.2 Appendix C.2 - Ducting Equipment and Acoustical Insulation

.1 This Cover Sheet

.2 Data Sheet - Reference Standards

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LEED/Green Building Notes:

Refer to Section 01 35 18 – LEED Requirements for:

1. Requirements necessary for this project to obtain points and prerequisites required for certification.
2. Confirmation of LEED prerequisites and credits affecting this Section; not all are mandatory for certification.

Maintain built-in sustainability regardless of LEED requirements for:

.1 Maximizing energy performance.

.2 Recycling, reuse of materials, components and assemblies.

.3 Diversion of construction waste from landfills.

.4 Use of recycled materials, local materials, rapidly renewable and durable materials.

.5 Maintain healthy indoor environment during constructing.

.6 Provide for thermal comfort, access to views and daylight for indoor spaces.

.7 Foster innovation into facility design and planning.

LEED Credits

Energy & Atmosphere:

SPEC NOTE: Though prerequisites do not contribute to a projects point score, they are mandatory and must be met for a project to receive LEED certification.

Prerequisite 2 – Minimum Energy Performance

Credit 1 – Optimize Energy Performance

END OF DATA SHEETS

1. General

1.1 RELATED REQUIREMENTS

1. Mechanical General Requirements: Section 20 00 13.

1.2 REFERENCE DOCUMENTS

1. American Society for Testing and Materials (ASTM):

.1	ASTM C411 05	Standard Test Method for Hot Surface Performance of High Temperature Thermal Insulation

2. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):

.1	ASHRAE 90.1-2007	Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings (or most recent version)

3. Canada Green Building Council (CaGBC):

.1	LEED Canada 2009 Rating System	LEED Canada for New Construction and Major Renovations. LEED Canada for Core and Shell Development. Website: www.cagbc.org

SPEC NOTE: SPECIFY THE ABOVE ONLY IF THIS IS A LEED PROJECT

4. Model National Energy Building Code of Canada for Buildings, 1997

5. National Fire Protection Association (NFPA):

.1 NFPA (Fire) 255 2006 Standard Method of Test of Surface Burning Characteristics of Building Materials

6. Underwriters Laboratories of Canada (ULC):

.1 CAN/ULC S102 07 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.3 PRODUCT OPTIONS AND SUBSTITUTIONS

1. Refer to Division 01 for requirements pertaining to product options and substitutions.

1.4 SUBMITTALS

1. Product Data:

.1 Submit manufacturer's product data

.1 Submit product data and test reports when requested to substantiate that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements for the assembly and thickness used.

2. Shop Drawings:

.1 Submit shop drawings in accordance with Mechanical General Requirements.

.1 Submit an insulation schedule, for each application include the following information:

.1 Materials
.2 "k" value
.3 Thickness
.4 Density
.5 Finish
.6 Jacketing

1.5 DEFINITIONS

1. For the purposes of this section, the following definitions apply:

   .1 Concealed: ductwork and equipment in shafts, furring, suspended ceilings and attics.

   .2 Exposed: ductwork and equipment in mechanical rooms or otherwise not "concealed".

   .3 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C).

1.6 FLAME/SMOKE DEVELOPMENT RATINGS

1. Duct insulation, recovery materials, vapour barrier facings, tapes and adhesives shall have maximum flame spread ratings less than or equal to 25 and maximum smoke developed less than or equal to 50, when tested in accordance with CAN/ULC S102.

2. Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C411.

1.7 DELIVERY, STORAGE, AND HANDLING

1. Separate waste materials for [reuse] [and] [recycling] in accordance with Section 01 74 19 – Waste Management and Disposal.

SPEC NOTE: Delete LEED requirements if Project is not pursuing LEED certification.

1.8 LEED REQUIREMENTS

1. EA Prerequisite 2 – Minimum Energy Performance

2. EA Credit 1 – Optimize Energy Performance

   .1 Performance rates of tanks and pipes have been designed to meet a predetermined level of energy performance and efficiency in accordance with ASHRAE 90.1 (most recent version).

.2 Submit information showing installed insulation and membrane products meet the requirements of ASHRAE 90.1.

2. Products

2.1 HOT DUCT INSULATION

1. Hot Duct Insulation - Round and Oval:

   .1 Material: flexible mineral fibre blanket insulation.

   .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.

   .3 Service Temperature: 20°C to 65°C.

2. Hot Duct Insulation - Rectangular

   .1 Material: rigid mineral fibre insulation.

