- Drum and tube heat exchanger with corrosion resistant steel components.
- Location and installation of HVAC units should occur as far away as possible from Wash Bay Areas in Bus and Rail Maintenance facilities. Other high moisture areas should also be avoided when placing HVAC equipment. Hangers and fasteners should also be protected from the detergents and moisture or be fabricated of materials that are not subject to corrosion.
- Discharge line thermostat, and phase monitor.
- Units supplying high occupancy rooms, such as meeting rooms, shall be controlled by a carbon dioxide sensor, in order to modulate the outside air damper.

ROOFTOP PACKAGED AIR HANDLING UNITS

Heavy-duty industrial Air Handling Unit with the following features:

- From a recognized manufacturer with proven product testing.
- Double wall unit with 16 gauge steel sheet outer skin, 20 gauge steel sheet interior liner, and 50mm (2”) thick insulated wall and roof panels.
- 16 gauge chequered plate floor with reinforcement and insulation.
- Fully hinged access doors, filter frames, and drains in every section.
- Exterior paint shall meet ASTM B117.
- ARI certified heating coils.
- Heating shall be via hydronic coil when boiler plant is available.
- Fans shall be centrifugal plenum type.
- Non-overloading backward inclined Aluminium blades.
- Heavy-duty weather tight and drainable stationary louvers.
- Internal vibration isolation of the fan and motor.
- Fully insulated and independent motorized dampers.
- Lights in access compartments with switch on the unit exterior.
- GFI receptacle.
- Separate 120v for light and GFI receptacle.

AIR CURTAINS

Heavy-duty industrial Air Curtain with the following features:

- From a recognized manufacturer with proven product testing.
- Suited for blanketing the door width and minimum 50mm (2”) overlap on each side.
- Performance and air flow delivery shall be rated in accordance with AMCA Standard 211.
- Belt drive motors shall be open drip-proof type, easily accessible for maintenance, and outside the airstream.
- Blowers shall be centrifugal forward curved type and tested in accordance to AMCA Standard 210.
- Minimum 14 gauge galvanized steel frame. Hangers and fasteners should also be protected from the detergents and moisture or be fabricated of materials that are not subject to corrosion.
- Minimum 16 gauge galvanized steel casing. Hangers and fasteners should also be protected from the detergents and moisture or be fabricated of materials that are not subject to corrosion.
- Maximum deflection of 6.35mm (0.25”).
- Inlet screens.
- Outer air velocity pattern shall have over 90% uniformity over the entire length of the Air Curtain.
- Complete factory-wired control panel.

SPLIT HEAT PUMP A/C UNIT

The split Heat Pump system shall have the following features:

- High efficiency
- Hyper heating at -25°C
- Low ambient cooling at -5°C
- R410A refrigerant
- Variable speed compressor
- Variable refrigerant flow

- Auto restart after power failure
- Hot start.

FANS

- In public area and occupied spaces, low noise centrifugal fans shall be used.
- Public area fan systems shall be provided with suitable attenuating silencers capable of maintaining space noise level no greater than NC40.
- Airfoil or backward inclined design is preferred. Forward curved wheels may be used for low pressure applications.
- Variable pitch axial fans should be considered for fan wheel diameters greater than 610mm and where system air volumes vary, due to control characteristics of summer/winter operation.
- Propeller fans may be used where they serve non-public or unoccupied areas.
- Additional ventilation with emergency power back-up may be required in large facilities, such as Willowbrook or Steeprock.

ENERGY RECOVERY

Energy Recovery Ventilators (ERV) shall be specified for energy conservation in all GO facilities, where practical and cost effective. In station buildings they shall be above the public washrooms or the janitor room, in the attic space, where applicable. Access by ceiling hatch.

FILTERS

Filters used in supply air systems shall be 50mm (2”) thick throw-away type, with minimum efficiency of 30%.

HEATERS

Electric fan forced heaters shall be considered in the waiting area and entrances. Heaters can be wall or ceiling mounted. Heaters should be controlled by wall mounted space sensors.

Supplemental electric fan forced heater should be considered in the ticket sales area.

Electric resistance duct heaters shall have Silicon Control Rectifiers (SCR), minimum airflow switch, and two high-temperature limit sensors.

Gas fired unit heaters and infrared heaters shall be considered in large facilities.

In all shelters, CSA compliant electric infrared radiant heaters c/w factory installed protective wire cage and stainless steel or nickel chromium tubular heating element shall be suspended by chains or threaded rods at 2440 mm (8 ft.) above finish floor level and controlled by a push button and timer.

