

**HEATING, VENTILATING AND AIR CONDITIONING**

**SECTION 232300 - REFRIGERANT PIPING**

- 1.1 PERFORMANCE REQUIREMENTS
  - A. QUALITY STANDARDS: ASHRAE 15 AND ASME B31.5.
  - B. LINE TEST PRESSURE FOR REFRIGERANT R-410A:
    - 1. SUCTION LINES FOR AIR-CONDITIONING APPLICATIONS: 300 PSIG (2068 KPA).
    - 2. SUCTION LINES FOR HEAT-PUMP APPLICATIONS: 535 PSIG (3689 KPA).
    - 3. HOT-GAS AND LIQUID LINES: 535 PSIG (3689 KPA).
- 1.2 PRODUCTS
  - A. COPPER TUBE AND FITTINGS: TYPE K
  - B. TIN-BRONZE BELLOW, FLEXIBLE CONNECTORS.
  - C. VALVES AND SPECIALTIES:
    - 1. DIAPHRAGM PACKLESS VALVES.
    - 2. PACKED-ANGLE VALVES.
    - 3. CHECK VALVES.
    - 4. SERVICE VALVES.
    - 5. SOLENOID VALVES: 24 -V AC.
    - 6. SAFETY RELIEF VALVES.
    - 7. THERMOSTATIC EXPANSION VALVES FOR 40 DEG F (4.4 DEG C) SUCTION TEMPERATURE; ADJUSTABLE SUPERHEAT.
    - 8. HOT-GAS BYPASS VALVES WITH INTERNAL, 24 -V AC STRAIGHT-TYPE STRAINERS.
    - 9. ANGLE-TYPE STRAINERS.
    - 10. MOISTURE/LIQUID INDICATORS.
    - 11. REPLACEABLE-CORE FILTER DRYERS WITH ACTIVATED ALUMINA MEDIA, (2-PSIG (14-KPA) MAXIMUM PRESSURE LOSS.
    - 12. PERMANENT FILTER DRYERS WITH ACTIVATED 2-PSIG (14-KPA)
    - 13. MUFLERS
    - 14. RECEIVERS.
    - 15. LIQUID ACCUMULATORS.
- 1.3 REFRIGERANTS
  - A. R-410A.
- 1.4 PIPING APPLICATION SCHEDULES
  - A. PIPING APPLICATIONS FOR REFRIGERANT R-410A: MAXIMUM NPS 4 (DN 100).
    - 1. SUCTION LINES FOR CONVENTIONAL AIR-CONDITIONING APPLICATIONS: COPPER.
    - 2. HOT-GAS AND LIQUID LINES, [AND SUCTION LINES FOR HEAT-PUMP APPLICATIONS]:
      - a. NPS 2 (DN 50) AND SMALLER: COPPER WITH BRAZED OR SOLDERED JOINTS.
    - 3. SAFETY-RELIEF-VALVE DISCHARGE PIPING:
      - a. NPS 2 (DN 50) AND SMALLER: COPPER WITH BRAZED OR SOLDERED JOINTS.
- 1.5 INSULATION
  - A. 3/4" (19MM) MINIMUM THICKNESS, SELF-SEALING CLOSED CELL FOAM INSULATION APPLIED TO SUCTION PIPING.
  - B. PROVIDE LINE SET SHROUD WHERE MOUNTED EXTERIOR TO BUILDING INCLUDING ROOF TO PROTECT INSULATION.