   .2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.

   .3 Service Temperature: 20°C to 65°C.

2.2 COLD DUCT INSULATION

1. Cold Duct Insulation - Round and Oval:

   .1 Material: flexible mineral fibre blanket insulation.

   .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.

   .3 Service Temperature: -40°C to 65°C.

   .4 Jacket: factory applied reinforced aluminum foil vapour barrier.

2. Cold Duct Insulation - Round (Exposed to Outdoors):

   .1 Material: semi-rigid mineral fibre in roll form.

   .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature

   .3 Service Temperature: -40°C to 65°C.

   .4 Jacket: factory applied reinforced aluminum for vapour barrier.

3. Cold Duct Insulation - Rectangular:

.~~1~~ Material: rigid mineral fibre insulation to.

.2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.

.3 Service Temperature: 20°C to 65°C.

.4 Jacket: factory applied reinforced aluminum foil vapour barrier.

2.3 ACOUSTIC DUCTWORK INSULATION

1. Material: flexible or rigid mineral fibre acoustical insulation.
2. Acoustic Properties: minimum NRC or 0.75 for 25 mm thickness.
3. "k" Value: maximum 0.035 W/m°C at 24°C mean temperature.
4. Service Temperature: -40°C to 65°C.
5. Surface Finish: air stream side coated to prevent fibre erosion. Surface roughness not exceeding 0.58 mm.

2.4 BREECHING INSULATION

1. Material: Semi-rigid mineral fibre with glass mat.
2. "k" Value: Maximum 0.038 W/m°C at 24°C mean temperature.
3. Service Temperature: 65°C to 450°C.

2.5 ACCESSORIES

1. FSK Tape: vapour barrier tape consisting of laminated aluminum foil, glass fibre scrim and paper, with pressure sensitive self adhesive.
2. ASJ Tape: vapour resistant tape consisting of all service jacket material with pressure sensitive self adhesive.
3. Contact Adhesive: quick setting, adhesive to adhere flexible or rigid mineral fibre insulation to ducts.
4. Lap Seal Adhesive: quick setting adhesive for joints and lap sealing of vapour barriers.

5. Canvas Adhesive: dilute, washable, fire retardant lagging adhesive for cementing canvas jacket to duct insulation.

6. Pins: welding pins 4 mm diameter shaft with 35 mm diameter head for installation through the insulation. Length to suit thickness of insulation with 32 mm square nylon retaining clips.

7. Finishing Cement: to CAN/CGSB-51.12-95, Type 1 - mineral fibre hydraulic setting thermal insulating and finishing cement for use up to 650°C.

Type 1: Mineral fibre hydraulic setting thermal **insulating and finishing cement** for use up to 650°C.

Type 2: Mineral fibre thermal **insulating cement** for use up to 870°C.

Type 3: Expanded or exfoliated vermiculite thermal **insulating cement** for use up to 980°C.

2.6 RECOVERY MATERIALS

1. Canvas: ULC listed, 220 g/m^2 plain weave cotton fabric.

2. Aluminum Jacket: to 0.5 mm thick with aluminum alloy butt straps, secured with mechanical fastener.

3. Execution

3.1 INSTALLATION, GENERAL

1. Dimensions shown are clear inside free area measurement regardless of insulation placement. Fabricate ducts accordingly.
2. Apply insulation after required duct system tests have been completed.
3. Ensure duct surfaces are clean and dry before installing insulation.
4. Install insulation over entire surface of duct, for full length of duct run including portions of duct passing penetrations through walls and floors.
5. Install insulation in a manner to insure hangers and standing duct seams do not penetrate insulation.
6. Locate finished seams in least visible location.
7. Do not insulate ductwork with external thermal insulation where acoustic duct insulation has been specified.
8. Install insulation at ambient temperatures within acceptable ratings for tapes, sealants and adhesives.

3.2 HOT DUCT INSULATION APPLICATION

1. Adhere insulation to round and oval ductwork with contact adhesive applied in 150 mm wide strips on 400 mm centres. Band on outside with wire until adhesive has set.
2. Butt insulation and seal joints with lap seal adhesive; cover joint ASJ tape.
3. Secure rigid insulation on rectangular ducts with 50% area coverage using contact adhesive, impale on pins located 400 mm on centre, secure in place with retaining clips.
4. Butt rigid insulation on rectangular ducts and seal joints with lap seal adhesive; cover joints with 100 mm strips of open mesh cloth imbedded between two coats of lap seal adhesive.