DIFFUSERS

Diffusers shall be aluminum. For perforated metal ceilings; diffusers to be perforated type to match the ceiling profile and colour. For high-traffic door locations, or where drafts are a problem with station attendants, linear diffuser air-curtains shall be provided at the doors.

DUCTS

Air ducts shall be galvanized sheet metal confirming to ASHRAE, SMACNA Duct Construction Standards, and NFPA 90A. Diffuser branch-ducts and air terminal ducts may be circular metal flex-ducts where concealed. Exposed ducts in public areas shall be aluminium spiral ducts. Hangers and fasteners should also be protected from the detergents and moisture or be fabricated of materials that are not subject to corrosion.

FIRE DAMPERS

Fire dampers shall be fusible link type conforming to ULC-S505. An access door shall be installed for inspection and resetting.

CONNECTORS

Flexible connectors shall be provided between vibrating equipment and connecting ducts.

INSULATION

Acoustical and thermal duct insulation shall be in accordance with the O.B.C. and ASHRAE 90.1. Acoustical insulation shall be provided to maintain a maximum room sound rating of 40dBA. Piping insulation shall be in accordance with ASHRAE 90.1, with PVC jackets.

SYSTEM CONTROL

HVAC systems shall be controlled using programmable thermostats to achieve night setbacks. Interlocks for fire protection to be as per OBC and NFPA.

RADIANT HEATING AND SNOW MELTING

BASIS OF CRITERIA

- Full width snow melting systems shall be installed on all new and rehabilitated GO rail island platforms.
- Full width snow melting systems shall be installed on new and rehabilitated GO rail side platforms as directed by GO.
- Radiant heating shall be installed in all Bus Facilities.
- Partial snow melting systems shall be installed in all Bus Facilities.
- Radiant heating and partial snow melting should be considered in new Station buildings, bus terminals, on a project by project basis.

DESIGN REQUIREMENTS

Including but not limited to the following:

- Gas fired boilers.
- Pumps.
- Expansion tank.
- Chemical treatment.
- Glycol make-up system.
- Pipework inside boiler room including manifolds, piping, fittings, valves, thermometers, gauges, devices, pipe hangers & support, and accessories.
- Pre-insulated supply and return pipes and fittings.
- Distribution manifolds c/w valves inside platform chambers.
- Embedded tubing and fittings.
- Complete control system.
- Electrical works.

BOILERS

- Natural gas boilers shall be approved to ANSI Z21.13 CSA 4.9-2000 with efficiency between 85% and 89%.
- 52°C (125°F) water supply temperature with no limit on inlet water temperatures.
- Constructed of eutectic cast iron sections in accordance with ASME requirements, with modulus of elasticity of 30% greater than other cast iron.
- Boiler plant shall include minimum 2 boilers. If one boiler is down, the remaining boiler(s) shall be capable of handling 60-70% of the full design load.
- Boiler warranty shall not be affected if flue gas condensation is allowed within the boiler.
- Boiler and burner shall be listed as package. Site approval is not acceptable. Package must have proven field verified track record for a minimum period of 3 years.
- All control circuits shall be 120v/60Hz/1Ph c/w fuse protection.
- Burner shall be fully modulating, factory tested, and CSA listed. No CO shall be present in the products of combustion.
- Boiler shall be fully started up and commissioned by factory trained personnel.
- Manufacturer shall have facility in Ontario.
- Qualified personnel and spare parts shall be available in GTA.

PRE-INSULATED PIPING AND TUBING

- Tubing shall be cross-linked Polyethylene (PEX) manufactured by the Engle method, in accordance with ASTM F876 and ASTM F877, and tested for compliance by an independent third-party agency.
- Minimum bend radius no less than six times the outside diameter.
- Oxygen diffusion barrier not to exceed 0.10 grams per cubic meter per day at 40°C (104°F).
- Pre-insulated piping shall be durable cross-linked polyethylene (PEX-a) manufactured by the Engle method, protected by multilayer PEX-foam insulation and covered by a corrugated seamless waterproof HDPE jacket.
- Manifolds shall be 50mm (2”) valved type L copper complete with cold expansion adaptors.