END OF SECTION 232300

**HEATING, VENTILATING AND AIR CONDITIONING**

**SECTION 233113 - METAL DUCTS**

- 1.1 MATERIALS
  - A. SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE" BASED ON INDICATED STATIC-PRESSURE CLASS UNLESS OTHERWISE INDICATED.
  - B. SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", CHAPTER 3, "ROUND, OVAL, AND FLEXIBLE DUCT", BASED ON INDICATED STATIC-PRESSURE CLASS UNLESS OTHERWISE INDICATED. SPIRAL ROUND OR SPIRAL OVAL DUCTS SHALL BE USED WHERE EXPOSED.
  - C. SHEET METAL MATERIALS:
    - 1. GALVANIZED SHEET STEEL.
    - 2. FINISHES FOR SURFACES EXPOSED TO VIEW: MILL PHOSPHATIZED.
  - D. DUCT LINER:
    - 1. FIBROUS GLASS, TYPE I, FLEXIBLE OR TYPE II, RIGID.
      - a. WATER-BASED LINER ADHESIVE: VOC CONTENT OF 80 G/L OR LESS FOR INTERIOR APPLICATIONS.
    - 2. FLEXIBLE ELASTOMERIC.
    - 3. NATURAL FIBER.
  - E. SEALANT MATERIALS:
    - 1. TWO-PART TAPE SEALING SYSTEM: VOC CONTENT OF 250 G/L OR LESS FOR INTERIOR APPLICATIONS.
    - 2. WATER-BASED JOINT AND SEAM SEALANT: VOC CONTENT OF 250 G/L OR LESS FOR INTERIOR APPLICATIONS.
    - 3. FLANGED JOINT SEALANT: VOC CONTENT OF 250 G/L OR LESS FOR INTERIOR APPLICATIONS.
    - 4. FLANGE GASKETS.
    - 5. ROUND DUCT JOINT O-RING SEALS.
- 1.2 SEISMIC-RESTRAINT DEVICES
  - A. CHANNEL SUPPORT SYSTEM.
  - B. STAINLESS-STEEL RESTRAINT CABLES.
  - C. HANGER ROD STIFFENER: STEEL TUBE OR STEEL SLOTTED-SUPPORT-SYSTEM SLEEVE WITH INTERNALLY BOLTED CONNECTIONS TO HANGER ROD.
- 1.3 DUCT CLEANING
  - A. CLEAN NEW AND EXISTING DUCT SYSTEM(S) BEFORE TESTING, ADJUSTING, AND BALANCING.
  - B. CLEAN THE FOLLOWING ITEMS:
    - 1. AIR OUTLETS AND INLETS.
    - 2. SUPPLY, RETURN, AND EXHAUST FANS.
    - 3. AIR-HANDLING UNITS.
    - 4. COILS AND RELATED COMPONENTS.
    - 5. RETURN-AIR DUCTS, DAMPERS, ACTUATORS, AND TURNING VANES.
    - 6. SUPPLY-AIR DUCTS, DAMPERS, ACTUATORS, AND TURNING VANES.
    - 7. DEDICATED EXHAUST AND VENTILATION COMPONENTS AND MAKEUP AIR SYSTEMS.
- 1.4 DUCT SCHEDULE
  - A. ALL DUCTS SHALL BE GALVANIZED STEEL.
- 1.5 HANGERS AND SUPPORT
  - A. HANGER RODS: ELECTROGALVANIZED, ALL-THREAD RODS OR GALVANIZED RODS WITH THREADS PAINTED WITH ZINC-CHROMATE PRIMER AFTER INSTALLATION.
  - B. STRAP AND ROD SIZES: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," TABLE 5-1 (TABLE 5-1M), "RECTANGULAR DUCT HANGERS MINIMUM SIZE," AND TABLE 5-2, "MINIMUM HANGER SIZES FOR ROUND DUCT."
  - C. STEEL CABLES FOR GALVANIZED-STEEL DUCTS: GALVANIZED STEEL COMPLYING WITH ASTM A 603.
  - D. STEEL CABLE END CONNECTIONS: CADMIUM-PLATED STEEL ASSEMBLIES WITH BRACKETS, SWIVEL, AND BOLTS DESIGNED FOR DUCT HANGER SERVICE; WITH AN AUTOMATIC-LOCKING AND CLAMPING DEVICE.
  - E. DUCT ATTACHMENTS: SHEET METAL SCREWS, BLIND RIVETS, OR SELF-TAPPING METAL SCREWS; COMPATIBLE WITH DUCT MATERIALS.
  - F. TRAPEZE AND RISER SUPPORTS:
    - 1. SUPPORTS FOR GALVANIZED-STEEL DUCTS: GALVANIZED-STEEL SHAPES AND PLATES.
    - 2. SUPPORTS FOR STAINLESS-STEEL DUCTS: STAINLESS-STEEL SHAPES AND PLATES.
    - 3. SUPPORTS FOR ALUMINUM DUCTS: ALUMINUM OR GALVANIZED STEEL COATED WITH ZINC CHROMATE.

