

PART 1 GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- .4 Section 23 05 94 – Pressure Testing of Ducted Air Systems.

1.3 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A 635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
 - .3 ASTM A 653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual.
 - .3 IAQ Guideline for Occupied Buildings Under Construction, 1st Edition.
- .7 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA).

1.4 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 QUALITY ASSURANCE

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
 - .1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Separate for reuse and recycling and place in designated containers steel, metal, plastic waste in accordance with Waste Management Plan.
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
 - .7 Fold up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
> 1000	A
750	B
500	C
250	C
125	C

.2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.
- .3 Class C: transverse joints and connections made air tight with gaskets, sealant tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

- .1 Rectangular: Centreline radius: 1.5 times width of duct.
- .2 Round: smooth radius or five piece. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

- .1 To 400 mm: with single thickness turning vanes.
- .2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct or 45° entry on branch.

- .2 Round main and branch: enter main duct at 45⁰ with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with volume control damper.
- .5 Transitions:
 - .1 Diverging: 20⁰ maximum included angle.
 - .2 Converging: 30⁰ maximum included angle.
- .6 Offsets:
 - .1 Full short radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

2.6 FIRESTOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 – Firestopping.
- .2 Firestopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653, G90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.8 STAINLESS STEEL

- .1 To ASTM A480/A480M, Type 304.
- .2 Finish: No 4. finish on exposed side of duct in finished area's, No. 3 finish or lower where concealed.
- .3 Thickness, fabrication and reinforcement: to SMACNA.
- .4 Joints: to SMACNA and be continuous inert gas welded.

2.9 ALUMINUM

- .1 To SMACNA. Aluminum type: 3003-H-14.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Longitudinal Joints: to SMACNA and to be continuous weld.

- .4 Transverse Joints: to SMACNA continuous weld or equal to TDC transverse aluminum connections as detailed by SMACNA T-25B.

2.10 BLACK STEEL

- .1 To ASTM A635/A635M.
- .2 Thickness: 1.2 mm
- .3 Fabrication: ducts and fittings or SMACNA.
- .4 Reinforcement: to SMACNA.
- .5 Joints: continuous weld.

2.11 KITCHEN EXHAUST SYSTEMS

- .1 Construct in accordance with NFPA 96.
- .2 Material: Type 304 stainless steel where exposed, stainless steel where concealed or black sheet where concealed.
- .3 Thickness: to NFPA 96.
- .4 Fabrication: joints, continuous inert gas welded for stainless steel, ARC welded for black steel.
- .5 Reinforcement: to SMACNA.
- .6 Drainage: at low point.
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2.12 HANGERS AND SUPPORTS

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.
- .2 Hanger configuration: to SMACNA.
- .3 Hangers: galvanized steel angle with black steel rods to ASHRAE or SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10

Duct Size	Angle Size	Rod Size
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .1 Acceptable Product: Myatt, Grinnell, Hunt.
 - .2 For steel joist: manufactured joist clamp steel plate washer.
 - .1 Acceptable Product: Myatt, Grinnell, Hunt.
 - .3 For steel beams: manufactured beam clamps:
 - .1 Acceptable Product: Myatt, Grinnell, Hunt.

2.13 PVS

- .1 To SMACNA. All ducts shall be PVS formed into spiral tubes.
- .2 Thickness: 100mm to 225mm diameter ductwork shall be 26Ga; 250mm to 400mm diameter ductwork shall be 24Ga; 450mm to 600mm diameter ductwork shall be 22Ga; 650mm to 800mm diameter ductwork shall be 20Ga; 850mm to 1400mm diameter ductwork shall be 18Ga.
- .3 Joints: Screw fastened then sealed with PVS tape and PVS duct sealer.
- .4 Load Specifications: Ductwork gauge and reinforcement shall be designed to meet load requirements as required. Reinforcement shall be accomplished using PVS Spiromatic Rings primed and coated with PVS paint.

