

Part 1 General**1.1 Summary**

- .1 Unless otherwise indicated, follow the standards below when specifying heating, ventilation and air conditioning (HVAC) work. These standards are not intended to restrict or replace professional judgment.

1.2 Refrigerant Equipment

- .1 General
 - .1 Centrifugal chillers are to be preferred over single stage absorption chillers. Stand-alone rooftop glycol units are to be avoided.
 - .2 Chillers shall use 134a refrigerant or better ozone friendly for units above 100 tons, shall have proven service and reliability, parts, services, all inclusive service contract for five (5) years and a five (5) year renewal clause. No McQuay 3600 Motor chillers.
 - .3 Chilled water coils shall have 25% extra capacity of refrigeration with respect to the design load required by the system.
 - .4 All multicoil DX shall be provided with interlaced type circuiting. Avoid multicoil DX with single compressor.
- .2 Glycol Re-circulation Systems
 - .1 It is the responsibility of the design engineer to use the appropriate type of glycol for each respective application taking into accounts the applicable laws and regulations.
 - .2 For glycol re-circulation systems, add expansion tanks for glycol replenishing and testing, an automatic glycol feed system to replenish glycol, a pressure transducer at the pump to monitor for low pressure and shutdown the pump, and monitoring sensor connected to the central Building Control Management System.
 - .3 Install by-pass filter on glycol and chill water loops.

1.3 Heating, Ventilation, Air Conditioning Equipment

- .1 Design Control for Mechanical Systems
 - .1 The professionals responsible for system design shall inform the Executive Director Facilities Management and Development in writing whenever budgetary constraints may prevent the performance objectives of this standard form from being respected.
 - .2 Longevity and Performance Criteria for any new systems may be introduced if and only if the supplier can provide an obsolescence statement guaranteeing a minimum of ten years serviceability for the system, including the refrigerant gas.
- .2 General
 - .1 Loading docks shall be provided with air curtains or other means to minimize air infiltration and be isolated from the rest of the building. Provide minimum heating at the docks by ducting the building exhaust air to this area. (Use air curtain wall)
 - .2 Humidifiers shall be ARMSTRONG or DRI STREAM or reusable canister. An approved equivalent manufacturer shall be considered if approved in writing by the representative of McGill's Facilities Operations Department (FOD).

- .3 Perimeter rooms shall be air-conditioned with sill type grilles and ceiling diffusers (Linear).
 - .4 All mechanic HVAC equipment shall be housed in a penthouse; rooftop units shall be avoided.
 - .5 Relative pressures for labs shall be negative with respect to corridor. Intermediate and high-level radiation labs shall be negative with respect to other labs, and buildings shall be slightly negative to the outside.
 - .6 If peripheral heating is required, it shall be fed from under the floor. An all-air system with a two-supply (hot and cold), one return fan dual duct variable air-column system shall be supplied along exterior walls from under the floor.
 - .7 The return air shall supply the hot duct 100%; excess air shall supply the cold duct (with outside air).
 - .8 See section 23 82 23 for HVAC units design.
- .3 Mechanical Preheat, Reheat or Cooling Coils
- .1 Whenever possible and applicable, the design engineer shall consider using "dual service" type coils (same coil for heating and cooling - depending on the season) filled with glycol and serviced by heat exchangers if required.
 - .2 Integral Face and Bypass (IFB) or Vertical Integral Face and Bypass (VIFB) preheat or reheat coils shall not be used. Glycol heating coils shall be provided instead.
 - .3 Coils shall be tested in accordance with A.R.I. standard 410.
 - .4 Cooling coils air velocities shall not exceed 490 ft/min (2.5 m/s).
 - .5 Coils construction:
 - .1 Coil casings shall be minimum 16-gauge 304L stainless steel.
 - .2 Headers shall be copper.
 - .3 Water and DX coils tubes shall be 5/8 inch (16 mm) minimum seamless drawn copper, thickness 0.035" minimum.
 - .4 Steam coils tubes shall be 1.0 inch (25.4 mm) minimum seamless drawn copper, thickness 0.049" minimum.
 - .5 Coil fins shall be flat type (flat fin rippled design) aluminum 0.010" thickness, maximum spacing of 10 fins per inch. If helical fins are provided for cooling or heat recovery coils, stainless steel mist eliminators are required in order to avoid water carryover.
 - .6 A strainer shall be installed before the control valve on any coil.
 - .7 All coils shall be equipped with a vacuum breaker at the highest point.
 - .8 Each hydronic coil shall be provided with isolation valves, balancing valve manometers, thermometers and air vent. The thermometers and manometers shall be installed on the supply and also on the return water sides.
 - .9 Steam traps shall be installed with recommended slopes for drainage.
- .4 Vibration Isolators
- .1 Vibration eliminators shall be provided for all moving equipment called for in all projects. Equipment shall be effectively isolated from the building structure to prevent undue vibration and noise transmission to the building.

