

087100	Finish Hardware
087113	Automatic Door Operators
088000	Glass and Glazing
089000	Louvers

DIVISION 9 - FINISHES

092400	Exterior Lath and Plaster
092900	Gypsum Drywall
099113	Painting

DIVISION 10 - SPECIALTIES - NOT USED

DIVISION 11 - EQUIPMENT

114200	Fall Arrest Systems
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DIVISION 12 - FURNISHINGS

124800	Stainless Steel Floor Grate
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DIVISION 13 - SPECIAL CONSTRUCTION - NOT USED

DIVISION 14 - CONVEYING EQUIPMENT - NOT USED

DIVISION 21 - FIRE SUPPRESSION - NOT USED

DIVISION 22 - PLUMBING - NOT USED

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING

230120	Operation and Maintenance of Heating System
230523	Common Works for HVAC System
230529	Hangers and Supports for HVAC Piping
230553	Identification for HVAC Piping System
230593	Testing, Adjusting and Balancing for HVAC
230713	Ductwork Insulation
230719	Pipe Insulation
232113	Hydronic Piping
232513	Water Treatment for Closed-Loop Hydronic System
233113	Metal Ductwork
238200	Convection Heating Units

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DIVISION 26 - ELECTRICAL

260500	Common Work Results for Electrical
260519	Low Voltage Electrical Power Conductors and Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533	Raceway and Boxes for Electrical Systems
260553	Identification for Electrical Systems
260923	Lighting Control Devices
262416	Panelboards
265100	Interior Lighting

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SECTION 230593-TESTING, ADJUSTING AND BALANCING FOR HVAC SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide cleaning and testing for the HVAC Work done in this Project, as specified herein, and as needed for a complete and proper installation..

1.2 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Heating Hot Water Piping

Operating Pressure	125 psig
Operating Temperature	150 - 250° F
Design Code (ANSI)	B31.9

1.3 RELATED SECTIONS

- A. Operation and Maintenance of HVAC Systems..... Section
230120
- B. Common Works for HVAC Systems..... Section
230523
- C. Hydronic Piping for HVAC Systems..... Section
232113
- D. Metal Ductwork..... Section
233113

1.4 SUBMITTALS

- A. Quality Control Submittals
 - 1. Test Reports (Field Tests):
Hot Water Heating Piping: Submit test results on piping record.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. Perform field testing of piping systems in accordance with all the State agencies having jurisdiction and as specified.
- B. Project Conditions
 - Protection

During test Work, protect controls, gauges and accessories which are not designed to withstand test pressures. Do not utilize permanently installed gauges for field testing of systems.

C. Sequencing and Scheduling

Transmit written notification of proposed date and time of operational tests to the Authority at least 5 days in advance of such tests.

Perform cleaning and testing Work in the presence of the Authority.

Pressure test piping systems inside buildings, at the roughing-in stage of installation, before piping is enclosed by construction Work, and at other times as directed. Perform test operations in sections as required and directed, to progress the Work in a satisfactory manner and not delay the general construction of the building. Valve or cap-off sections of piping to be tested, can utilize valves required to be installed in the permanent piping systems, or temporary valves or caps as required to perform the Work.

PART 2 MATERIALS

2.1 MATERIALS

A. Certified Test Equipment and Instruments

Type and kind as required for the particular system under test. All gauges, instruments and test devices shall be provided with a certificate of calibration and calibration curve. The certificate must show date of last calibration. Calibration must be current.

B. Test Media (air, water) as specified for the particular piping or system under test.

C. Cleaning Agent (chemical solution, steam, water) as specified for the particular piping, apparatus or system being cleaned.

PART 3 EXECUTION

3.1 INSTALLATION

A. Preliminary Work

Thoroughly clean pipe and tubing prior to installation. During installation, prevent foreign matter from entering the systems. Prevent if possible and remove stoppages or obstructions from piping and systems.

Thoroughly clean control air and similar systems prior to pressure testing.

B. Pressure Tests- Piping

Apply tests as specified below. No work shall be covered or concealed before it is tested. Piping may be concealed after the hydrostatic test and an inspection of the position, pitch and allowance for expansion has been made.