3.3 COLD DUCT INSULATION APPLICATION

1. Adhere mineral fibre insulation to round and oval ductwork with adhesive applied in 150 mm wide strips on 400 mm centres. Band on outside until mastic sets then remove bands.

2. Butt mineral fibre insulation and seal joints with lap seal adhesive; cover joint with FSK tape.

3. Secure rigid insulation on rectangular ducts with 50% area coverage of adhesive and impale on pins located 400 mm on centre and secure in place with the retaining clips.

4. Butt rigid insulation on rectangular ducts and seal joints with lap seal adhesive; cover joints with 100 mm strips of open mesh cloth imbedded between two coats of lap seal adhesive.

3.4 ACOUSTIC DUCT INSULATION APPLICATION

1. Line ducts with flexible or rigid acoustic insulation. Line plenums with rigid acoustical insulation. Adhere insulation to duct with 100% coverage of contact adhesive and pins located 400 mm OC each way. Secure in place with retaining clips. Remove excess length of pins and cover with brush coat of lap seal adhesive.

2. Bevel corners at joints and butt together. Brush coat all cut edges with lap seal adhesive. Install acoustic gauze over all cut corners and joints and brush coat with lap seal adhesive.

3. Where duct velocities exceed 20 m/s, cover insulation with 0.8 mm perforated galvanized steel with 24% free area.

SPEC NOTE: Specify acoustic duct insulation when the intention is to install acoustic duct insulation on site. Where only prefabricated acoustic lined ducts are desired delete Acoustic Duct Insulation requirements and specify requirements in Section 23 31 13 - Ductwork. Re- think wording for clarification

3.5 BREECHING INSULATION APPLICATION

1. Face breeching with 9.5 mm rib lath turn out to provide 12 mm space between insulation and hot surface and 12.5 mm mesh expanded lath on the outside.

2. Butt insulation firmly together and secure with 1.6 mm galvanized wire.

3. Lace metal mesh together. Coat with 12 mm thick finishing cement. Finish with a final 12 mm coat of finishing cement with 25% by weight of Portland cement. Trowel to a smooth hard finish.

3.6 EXPOSED DUCTS

1. Finish exposed ducts with canvas jacket suitable for paint finish.

OR

SPEC NOTE: Use canvas jacket finish if ductwork is to be painted.

2. Finish ducts exposed to outdoors with aluminum jacket. Caulk all joints on jacket for weathertight finish. Locate longitudinal joints in least weather exposed position.

3.7 INSULATION TYPE AND THICKNESS SCHEDULE

SPEC NOTE: Insulation thicknesses generally conform to ASHRAE recommendations. See Table 6.8.2B in ASHRAE 90.1 Standard or Table C-10 in ASHRAE 189.1 Standard (latest edition) for current thickness requirements.

Service Type	Insulation Type	Insulation Thickness (mm)
Exhaust and relief ducts within 3 m of exterior openings	Hot duct	25
Supply ducts and plenums	Hot duct	25
Combustion air	Cold duct	50
Outside air	Cold duct	50
Mixing plenums	Cold duct	50
Supply air plenums	Cold duct	25
Medium pressure supply ducts	Cold duct	25
Low pressure supply ducts	Cold duct	25
Supply and return ducts exposed to outdoors	Cold duct	50
Supply and return ducts in cold attic spaces	Cold duct	50
Ventilation equipment	Cold duct	50
Evaporative condenser intake and exhaust	Cold duct	25

Continued next page

3.7 INSULATION TYPE AND THICKNESS SCHEDULE (Cont'd)

SPEC NOTE: Insulation thickness recommendations to be reviewed by an acoustical engineer and mechanical engineer. These thicknesses may not be adequate for personnel protection of maximum thermal efficiency.

Service Type	Insulation Type	Insulation Thickness (mm)
High and Medium pressure supply ducts	Acoustic	25
Low pressure supply and return	Acoustic	25
Plenums	Acoustic	25
Boilers	Breeching	50
Domestic hot water heaters, atmospheric burners	Breeching	25
Domestic hot water heaters, forced air burners	Breeching	50
Furnaces	Breeching	25
Gas-fired unit heaters	Breeching	25
Indirect gas-fired air handling units, forced air burners	Breeching	25
Indirect gas-fired air handling units, atmospheric burners	Breeching	50

END OF SECTION