2.14 PVC

- .1 To SMACNA and ASTM-D-1784
- .2 Thickness: 100mm to 200mm diameter ductwork shall be 26Ga; 225mm to 400mm diameter ductwork shall be 24 Ga; 450mm to 600mm diameter ductwork shall be 22 Ga; 650mm to 800mm ductwork shall be 20Ga; 850mm to 1000mm diameter ductwork shall be 18 Ga; 1050mm to 1500mm ductwork shall be 16 Ga.
- .3 Joints: Screw fastened then sealed with PVC tape and PVS duct sealer or flanged and gasketed then sealed with PVC tape and PVC duct sealer.
- .4 Load Specifications: Ductwork gauge and reinforcement shall be designed to meet load requirements as required. Reinforcement shall be accomplished using angle rings or special bracing primed and coated with PVC paint.

2.15 FRP

- .1 To SMACNA, UL181 and ASTM-D-3982

- .2 Thickness: 50mm to 500mm Diameter Ductwork shall have a thickness of 3.2mm; 550mm to 900mm Diameter Ductwork shall have a thickness of 4.8mm; 950 to 2400 Diameter Ductwork shall have a thickness of 6.4mm.
- .3 Joints: Field Joints to be Butt & Wrap type for wet lay-up method. Resin shall be same as duct.
- .4 Load Specifications: Ductwork gauge and reinforcement shall be designed to meet load requirements as required.
- .5 Resin: Monoxivent 824 modified acrylic resin that complies with UL 181, Class 1, maximum flame-spread index of 25 and maximum smoke-development index of 50 when tested by an NRTL according to ASTM E 84. The use of liners to achieve the indicated smoke and flame spread development will not be accepted.
- .6 Fittings: Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, and access doors and panels, according to SMACNA's "Thermoset FRP Duct Construction Manual" Chapter 7, "Requirements".

PART 3 EXECUTION

3.1 GENERAL

- .1 Do work in accordance with NFPA 90A, NFPA 90B, and SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation. Do not place fire stopping material in expansion space between damper sleeve and fire partition.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA or as follows:

Duct Size (mm)	Spacing (mm)
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Duct Size to 1500	Spacing 3000
1501 and over	2500

3.3 WATERTIGHT DUCT

- .1 Provide watertight duct for:
 - .1 Dishwasher exhaust.
 - .2 Fresh air intake.
 - .3 Minimum 3000 mm from duct mounted humidifier in all directions.
 - .4 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal other joints with duct sealer.
- .3 Slope horizontal branch ductwork down towards fume hoods served. Slope header ducts down toward risers.
- .4 Fit base of riser with 150 mm deep drain sump and NPS 1 ½ drain connected, with deep seal trap and valve and discharging to open funnel drain or service sink or as approved by Owner's Representative.

3.4 KITCHEN EXHAUST SYSTEMS

- .1 Install to NFPA 96 and as indicated.

3.5 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations. Sealant and tape to be applied to full perimeter of duct.

3.6 LEAKAGE TESTS/COMMISSIONING

- .1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.
- .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Do leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.
- .5 Install no additional ductwork until trial test has been passed.
- .6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90° elbows.

- .7 Complete test before insulation or concealment.

3.7 UNDERGROUND DUCTWORK

- .1 Repair scratches or damage with applicable material coating compound.
- .2 Underground ductwork shall be installed above the water table.
- .3 All underground ductwork and fittings shall be installed and back filled according to manufacturers recommendations.
- .4 All underground ductwork shall be specifically manufactured for underground application.
- .5 FRP ductwork shall be designed with safety factor of 10 to 1 for pressure and 5 to 1 for vacuum.
- .6 Grade underground ducts with a 1% pitch back to the largest diameter duct. Provide drain in accessible location.
- .7 Disassemble, reassemble and seal segments of systems to accommodate leakage testing and for compliance with test requirements. Test for leaks before burial of ducts.

END OF SECTION