C. Hydrostatic Tests

Hot water systems shall be tested at not less than 80-pounds per square inch hydrostatic pressure maintained for at least 4-hours during the progress of installation, and all leaks shall be properly eliminated. Caulking of leaky joints is not permitted. For testing purposes end of piping to be tested shall be plugged or capped. Convectors, pneumatic valves and other equipments or apparatus which may be damaged by this hydrostatic test shall be excluded from the test.

D. Heating Systems – Cleaning and Operational Testing

1. Hot Water Systems

- a) After the hot water systems installation has been completed, they shall be chemically cleaned. Notify the Authority 5-days in advance of starting the cleaning operation. In the presence of the, one of the following solutions shall be placed in the system and circulated: (1) Trisodium Phosphate - one pound for each fifty gallons of water in the system; (2) Sodium Carbonate -one pound for each thirty gallons of water in the system; or (3) Sodium Hydroxide (Lye) - one pound for each fifty gallons in the system. Their preference is in the order named, and a solution of only one type shall be used.
- b) Fill, vent, and circulate this solution through the system, allowing it to reach design or operating temperature. After circulating for at less than 4-hours, the solution shall be drained completely from the system, strainers shall be cleaned, and the system shall be refilled with fresh water. The water shall be circulated for one hour, and, at that time, a sample of the water shall be tested for alkalinity in the presence of the Authority.
- c) Operational Test: Run system in an automatic mode for a minimum of 120 consecutive hours. At completion, make final connections and adjustments to apparatus, equipment and accessories.

END OF SECTION

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SECTION 230719-DUCTWORK INSULATION

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide thermal insulation on the ductwork installed and required on this Project shown on the Drawings, specified herein and needed for a complete and proper installation.
- B. All insulation materials shall be free of asbestos.

1.2 RELATED SECTIONS

- A. Operation and Maintenance of HVAC Systems..... Section
230120
- B. Common Works for HVAC Systems..... Section
230523
- C. Metal Ductwork..... Section
233113

1.3 SUBMITTALS

A. Product Data

Submit manufacturer's product data and installation instructions for each type of duct insulation. Submit schedule showing manufacturer's product number, k-value, thickness and furnished accessories for each duct system requiring insulation.

B. Maintenance Data

Submit maintenance data and replacement material lists for each type of duct insulation. Include this data and product data in maintenance manual in accordance with the requirement of Division 1.

C. Samples

Submit manufacturers sample of each duct insulation type required in accordance with the requirement of Division-1. Affix label to sample completely describing product.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications

Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications

Firm with at least three years successful installation experience on projects with mechanical insulations similar to that required for this Project.

C. Flame/Smoke Ratings

Provide mechanical insulation with flame spread index of 25 or less and smoke developed index of 50 or less, as tested by ASTM E-84.

D. Code and Standards

Comply with New York State Energy Code and ASHRAE Standards.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water and chemical and mechanical damages. Do not install damaged or wet insulation; remove from site.

1.6 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Armstrong World Industries, Inc.
Certain Teed Corp.
Knauf Fiber Glass.
Owens-Corning Fiberglass Corp.
Pittsburgh Corning Corp.
Rubatex Corp.

PART 2 MATERIALS

2.1 FLEXIBLE TYPE

- A. Flexible (blanket) type fiberglass: 1 lb nominal density, thermal conductivity not exceeding 0.29 at 75° F mean temperature; factory applied foil reinforced kraft facing as specified for the fiberglass board.
- B. Jackets for Ductwork Insulation ASTM C-921; Type I for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient. (Type I-Vapor Barrier, Type II-Water Vapor Permeable).

2.2 DUCTWORK INSULATION ACCESSORIES

- A. Provide staples, bands, wires, tape, anchors, corner angles and all other items and accessories recommended by insulation manufacturer for applications indicated.
- B. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and all other items and compounds recommended by insulation manufacturer for applications indicated.

PART 3 INSTALLATION

3.1 EXAMINATION

- A. Examine areas and conditions under which the duct insulation is to be installed. Before applying the insulation, all tests specified in Division 23 Sections should have been completed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Authority.

