

## 1 GENERAL

### 1.1 Design Criteria:

#### 1.1.1 Outside Conditions:

1.1.1.1 Winter: In accordance with Environment Canada Weather Data for Ottawa, 1% January design temperature and wind velocity of 4.6 metres/second.

1.1.1.2 Summer: In accordance with Environment Canada Weather Data for Ottawa, 2-1/2% July design day and wet bulb temperature and wind velocity of 2.3 metres/second.

1.1.1.3 Cooling Towers to be selected at 2°C wet bulb above selected Wet Bulb Temperature.

### 1.2 General Objectives and Proposal Evaluation Criteria:

1.2.1 Air Quality. The HVAC installation must be able to deliver and maintain a healthful environment. Please refer to item 3 below for further detailed information on specific definition of requirements for air quality. Please note that all of the stipulated system design criteria must be satisfied including a) outside air ventilation to satisfaction of ASHRAE Standard 62, b) outside air ventilation rate not less than 7.5 L/s per person, c) lower than 1000 p.p.m. carbon dioxide levels as a barometer of effective air circulation through the occupied space and effective outside air ventilation rate, and d) minimum air circulation rates greater than 4.0 L/s per net m<sup>2</sup> of area in each specific occupied space.

- 1.2.2 Comfort. The building envelope and HVAC installation must be able to deliver and maintain a comfort environment at all times in all of the occupied space. Please refer to Section D3060 for further detailed information on design criteria for space temperature controls. Please refer to Building Envelope design criteria for thermal performance requirements and minimum surface temperatures. The general objective is that building envelope including associated glazing installations will represent a design condition heat loss rate of less 90 watts per lineal meter of perimeter wall for each space. With compliance to this building envelope performance criteria, design of the HVAC system may eliminate the customary perimeter supplementary heating system and rely on the air circulation system for space heating. The glazing and metal frame surface temperatures must be not lower than 6<sup>0</sup>C at design conditions. This system performance must be demonstrated by way of recognized test data. The glazing must incorporate a shading coefficient in the range of 0.40 and a light transmittance factor in the range of 0.60. Please refer to Electrical section for projected lighting system efficiencies and controls including daylight harvesting which will reduce the space cooling demand. Spaces with similar thermal loads and use may be serviced by a common zone space temperature control within following limits: 50 m<sup>2</sup> maximum area where supplementary heat is required, 50 m<sup>2</sup> for small offices and perimeter zones and 100 m<sup>2</sup> for interior zones except small offices.
- 1.2.3 Maintenance Cost. The HVAC installation will be designed for lowest life cycle maintenance cost and longest useful life. Ventilation systems and heating / cooling installations will be housed in equipment rooms with adequate space for servicing and hardware replacement. Commercial factory packaged rooftop equipment with exterior access for maintenance will not be acceptable. Factory packaged rooftop penthouse installations with interior service area are acceptable. Modular systems such as utilizing fan powered terminal units for delivery of stipulated space air circulation rates or multiple heat pumps and systems requiring maintenance of fan equipment, cooling equipment, filters, etc. above ceilings of occupied space will not be acceptable.

- 1.2.4 Energy Efficiency. The HVAC installation will be designed for benchmark performance levels in regard to energy efficiency. Please refer to Electrical section for lighting energy budget allocations and lighting control requirements. Please refer to Building Envelope section for performance requirements of glazing installations. Systems incorporating reheat of refrigerated ventilation air will not be acceptable. Systems incorporating bypass of refrigerated cooling coils will be designed so as to avoid supply of any heat to the bypass stream when mechanical cooling is energized. The design shall achieve energy efficiency performance at 25% lower level than stipulated by the Model National Energy Code for Buildings (MNECB) and to incorporate objectives generally as described for the Commercial Building Incentive Program of National Resources Canada.
- 1.2.5 Life Cycle Costing. The proponent's proposal will be evaluated against the specific requirements of this specification. It shall be the proponent's sole responsibility to include in his proposal any and all information useful to an accurate technical evaluation. All requirements of these specifications will be binding upon the proponent unless specifically noted for exclusion and formally adopted. Proposals may be rejected if they do not meet the specifications. For purpose of the economic evaluation, adjustments may be made to the capital cost submitted in the proposal for considered performance deficiencies so as to establish a comparable performance basis for the cost evaluation of all proposals. Comparative maintenance cost, comparative energy cost, and life cycle costing methodologies will also be utilized for the economic evaluation of proposals. The lowest first cost proposal will not necessarily be selected. Considered performance, maintenance cost projections, and energy cost projections will also be recognized in the comparative evaluation of proponent's proposals.
- 1.2.6 System Layout. HVAC distribution systems shall be designed for horizontal vs. vertical service. Separate systems shall be used for different use areas such as classrooms, office space, training space, uniquely ventilated space, etc.
- 1.2.7 Where possible, install ceiling mounted terminal units over corridors for ease of servicing. Provide schedule of air terminal units with acoustic performance at shop drawing review stage.
- 1.2.8 The heating, ventilation and air conditioning system design must incorporate a high degree of flexibility to allow for future changes in use of space, relocation of walls and partitions and changes in occupancy.

