertical rectangular ducts as per SMACNA HVAC Duct Construction Standards, Third Edition-2005, with the exception that riser supports shall be provided at every floor.

3.06 OPENINGS IN WALLS AND FLOORS

- A. In Walls: Sheet metal Contractor shall provide sleeves for all exposed non-rated penetrations and shall provide collars for penetrations through rated construction. All structural openings (including lintels etc.) shall be provided by the General Contractor.

B. In Floors:

1. When the floor and/or roof slab construction for the project is the composite metal deck type, consisting of corrugated sheet steel and reinforced concrete, the following directions apply: Any opening, which is not framed by structural steel beams on all sides (refer to the structural steel drawings), and which is required in steel decking for the installation of HVAC work shall be provided by

General Contractor by installing the proper size form (prior to the pouring of concrete), and cutting the metal deck when the ducts are to be installed. Holes greater than 6" but less than 30" in any dimension will be reinforced. Holes 6" or less in dimension need not be reinforced.

2. When the floor slab or roof slab for the project is of conventional reinforced poured concrete type, the following directions apply: General Contractor shall form openings in the slabs for the passage of ducts. Provide the exact location and size (including clearances) of each opening required.

3.07 IDENTIFICATION

- A. Where the outside air intake for a supply fan system is isolated from the fan it serves, the connecting duct shall be identified at the intake. Identification shall consist of a 1/8" thick laminated plastic plate with 1/2" white core letters, designating the system it supplies. Plate shall be secured to the wall adjacent to the intake (Refer to Section 23 05 53: HVAC Identification).

3.08 CONNECTIONS

- A. General Contractor shall arrange to have the connections of metal ductwork to equipment and shall provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. (Refer to Section 23 33 00: "Duct Accessories", for flexible connectors).
- B. Coordinate as necessary to ensure that, where required in architectural construction, access doors have been provided for proper access, operation and maintenance.

3.09 ADJUSTING AND CLEANING FOR STARTUP AND WARRANTEE

- A. Clean dust and debris out of ductwork internally, unit by unit, as units are installed. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal.
- B. Balancing: Refer to Section 23 05 93 for air distribution balancing of metal ductwork. Seal any leaks in ductwork that become apparent during the balancing procedure.

END OF SECTION