3.2 INSTALLATION

- A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Flexible type duct insulation shall be used to insulate ductwork which is installed in concealed spaces (hung ceilings, furred spaces, pipe and duct spaces, crawl spaces and tunnels).
- C. Facing and Finishing: Concealed Ducts: Insulation on ductwork installed within pipe and duct spaces, storerooms, hung ceilings, furred spaces, or pipe tunnels shall have no additional finishing, other than the foil-reinforced-kraft facing.

3.3 INSTALLATION OF FLEXIBLE TYPE INSULATION

- A. Flexible type insulation shall be cut slightly longer than the perimeter of the duct to insure full thickness at corners. Insulation shall be applied with edges tightly butted, and seams stapled approximately 6" on centers with outward clinching staples. Insulation shall be additionally secured with No. 16 gage soft annealed galvanized steel wire on not more than 12" centers. When the width of a horizontal duct is 24" or more, the insulation shall also be fastened with welded pins or stick clips spaced on 18" centers on the bottom surface of the duct. All joints and clips shall be taped and sealed with 3" wide strips of foil-reinforced-kraft facing applied with insulation adhesive. The use of pressure sensitive tape of the same facing material also is acceptable for this purpose.
- B. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- C. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- D. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

3.4 EXISTING INSULATION REPAIR

- A. Repair damaged sections of existing duct insulation, both previously damaged or damaged during construction. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.
- B. Protection and Replacement: Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

- C. Protection: Insulation Worker shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

3.5 SCHEDULES OF DUCTWORK INSULATION

- A. Insulate the following:
 - 1. Cold Ductwork: Supply and return ductwork removed and re-install as part of this contract in its entirety from the section where removal stopped to the room terminal outlets.
 - 2. Each system specified above with the following types:
 - Flexible Fiberglass: 2" thick, application limited to concealed locations.

END OF SECTION

SECTION 230719-HVAC PIPING INSULATION

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide thermal insulation on the piping installed and required on this Project shown on the Drawings, specified herein and needed for a complete and proper installation.
- B. All insulation materials shall be free of asbestos.

1.2 RELATED SECTIONS

- A. Operation and Maintenance of HVAC Systems..... Section
230120
- B. Common Works for HVAC Systems..... Section
230523
- C. Hydronic Piping..... Section
232113

1.3 SUBMITTALS

A. Product Data

Submit manufacturer's product data and installation instructions for each type of pipe system insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each piping system requiring insulation.

B. Maintenance Data

Submit maintenance data and replacement material lists for each type of pipe insulation. Include this data and product data in maintenance manual in accordance with the requirement of Division 23.

C. Samples

Submit manufacturers sample of each pipe insulation type required in accordance with the requirement of Division-23. Affix label to sample completely describing product.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications

Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications

Firm with at least three years successful installation experience on projects with mechanical insulations similar to that required for this Project.

C. Flame/Smoke Ratings

Provide mechanical insulation with flame spread index of 25 or less and smoke developed index of 50 or less, as tested by ASTM E-84.

D. Code and Standards: Comply with New York State Energy Code and ASHRAE Standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label including fire hazard indexes.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from site.

1.6 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Armstrong World Industries, Inc.
CertainTeed Corp.
Knauf Fiber Glass.
Manville/Schuller Intl. Inc.
Owens-Corning Fiberglas Corp.
Pittsburgh Corning Corp.
Rubatex Corp.

PART 2 MATERIALS

2.1 PIPE INSULATION

A. One-piece molded sectional fiber glass insulation shall have a nominal 4-pound density with a thermal conductivity of not over 0.23 at 75° F. mean temperature. Insulations shall have a jacket and adhesive used to adhere the jacket to the insulation. Insulation shall be suitable for use on piping up to 450° F. operating temperature.

2.2 JACKETS

A. The jackets shall be of white kraft paper outer surface bonded to aluminum foil and reinforced with fiber glass yarn (all service jacket with self-sealing lap). The jackets shall meet the requirements of the specification HH-B-100B type 1. For cold water pipe insulation, the jackets shall be the vapor barrier type.