### 1.3 Energy Consumption

- 1.3.1 A total energy budget and balance temperature performance level will be submitted with the proposal as part of the project specific requirements. The projected energy consumption budget will identify electrical and natural gas energy sources and include an annual profile.
- 1.3.2 Please refer to Section D3060 for requirements to monitor energy consumption for the building overall.
- 1.3.3 At the 90% stage of design development, the Design Builder will submit satisfactory documentation to demonstrate compliance with the energy performance undertakings. The Owner will be provided access to computer simulation input data for review and acceptance. *[The software used shall be TRANE...]*

#### 1.4 Air Quality

- 1.4.1 The mechanical systems must be capable of limiting the maximum carbon dioxide levels in all classrooms, office areas, cafeterias, etc. to 1000 p.p.m. Minimum fresh air quantities shall not be less than required by *[ASHRAE Standard 62]*, nor less than 0.812 L/s x m<sup>2</sup> of gross floor area or 7.5 L/s per person, whichever is greater.
- 1.4.2 The mechanical systems must be capable of maintaining a minimum air flow rate of not less than 4.0 L/s/m<sup>2</sup> or 6 air changes per hour based on a 2700 considered ceiling height, whichever is greater and regardless of internal loads. All lunch/coffee rooms are to be fully exhausted in occupied mode by designated exhaust systems.
- 1.4.3 The mechanical systems shall be fitted for economizer operation and allow for the flushing out of the building with 100% outside air at ambient temperatures above 0°C.
- 1.4.4 Minimum ventilation rate for washrooms, janitorial rooms, waste storage rooms, coffee stations and lunch/coffee rooms shall be not less than 10 L/s/m<sup>2</sup>.
- 1.4.5 Main communications equipment room, telephone and electrical closets, electrical and transformer switchgear rooms shall be mechanically ventilated and/or heated to maintain minimum/maximum temperatures as recommended by equipment manufacturers, as scheduled, or as required by code. Where these rooms are located on outside walls, economizers shall be provided.
- 1.4.6 Locate fresh air intakes to prevent contamination by external sources such as road traffic, smoke stacks or exhaust outlets and other sources of contaminated air.