- For system compatibility, use manifolds, fittings, connectors, wall sleeves, and all accessories from the same manufacturer.
- Use 50mm (2”) Styrofoam insulation under the tubing, to maximize heat transfer upward.
- For tubing under asphalt, the tubing shall be embedded in limestone screening.
- Tubing shall be installed in one continuous piece and no splice shall be allowed in the slab.
- Contractor and Supplier shall have minimum 10 years demonstrated experience on projects of similar size and complexity.
- Contractor and Supplier shall submit as-built drawings verified by the Engineer.

PUMPS

- The heating plant piping arrangement shall contain a primary/secondary loops layout, with 4-way mixing valve between the two loops.
- Each loop shall be served by two vertical in-line centrifugal pumps.
- steel shaft, stainless steel mechanical seals, 50 micron cartridge filter, and a sight indicator. These pumps shall be equipped with suction guides, stainless steel strainers, triple duty valves, and insulation.
- -tight, long life Armseal mechanical seal. They shall be suitable for 107°C (225°F) and 125 psi.
- Downstream each in-line circulator pump goes a circuit balancing valve, “Y” pattern, to provide precise flow measurement, precision flow balancing, and positive drip-tight shut-off.

CONTROLS

- Complete microprocessor-based programmable control system able to interface with LONWORKS and BACNET, in order to control, monitor, and adjust the radiant heating system and/or snow melting system remotely and/or locally.
- The control system shall include all required PCUs (Primary Control Units), PACs (Programmable Application Controllers), and ASCs (Application Specific Controllers) to interface with all equipment.
- The control system shall also include dynamic graphics, snow sensors, outdoor air temperature sensors, immersion temperature sensors, current sensors, status relays, automatic control valves, automatic control valve actuators, local service ports, and LAN cabling.

MANIFOLD CHAMBERS

The recessed manifold chambers on the platform shall be fully accessible with adequate maintenance clearances around the manifolds and valves. Footprint and depth to avoid classification as “confined space”. Adequate means of drainage shall be provided. Cover shall be heavy-duty Aluminium, traffic bearing, lockable, self opening with piston kit, and with recessed handles.

GLYCOL/WATER SOLUTION

The Glycol/Water solution shall be premixed, or site mixed with proper concentration before entering the system. Glycol shall be non-toxic, environmentally friendly, and suitable for boilers.

WARRANTY

All warranty periods are measured from the date the substantial completion of the system has been confirmed by the Engineer and GO:

- The complete system shall be covered by 2-year warranty against failure due to defects in material or workmanship. During this period, the system shall be started-up and inspected in November, shut-down in April, and monitored 24/7 via central station by Contractor and/or Supplier.
- The complete system shall be covered by 10-year limited system performance warranty. This warranty requires that the system detailed design, supervision, commissioning, and test witnessing shall be performed by the manufacturer’s authorized personnel along with the contractor’s superintendent and the Engineer.
- All tubing and pre-insulated piping shall carry a 25-year non-prorated warranty against failure due to defects in material or workmanship.

TESTING ADJUSTING AND BALANCING (TAB)

The TAB agency shall be a subcontractor of the general contractor who should identify it within 10 days after the award of the contract. The TAB agency shall be a certified member of AABC.

TRAINING

Mechanical Contractor / Manufacturer shall provide adequate training for GO staff including advanced maintenance level training as determined by GO. Training sessions may take place on site, or any other suitable location.

IDENTIFICATION, APPEARANCE, AND NOISE VIBRATION

DESIGN REQUIREMENTS

IDENTIFICATION

Equipment, piping and systems shall be clearly identified according to industry standards. Equipment shall include manufacturer's nameplate, CSA and/or CUL registration plates where applicable. Piping and ducting systems shall be identified using a standard identification system, ASHRAE, CGSB or similar. All labels, tags, nameplates, etc., shall be stainless steel, brass or thick laminated plastic, as appropriate to suit application.

APPEARANCE

All equipment, vent, access door, door grille, diffuser, return air grille, and exposed duct locations shall be coordinated by the architect/prime consultant. Roof-mounted equipment shall be screened. Where permitted, multiple exhaust ducts shall be combined to minimize building penetration. On sloping station roofs, exhaust ducts shall be directed to vertical gable vents, if applicable.

Exterior grade-level equipment (condensing units, etc.) shall be elevated 300 mm minimum above grade, and screened by fencing. Grilles, vents and diffusers shall be recessed or flush with adjoining base-building materials, as detailed by the architect/prime consultant, and shall not be surface-mounted over base-building materials.