B. For outdoor pipe insulations, the jackets shall be made of 0.016" aluminum or stainless steel held with a

friction type, Z-lock.

2.3 ACCESSORIES

- A. Bands, staples, tapes, wires, cements, adhesives, sealers and protective finishes: As specified herein or as recommended by insulation manufacturer for proper uses on piping insulations.

PART 3 INSTALLATION

3.1 EXAMINATION

- A. Examine areas and condition under which the pipe insulation is to be installed. Before applying the insulation, all tests specified should have been completed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Authority's Representative. However, thermal insulation can be applied to pipes prior to these tests providing that all fittings are left bare to permit detection and possible leaks.

3.2 INSTALLATION

- A. Apply adhesive, sealers, coating, and all other items and accessories at the proper temperature as recommended by the manufacturer. If ambient conditions are not acceptable, provide temporary heat as required for proper installation without any delay to the Project completion.
- B. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves intended purpose.
- C. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.
- D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered. Maintain integrity of vapor-barrier jackets on pipe insulation and protect to prevent puncture or other damage.
- E. Valves shall be insulated up to packing unit.
- F. Fire Seal Application: Where pipes pass through fire walls, fire partitions, fire rated pipe chase walls or floors above grade, insulation shall be interrupted and a fire seal shall be provided.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Use of pipe insulation having a "self-sealing lap" and "self-sealing lap strips" is also acceptable.
- I. The temperature of the jacket shall not exceed 150° F.

3.3 HOT PIPING

- A. Install the fiber glass insulation with factory supplied jacket. Butt all joints firmly together and smoothly secure all jacket laps and joints strips with lap adhesive.

- B. Fittings and valves shall be insulated by applying the proper factory pre-cut fiber glass insulation insert to the pipe fitting and valve. The ends of the fiber glass insulation insert shall be tucked snugly into the throat of the fitting, valve and the edges adjacent to the pipe insulation tufted and tucked in, fully insulating the pipe fitting. The fitting cover is then applied and shall be secured by tack fastening, banding or taping the ends to the adjacent pipe insulation.

3.4 FROSTPROOFING

- A. When the Drawings indicate piping to be frostproofed, it shall be insulated with two layers of molded fiberglass insulation with a outdoor pipe type of jacket. The final insulation shall be protected with a casing of 0.016" thick aluminum applied with aluminum lock-type bands, 12" apart. Where the piping is installed within a furred enclosure, the casing shall be omitted.

3.5 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation during construction which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation worker shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

3.6 SCHEDULE OF PIPE INSULATION

- A. The following piping systems shall be insulated:

1. Supply and return piping for hot temperature water system.
2. Bonnets of valves in hot water piping shall also be insulated.

- B. Insulation Omitted

Omit insulation on hot piping within radiation enclosures or unit cabinets; on condensate piping between steam trap and union; and on unions, flanges, strainers, flexible connections, expansion joints and drips.

- C. Recommended Thickness:

System Temp, F	Pipe 1" & Below	Pipe 1-1/4" to 2"	Pipe 2-1/2" to 4"	Pipe Above 4"
=====				

HEATING:

Hot Water-Dual Temp	40-150	1.0	1.0	1.0	1.5
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END OF SECTION

SECTION 232113 - HYDRONIC PIPING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide pipes, pipe fittings, pipe specialties, and pipe supports as specified herein, as shown on the Drawings, and as needed for a complete and proper installation.
- B. Heating Hot Water Piping:
 - a. Operating Pressure 125 psig
 - b. Operating Temperature 150 - 250° F
 - c. Design Code (ANSI) B31.9

1.2 RELATED SECTIONS

- A. Operation and Maintenance of HVAC Systems..... Section 230120
- B. Common Works for HVAC Systems..... Section 230523
- C. Pipe Insulation..... Section 230719

1.3 SUBMITTALS

A. Product Data

Submit manufacturer's technical data, figure number, installation instructions, and dimension drawings. Submit schedule showing pipe or tube weight, fitting and joint type for each piping system; size, location and feature for each piping specialty, expansion compensation, hanger and support. Include pressure drop curve or chart for each type and size of pipeline strainer. Include maximum allowable temperature and pressure rating, and maximum expansion compensation.