- 1.5 Heating: Heating requirements for entrances, large public areas with greater heat loss rate than stipulated above in design criteria, and generally unoccupied spaces not subject to need for ventilation will be met utilizing fan coil units. Heating coils may be supplied with heating water sourced from reclaimed building heat if available. During unoccupied hours maintain building ambient temperature at a minimum of 18°C without operating the main air handling units except possibly for most severe portion of the heating season – Maximum size of control zone: 50 m<sup>2</sup>.
- 1.6 Cooling: For spaces and installations requiring cooling for 24 hour, 12 month operation, provide a roof mounted dry cooler and associated closed loop heat rejection system.
- 1.7 Vehicular Area Ventilation: Ventilate vehicular areas with multi-speed exhaust fans to code requirements. Fans shall be controlled by gas detecting and alarming systems. Make-up air by means of outside air shafts.
- 1.8 Smoke Control: Where required by code, smoke control and life safety systems shall be based upon Measure A for fully sprinklered buildings.
- 1.9 Insulation: H.V.A.C. piping, ductwork and equipment is to be insulated. Insulate all domestic cold water, domestic hot water, and domestic hot water recirculation systems. Provide vapour barriers where condensation may occur. Provide canvas jackets on all insulation exposed to view. Insulate all storm piping for 2 m from roof drains
- 1.10 Identification
  - 1.10.1 Provide manufacturers nameplate on each piece of equipment indicating: size, model, manufacturers name, serial number, voltage, cycle, phase and power of motors. Provide ULC and CSA registration plates as required by the respective agency. Locate name plates so that they are easily read. Do not insulate or paint over plates.
  - 1.10.2 Provide laminated plastic plates with black face and white centre. Minimum size 90 x 40 x 2.5 mm thick engraved with 6 mm high lettering. Fasten nameplates securely in a location where easily read. Use stand-offs where mounting surfaces are warm or hot. Identify equipment type and number and service or area or zone served.
  - 1.10.3 Provide piping markers for pressure, temperature, service and flow direction in accordance with [CAN/CGSB-24.3-92]. Apply primary colours and secondary colour bands on finished piping surfaces in exposed areas only. Acceptable Material: [W.H Brady, Seton Name Plate Corporation, Setmark pipe markers].
  - 1.10.4 Locate markers and classifying colours on piping systems so they can be seen and read from floor or platform. Identify pipe runs as follows:
    - 1.10.4.1 At least once in each room.

- 1.10.4.2 Maximum 10.000 m between identifications in open areas.
  - 1.10.4.3 Both sides where pipe passes through wall, partition or floor.
  - 1.10.4.4 At point of entry and leaving of chases and confined spaces and at each access opening.
  - 1.10.4.5 At each piece of equipment and at major manual and automatic valves on the upstream side.
  - 1.10.5 Provide 50 mm high stenciled black letters and flow direction arrows to identify ductwork service. Maximum 10.000 m between markings. Identify ducts on each side of dividing wall or partition and beside each access door. Stencil over final finish only.
  - 1.10.6 Provide brass tags with 12 mm stamped code lettering filled with black paint. Secure with non-ferrous chains for valves and operating controllers. Provide 6 identification flow diagrams for each system. Include valve tag schedule, designating number, service, function and location of each tagged item and normal operating position of each valve.
  - 1.10.7 Provide thermometers at the inlet and outlet of all equipment where there is a change in temperature.
- 1.11 Acoustic Performance Criteria
- 1.11.1 Refer to Section C1010 for space acoustic performance criteria. The design HVAC system ductwork and penetrations for piping shall respect the performance requirements for partitions and listed FSTC ratings. Transfer ducts from rooms requiring an FSTC of 40 or more shall extend into the adjacent corridor space rather than terminate next to adjacent occupied space. For spaces requiring an NC level below 35 and in conjunction with FSTC ratings of 40 and over, the design of HVAC system ductwork shall incorporate as follows:
    - 1.11.1.1 Transfer ducts shall be designed as cross-talk silencers
    - 1.11.1.2 Ductwork shall not directly connect one room to another without appropriate acoustic isolation.
    - 1.11.1.3 High transmission loss casings shall be provided for terminal units or units relocated to less sensitivity areas.
    - 1.11.1.4 Balancing damper adjustment must not increase the noise level above the NC requirement. Avoid dampers at diffusers.
    - 1.11.1.5 The design of ductwork and terminal distribution shall conform to ASHRAE recommendations for turbulence reduction and least system generated noise.

- 1.11.1.6 All take-offs at terminal units shall be after the acoustically lined extended discharge plenum.
  - 1.11.1.7 Roof mounted equipment and interior mechanical rooms shall be located away from acoustically sensitive space.
  - 1.11.1.8 The commissioning procedures will include site verification of achieved NC levels including the 63 Hz band and above.
- 1.12 Environmental Noise Impact: The *[Design Builder]* shall take notice of the residential character of this site. Particular attention shall be placed on location of louvres and rooftop equipment such as exhaust fans and HVAC equipment. The commissioning procedures will include the measurement of ambient outdoor noise levels during day and night with building systems disabled and the HVAC systems operational.
- 1.13 Environmental Air Quality Impact: The *[Design Builder]* shall take notice of the residential character of this site and particular attention to filtration of exhaust air from the firing range to satisfaction of MOE and Occupational Health Standards.

***End of Section***