END OF SECTION 233113

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**SECTION 233300 - AIR DUCT ACCESSORIES**

- 1.1 QUALITY ASSURANCE
  - A. INSTALLATION STANDARDS: NFPA 90A, NFPA 90B, AND SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE."
  - B. MOTORIZED AND NON-MOTORIZED DAMPERS USED FOR OUTSIDE AIR INTAKES, EXHAUST AND PRESSURE RELIEF (INCLUDING THOSE WITHIN PACKAGED HVAC EQUIPMENT) SHALL HAVE A MAXIMUM AIR LEAKAGE VALUE PER THE ENERGY CODE OR ASHRAE 90.1 WHEN TESTED PER AMCA STD. 500.
- 1.2 PRODUCTS
  - A. BACKDRAFT AND PRESSURE RELIEF DAMPERS: MULTIPLE BLADE, PARALLEL ACTION, GRAVITY-BALANCED WITH RETURN SPRINGS.
  - B. BAROMETRIC RELIEF DAMPERS: HORIZONTAL OR VERTICAL MOUNTING; MULTIPLE BLADE, PARALLEL ACTION, GRAVITY-BALANCED WITH RETURN SPRINGS.
  - C. MANUAL VOLUME DAMPERS: SINGLE BLADE DESIGN, WITH LINKAGE OUTSIDE AIRSTREAM
    - 1. STANDARD, STEEL, MANUAL VOLUME DAMPERS.
    - 2. STANDARD, ALUMINUM, MANUAL VOLUME DAMPERS.
    - 3. LOW-LEAK, STEEL, MANUAL VOLUME DAMPERS.
    - 4. LOW-LEAK, ALUMINUM, MANUAL VOLUME DAMPERS.
  - D. CONTROL DAMPERS: OPPOSED-BLADE DESIGN; GALVANIZED-STEEL FRAME AND BLADES.
  - E. FIRE DAMPERS: STATIC AND DYNAMIC, REPLACEABLE HEAT-RESPONSIVE DEVICE.
  - F. CEILING RADIATION DAMPERS: REPLACEABLE HEAT-RESPONSIVE DEVICE.
  - G. SMOKE DAMPERS:
    - 1. CURTAIN TYPE WITH BLADES INSIDE AIRSTREAM
    - 2. LEAKAGE: CLASS I
  - H. COMBINATION FIRE AND SMOKE DAMPERS: STATIC AND DYNAMIC HEAT-RESPONSIVE DEVICE
  - I. FLANGE CONNECTORS.
  - J. DUCT SILENCERS: FACTORY FABRICATED AND TESTED, ROUND OR RECTANGULAR.
  - K. TURNING VANES: SINGLE-BLADE, GALVANIZED SHEET STEEL.
  - L. REMOTE DAMPER OPERATORS.
  - M. DUCT-MOUNTED ACCESS DOORS: DOUBLE WALL, RECTANGULAR, GALVANIZED SHEET STEEL WITH INSULATION.
  - N. FLEXIBLE CONNECTORS: INDOOR AND OUTDOOR
  - O. FLEXIBLE DUCTS: INSULATED
  - P. DUCT SECURITY BARS.
  - Q. DUCT ACCESSORY HARDWARE.

END OF SECTION 233300

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**SECTION 233423 - HVAC POWER VENTILATORS**

- 1.1 QUALITY ASSURANCE
  - A. AMCA-CERTIFIED RATINGS SEAL.
- 1.2 CENTRIFUGAL ROOF VENTILATORS
  - A. DIRECT-DRIVE OR BELT-DRIVEN CENTRIFUGAL TYPE, AS SPECIFIED ON PLAN.
    - 1. VARIABLE-SPEED CONTROLLER.
    - 2. DISCONNECT SWITCH.
    - 3. BIRD SCREENS.
    - 4. BACKDRAFT DAMPERS.
    - 5. MOTORIZED DAMPERS.
    - 6. GALVANIZED-STEEL ROOF CURBS WITH BUILT-IN CANT AND MOUNTING FLANGE.
- 1.3 CENTRIFUGAL WALL VENTILATORS
  - A. DIRECT-DRIVE OR BELT-DRIVEN CENTRIFUGAL TYPE, AS SPECIFIED ON PLAN.
    - 1. VARIABLE-SPEED CONTROLLER.
    - 2. DISCONNECT SWITCH.
    - 3. BIRD SCREENS.
    - 4. WALL GRILLE.
    - 5. BACKDRAFT DAMPERS.
    - 6. MOTORIZED DAMPERS.
- 1.4 CEILING-MOUNTED VENTILATORS
  - A. HOUSING: STEEL WITH ACOUSTICAL INSULATION.
  - B. GRILLE: ALUMINUM.
  - C. ACCESSORIES:
    - 1. VARIABLE-SPEED CONTROLLER.
    - 2. MANUAL STARTER SWITCH.
    - 3. TIME-DELAY SWITCH.
    - 4. MOTION SENSOR.
    - 5. CEILING RADIATION DAMPER.
    - 6. WASHABLE FILTER.
    - 7. VIBRATION ISOLATORS.
    - 8. ROOF JACK OR WALL CAP AND TRANSITION FITTINGS.
- 1.5 IN-LINE CENTRIFUGAL FANS
  - A. IN-LINE, CENTRIFUGAL TYPE, AS SPECIFIED ON PLAN.
    - 1. VARIABLE-SPEED CONTROLLER.
    - 2. VOLUME-CONTROL DAMPER.
    - 3. COMPANION FLANGES.
    - 4. FAN GUARDS.
    - 5. MOTOR AND DRIVE COVER (BELT GUARD).