NOISE/VIBRATION

Isolators and vibration control devices shall be specified as required to ensure that equipment-noise and vibration do not interfere with GO Transit operations, as well as to protect adjacent properties from noise and vibration, where necessary.

PLUMBING AND DRAINAGE

BASIS OF CRITERIA

This Section deals with cold and hot water distribution, building storm and sanitary drainage within the immediate vicinity of any building.

TYPICAL APPLICATIONS

- Staff washrooms.
- Public washrooms.
- Tenant and vending premises.
- Bus and rail maintenance facilities.
- Hose bibs at buildings, tunnels and on platforms.
- Sump pits for tunnels, elevators and buildings (if applicable).
- Specialized installations: vehicle wash equipment, progressive maintenance bays (PMB's) for locomotive and coach water supply and sewage disposal, and wells and septic systems or holding tanks at rural sites, if required.

DESIGN REQUIREMENTS

WATER PIPING

- Water piping shall be copper, type "L" above ground, type "K" for buried services. Copper type "M" and galvanized pipe shall not be used. Hangers and fasteners should also be protected from the detergents and moisture or be fabricated of materials that are not subject to corrosion.
- Waterlines in unheated areas shall be protected from freezing with electric tracing, thermostatically controlled. These sections of piping shall be valved to enable isolation and drainage.
- Insulation shall be in accordance with ASHRAE 90.1 standard.
- Piping shall be concealed in public areas. Exposed chrome piping shall have chrome-plated anchors and hangers.
- Pipes shall not be routed through electrical rooms, control rooms or communication rooms.

- Cathodic protection for buried pipes shall be provided if required.
- Vending and concession areas shall have a cold water supply valved and capped connection as well as a sanitary and vent capped connections, c/w check-meter and remote reader.

DRINKING FOUNTAINS

Drinking fountains are not to be included in station buildings.

HOT WATER

The energy source shall be the most economical available.

Service hot water shall be provided tempered at 40°C at station and terminal washbasins in washrooms. Shops, maintenance and garage facilities may have higher temperatures if required. A re-circulation system normally is not required in a typical GO Station building.

Hot water heaters in stations/terminals shall be located in janitor rooms, ceiling-hung to suit space requirements. Relief valves shall be piped to floor drains with air break. A gas fired tankless type hot water system may be used where approved by GO, to minimize piping.

HYDRANTS AND HOSE BIBS

Wall hydrants and hose bibs shall be minimum 20 mm anti-siphon, non-freeze type in flush mounted box with locking cover and located at buildings, tunnels and on platforms to suit maintenance requirements as directed by GO. Tunnel/platform hose-bib pipe systems shall have gravity drain capability for water shut-off. Hose-bibs shall also be located in shops, maintenance facilities, loading docks, bus platforms, etc. as directed by GO, sized to suit.

LANDSCAPE WATER

Buried water supply piping systems shall be provided for the manual watering of landscaping only if specifically requested by GO. If requested, they shall consist of PVC piping and quick coupling hose attachments spaced so that every point in the landscaped area can be reached by a 30 m hose extended from the hose attachment. The system shall be capable of being completely drained or air-blown dry in the autumn.

PIPE SLEEVES

Galvanized steel pipe sleeves shall be provided in concrete structures to accommodate future piping installations, if required. Hangers and fasteners should also be protected from the detergents and moisture or be fabricated of materials that are not subject to corrosion.

WATER METERS

Water supply lines shall be sized for the specific requirements of the facility. The incoming service shall be metered inside with an exterior readout acceptable to the local utility. Major tenants shall have check-meters.

VALVES

Each fixture shall have a key operated service valve or shut-off valve. Additional shut-off valves shall be provided for each group of fixtures, e.g., a washroom. At least one shut-off valve shall be provided for each room with one or more fixtures.

STORM DRAINAGE

- Drainage shall be designed to meet the requirements of local authorities, and the relevant storm water management study.
- See Stormwater Management (section CI-0205).
- Drainage: oil and grit interceptors and inlet control devices may be required.
- The location of scupper drains and splash pads should be coordinated with the prime consultant.
- Rail platform shelter roof drains where required, may be directed to Railway R.O.W. ditches, where approved by the Railway, or to a sump pit in the tunnel and then pumped to the storm system.