1.4 Air Distribution

- .1 General
 - .1 Transformer grilles in doors or transoms are not permitted. Air transfer shall be achieved by duct transfer grilles installed in ceilings, with fire dampers and provision for sound attenuation as required.
 - .2 Air intakes shall be located away from vehicle circulation areas and exhausts at roof level, not at street level for car fumes. If this cannot be done, then airflow studies shall be considered with respect to the positioning of air intakes and wind.
 - .3 Air intake velocity shall be 200 feet per minute or less. All basins in air handling units shall be drained with slopes to drains.
 - .4 Duct insulation shall be installed on the outside of ductwork. Insulation on the inside of ductwork shall be avoided. Acoustical insulation shall be accomplished with silencers.
 - .5 Transformer rooms shall have their own exhaust and supply with no heating to be provided.
 - .6 Mechanical room and washroom exhaust fans shall be stop-start programmable.
 - .7 Air supply to transformer rooms shall be filtered (using 2" deep - Merv 8 filters, combining standard sizes of 24"x24" and 12"x14" only).
- .2 Ductwork
 - .1 Ductwork shall be as per the latest SMACNA and ASHRAE standards.
 - .2 If the ductwork needs to be insulated, then the insulation shall be placed on the outer wall of the ventilation ducts (i.e. no insulation allowed in the air tunnel). If required, acoustic silencers shall be provided.
 - .3 All new ductwork for chemical fume hood exhaust systems shall be 316 stainless steel, low carbon, round, with annealed welds; or fiberglass reinforced plastics depending on the application.
- .3 Diffusers
 - .1 All new and replacement ceiling diffusers shall be selected in order to achieve an efficient air distribution. Color to be coordinated with the project architect. Provide balancing dampers for each diffuser.
- .4 Terminal boxes (mixing boxes and VAV boxes)
 - .1 For each new project, verify that the terminal boxes serving the designated area are still functional and have not exceeded their life expectancy, in which case they would need to be replaced.
 - .2 All new mixing or variable air volume (VAV) terminal boxes shall be Direct Digital Control (DDC) type and be connected to McGill University's Building Automation System (BAS). This shall be done even when the existing terminal boxes are pneumatic type.
 - .3 Each box shall serve a designated zone and be controlled by its dedicated DDC thermostat connected to the BAS system.
- .5 Air Filters
 - .1 For general applications pre-filters shall be MERV 8 2 "(50mm) and final filters shall be MERV 13 - 12" (300mm) rigid box type.

- .2 Always use standard filter sizes 24"x24" and 12"x24". Other filters sizes shall be used when it is impossible to use standard size or when the standard size is not available for a given application. When this is the case, notify in writing the maintenance mechanical engineer of McGill University Facilities Operations Department.
- .6 Fans
 - .1 Whenever available, fans shall be direct driven type rather than belt driven.
- .7 Access Doors
 - .1 Access doors shall be provided at locations in the duct systems where access to manual or automatic fire dampers, coils, thermostats or any other apparatus requires inspection.
 - .2 Doors shall be constructed with an external built-up metal frame for stiffening. Doors on insulated ductwork shall be of double panel construction provided with glass fibreboard filler.
 - .3 Access doors shall be provided ahead of all fan inlets and on both sides of all coils to allow for cleaning and inspection.
- .8 Flexible Connections and Isolating Connections
 - .1 Flexible connections shall be provided on joints between ducts and air-handling equipment. They shall be 150 mm (6 inch) wide Ventglass type flexible connections. Two 13 mm (1/2 inch) wide heavy flexible braised copper conductors with clamps shall be installed to ground all systems.
 - .2 Flanges shall be provided on the ducts to make proper connections. Connections shall have a minimum of 100 mm (4 inch) between the flanges and shall be airtight. Similar connections shall be supplied for the joints between dissimilar metals in the ductwork. Flexible conductors shall be used to bridge all flexible connections in ductwork.
- 1.5 Testing, Adjusting, and Balancing**
 - .1 General
 - .1 Before renovations, all HVAC systems affected by the change shall be checked and airflow readings shall be recorded.
 - .2 After renovations, all HVAC systems affected by the change shall be checked and balanced.
 - .3 Commissioning of new HVAC systems shall wait until all construction work is complete and all dust and dust sources have been cleaned-up and eliminated.
 - .4 Air handling units shall not be turned on during construction.
 - .5 Filters on the return air shall be changed after construction is finished and before final balancing.
 - .6 Final inspections shall be made to assure after start-up that filter frames are not damaged, ducts are clean, balancing is correct.
 - .7 The project contractor has the responsibility to document the test.
 - .8 The project engineer has the responsibility to conclude on the passage of the test.
 - .2 Balancing and Testing
 - .1 All air handling units and their respective distribution networks shall be balanced for air quantities as shown on the engineering drawings.

- .2 Trades shall provide all belts and pulleys required for balancing all fan systems.
- .3 Trades shall submit all testing and balancing results on 8.5 x 11 inch sheets with cross-referenced drawing showing diffuser location and air quantities removed.
- .4 Fan test shall be submitted. The entire document shall be bound in a title binder with hard fibreboard cover.

1.6 Cooling Towers

- .1 Cooling towers and all interior surfaces and components shall be made of 304L stainless steel. The unit's floor shall be complete with heavy duty 304L stainless steel grating.
- .2 The fans shall be direct driven type. If direct driven is not available, provide gearbox driven motor. Belt driven fans shall be avoided.
- .3 The motors must be controlled by variable frequency drives – see VFD section 23 09 33.
- .4 Cooling tower shall be complete with 304L stainless steel ladder and railing.
- .5 Depending on the cooling tower location and its surroundings there might be a risk that contaminants (dust, pollen, etc.) get into the cooling tower causing clogging and premature stoppage of the unit. Removable stainless steel mesh screens shall be provided at the air intake in order to ensure proper operation.

END OF SECTION 23 00 00