END OF SECTION 233423

**HEATING, VENTILATING AND AIR CONDITIONING**

**SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES**

- 1.1 PRODUCTS
  - A. SEE MECHANICAL SCHEDULE FOR SPECIFIC DIFFUSERS, REGISTERS, AND GRILLES.
  - B. DIFFUSERS: METAL CONSTRUCTION, EXCEPT USE ALUMINUM MATERIAL WHEN IN DAMP AREAS.
    - 1. ROUND CEILING DIFFUSERS, FULLY ADJUSTABLE
    - 2. RECTANGULAR AND SQUARE CEILING DIFFUSERS, FIXED
  - 3. LOUVER FACE DIFFUSERS.
  - 4. LINEAR BAR DIFFUSERS WITH WIDE CORE SPACING ARRANGEMENT.
  - 5. LINEAR SLOT DIFFUSERS.
  - C. REGISTERS AND GRILLES: METAL CONSTRUCTION, EXCEPT USE ALUMINUM MATERIAL WHEN IN DAMP AREAS.
    - 1. ADJUSTABLE BAR REGISTERS AND GRILLES.
    - 2. FIXED FACE REGISTERS AND GRILLES.
    - 3. LINEAR BAR GRILLES WITH GRID AND PERFORATED FACE ARRANGEMENT.
  - D. EXTERIOR LOUVERS:
    - 1. WEATHERPROOF, RAINPROOF DESIGN.
    - 2. FRAME STYLE SHALL BE COMPATIBLE WITH THE EXTERIOR FINISH OF BUILDING AND WALL CONSTRUCTION.
    - 3. DRAINABLE BLADE CONSTRUCTION.
    - 4. CAULK SLOTS.
    - 5. GALVANIZED REMOVABLE BIRD SCREEN.
    - 6. COORDINATE FINISH WITH ARCHITECT.

END OF SECTION 233713

**HEATING, VENTILATING AND AIR CONDITIONING**

**SECTION 235123 - GAS VENTS**

- 1.1 QUALITY ASSURANCE
  - A. CERTIFIED SIZING CALCULATIONS: MANUFACTURER SHALL CERTIFY VENTING SYSTEM SIZING CALCULATIONS.
  - B. COMPATIBLE WITH VENT TYPE AND LISTED ACCESSORIES AS NEEDED FOR A COMPLETE INSTALLATION.

END OF SECTION 235123



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STARBUCKS TEMPLATE VERSION I2016.12.23



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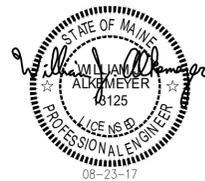
PROJECT NAME:  
**RENOVATION OF STARBUCKS COFFEE PORTLAND, 1080 FOREST AVE.**  
 PROJECT ADDRESS:  
**1080 FOREST AVENUE PORTLAND, ME 04103 CUMBERLAND COUNTY**

STORE #: 11917  
 PROJECT #: 37548-037  
 ISSUE DATE: 08/04/2017  
 PROGRAM MANAGER: J. BOND  
 DESIGNER: A. LEE  
 LEED AP: R. TURNER-LAUCK  
 PRODUCTION DESIGNER: E. VEGA  
 CHECKED BY:

Revision Schedule			
Rev	Date	By	Description

SHEET TITLE:  
**MECHANICAL SPECIFICATIONS**  
 SCALE: AS SHOWN

SHEET NUMBER:  
**M-0003**



**ISSUED FOR CONSTRUCTION - 08/23/2017**