1.4 QUALITY ASSURANCE

- A. Brazing Certifications:
Submit reports as required for piping work

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Protect flanges, fittings, and all other items and accessories from moisture and dirt by packaging with durable, waterproof wrapping.

SECTION 233113-METAL DUCTWORK

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

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

1.2 RELATED SECTIONS

- A. Operation and Maintenance of HVAC Systems..... Section
230120
- B. Common Works for HVAC Systems..... Section
230523
- C. Ductwork Insulation..... Section
230713

1.3 SUBMITTALS

A. Product Data

Submit manufacturer's product data including gages, materials, type of joints, sealing materials and installation instructions for metal ductwork materials and products.

B. Shop Drawings:

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. 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.

C. Coordinate Shop Drawings with related trades prior to submission.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications

Firms regularly engaged in manufacture of metal ductwork products of types, materials and sizes required whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications

Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for the Project.

C. Code and Standards

1. SMACNA Standards: Comply with SMACNA's HVAC Duct Construction Standards Metal and Flexible for fabrication and installation of metal ductwork.
2. NFPA Compliance: Comply with NFPA 90A: Standard for the Installation of Air Conditioning, and Ventilating Systems.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protection

Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage, dirt and moisture from entering ducts and fittings.

B. Storage

Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

C. During construction, cover duct openings with sheet metal blanks. Blanks shall be removed just prior to the inlets, outlets or end section installation.

PART 2 MATERIALS

2.1 SHEET METAL

A. Galvanized Steel: ASTM A527 lock forming quality galvanizing. ASTM A525 coating designation G-90 or chemical treat or oil coat G-60.

B. Gage of Metal:

Galvanized steel sheets for ducts, and all other items and accessories shall be in accordance with the following table, except as otherwise specified.

Up to 30-inches	(either dimension)	No.24-gage
30-inches to 54-inches	(either dimension)	No.22-gage
54-inches to 72-inches	(either dimension)	No.20-gage

2.2 HANGERS AND SUPPORTS

A. Rod Type Hangers: Mild low carbon steel unless otherwise specified, fully threaded or threaded each end with 2 removable nuts each end for positioning and locking rod in place. Unless stainless steel, galvanized or cadmium plated, prime with heat resistant paint.

B. Strap Hangers: Same material as ducts, except that hangers for stainless steel ducts in unfinished spaces may be galvanized steel.

2.3 MISCELLANEOUS DUCTWORK MATERIALS:

A. Sheet Metal Screws, Machine Bolts, Rivets and Nuts: Tinned, cadmium plated or rust resistant materials. Bolts shall be button-head stove bolts, 1/4" x 3/4" unless otherwise specified.

- B. Concrete Inserts: Steel or malleable iron, galvanized; continuously slotted or individual inserts conforming with MSS SP-58, Types 18 and 19, Class A-B.
- C. C Clamps: Fee & Mason 255L with locking nut and 255S retaining strap.
- D. Machine Bolt Expansion Anchors:
 - a. Non-caulking single unit type: FS FF-S-325, Group II, Type 2, Class 2, Style 1.
 - b. Non-caulking double unit type: FS FF-S-325, Group II, Type 2, Class 2, Style 2.
- E. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
- F. 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.
- G. Flexible Ducts: Either spiral-wound spring steel with flameproof vinyl sheathing, or corrugated aluminum; complying with UL 181. Where installed in unconditioned spaces other than return air plenums, provide 1" thick continuous flexible fiberglass sheath with vinyl vapor barrier jacket.

PART 3 EXECUTION

3.1 FABRICATION

A. General

Fabricate ductwork from galvanized sheet metal of the gages specified.

B. Factory-Fabricated Low Pressure Ductwork

Provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

3.2 MATERIAL

A. Galvanized sheet steel complying with ASTM A527, lock forming quality with ASTM A525, G 90 or G 60 coating, mill phosphatized then chemically treated or oil coat.

B. Gage as specified above.

C. Elbows

One piece construction for 90° and 45° elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

D. Divided Flow Fittings

90° tees constructed with saddle tap spot welded and bonded to duct fitting body.

3.3 MANUFACTURERS

A. Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:

- Semco Mfg., Inc.
- United Sheet Metal Div.
- United McGill Corp.

B. Factory-Fabricated High Pressure Ductwork

Provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

3.4 DUCTWORK

A. Construct of galvanized sheet steel complying with ASTM A527 by the following methods and in minimum gages listed.

<u>Diameter</u>	<u>Minimum Gage</u>	<u>Manufacture</u>	<u>Method of</u>
3" to 14"	24		Spiral Lockseam
15" to 26"	24		Spiral Lockseam
27" to 36"	22		Spiral Lockseam
37" to 50"	20		Spiral Lockseam
51" to 60"	18		Spiral Lockseam
Over 60"	16		Longitudinal Seam

1. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.
2. Fittings and Couplings: Construct of minimum gages listed. Provide continuous welds along seams.

<u>Diameter</u>	<u>Minimum Gage</u>
3" to 36"	20
38" to 50"	18
Over 50"	16

B. Internally Insulated Duct and Fittings

Construct with outer pressure shell, 1" thick insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gages listed.

<u>Nominal Duct Diameter</u>	<u>Outer Shell</u>	<u>Inner Liner</u>
3" to 12"	26 ga.....	24 ga.
13" to 24"	24 ga.....	24 ga.
25" to 34"	22 ga.....	24 ga.

1. Fittings and Couplings: Construct of minimum gages listed. Provide continuous weld along seams of outer shell.

<u>Nominal Duct Diameter</u>	<u>Outer Shell</u>	<u>Inner Liner</u>
3" to 34"	20 ga.....	20 ga.
36" to 48"	18 ga.....	20 ga.
Over 48"	16 ga.....	20 ga.

2. Inner Liner: Perforate with 3/32" holes for 22% open area. Provide metal spacers welded in position to maintain spacing and concentricity.

C. Manufacturers

Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:

- Semco Mfg., Inc.
- United Sheet Metal Div.
- United McGill Corp.

3.5 INSPECTION

- A. Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Authority's Representative.

3.6 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 15910: 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. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipments. 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 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. Ducts shall be stiffened and where required braced from walls, ceilings, and all other items and accessories.

3.7 HANGERS AND SUPPORTS

- A. All ducts shall be run at the levels indicated on the Drawings, as close to the ceiling as possible, excepting where pipes or electric conduits are indicated as passing above them. They shall be installed within the enclosing work (hung ceiling or furring) shown on the Drawings and shall not interfere with its construction. Horizontal ducts shall be supported on galvanized steel hangers. For ducts having a cross-sectional area of 4-square feet or less, the hangers shall be located near each duct joint and shall be spaced not more than 8' apart. For ducts having a cross-sectional area greater than 4-square feet, the hangers shall be located near each duct joint and duct brace and shall be spaced not more than 4' apart. Where one duct is run below another duct of greater width, the lower duct shall be hung from the braces of the upper duct by means of strap hangers bolted to the braces of the upper duct. The braces of the upper duct shall be increased in thickness in such cases.

3.8 COORDINATION

- A. Coordinate duct installations with installation of accessories, dampers, air handling unit, controls and other associated work of the ductwork system.
- B. 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.
- C. Sealing Seams, Joints, and Penetrations

Seal ductwork in accordance with the SMACNA Manual except for the following:

- 1. Ductwork Specified to be Insulated: Conform with Seal Class A for all pressure classes.

3.9 ADJUSTING AND CLEANING

- A. Clean ductwork internally unit by unit as it is installed of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted might interfere with painting or cause paint deterioration.
- B. Paint the required duct as per Basic HVAC Requirements.
- C. Balancing

Refer to Section: Balancing of Systems for air distribution balancing of metal ductwork. Seal any leaks in ductwork that become apparent during the balancing procedure.

END OF SECTION