SANITARY DRAINAGE

- Drainage shall be designed to meet the requirements of local authorities.
- All washrooms, janitor rooms, mechanical rooms, vending and concession areas and certain maintenance areas as directed by GO, shall be provided with floor drains and strainers.
- Strainer and sediment buckets shall be provided for heavy duty floor drains, trench drains, and tunnel floors. Tunnels shall have open shallow trench drains at the wall perimeters. See Technical Standards.
- Food preparation areas require grease interceptors. This applies particularly to tenant premises.
- Service stations, repair shops and garages require oil interceptors. Parking lots and elevator pits do not require oil interceptors as per O.B.C.

SUMP PUMPS

Where storm or sanitary drains cannot be discharged to the sewer by gravity flow, flow shall be discharged into a tightly covered and vented sump pit, from which the liquid is lifted and discharged to the sewer by an automatic duplex pump system with automatic changeover and guide bars. Each pump should be sized for 100% flow. Pumps shall be epoxy coated with two (2) totally independent seal assemblies.

A 4 float control system shall be provided (OFF – LEAD ON – LAGG ON – ALARM). Provision shall be made for dry 'C' contacts for connection to a remote alarm. Pumps shall be easily removable for maintenance without the need to enter the wet well.

- Pit cover shall be gas tight, self-opening with piston kit and safety grid.
- System shall be complete with lifting equipment including lifting davit, chain hoist, lifting device, and chain hook.
- Sump pits are used for shelter, roof and tunnel drainage, and in elevator or escalator pits.
- Special sump pumps may be required for maintenance facilities or rural stations (TBD).
- For further details refer to GO Standards Master Specifications.

FIXTURES: GENERAL

All fixtures except janitor sink shall be vandal resistant vitreous china.

CUSTODIAN SINKS

Janitor sinks to be terrazzo, floor mounted.

WASHBASINS

- Multi use public washrooms to have individual semi-countertop basins with one barrier free basin. Faucets to be two-handle centreset type for the barrier free basin.
- Single use public washrooms to have a barrier free semi-countertop mounted basin with a two-handle centreset faucet.
- Staff washroom basin to be countertop type with a two handle centreset faucet. There shall be a storage cabinet below.
- Shop or maintenance facility washrooms to have a trough-type multi-station sink or circular wash basin. Faucets can have foot control, infrared control, or push button control.

WATER CLOSETS

- Water closets in public washrooms shall be wall hung, with carrier elongated siphon jet flush action bowl, top spud for exposed manual flush valve with non-hold open feature. Seats shall be white, elongated, heavy duty, solid material, open front without cover.
- Water closets in staff washrooms shall be floor mounted tank type. Seat shall be white, heavy duty, open front, solid material, oval, with cover.
- Barrier-free (accessible) water closets shall have covers (lids) as back-rests, to code requirements.

URINALS

Urinals shall be wall hung with carrier, top spud for exposed manual flush valve with non-hold open feature and vacuum breaker, siphon jet flush action, integral flush spreader.

EYE WASH FOUNTAINS

In rail and bus maintenance facilities, eye wash fountains shall be wall recessed, stainless steel, located per Code outside battery rooms, or other areas with hazardous products. Typically found in plant facilities.

SPECIAL REQUIREMENTS

- Septic systems and/or holding tanks for rural facilities.
- Filling stations for locomotive and coach washroom water supply.
- Coach washroom sewage removal facilities at progressive maintenance bays (PMB's) in train maintenance facilities.
- Train and bus wash facilities including recycling of wash water.
- Wells or water reservoirs at rural facilities to approval of authorities having jurisdiction, including filtration and purification systems. A minimum GO requirement is ultraviolet purification for coliforms and e-coli bacteria with pre-filters.
- Thermostat controlled electric pipe heating cables shall be used on all water pipes in unheated areas, where the temperature may fall below freezing.
- Minimum burial depth of piping shall be 1.65m or to municipal requirements.

FIRE PROTECTION

BASIS OF CRITERIA

The Ontario Building Code, N.F.P.A. Standards, and Municipal Fire Department shall govern Fire Protection requirements.

DESIGN REQUIREMENTS

SPRINKLERS

Sprinkler systems are typically found in facilities and regional offices, not typical station buildings.

Where sprinklers are required by code, sprinkler systems shall be designed, constructed, installed, and tested in conformance with NFPA 13. Sprinkler heads in public areas shall be concealed flush type, where sprinklers are code-required for major station or terminal facilities.

FIRE HYDRANTS

Hydrants shall be provided at all facilities. Fire hydrants in landscaped areas or snowdrift areas shall be raised or marked with raised identification “flag” devices. Minimum burial depth of piping and pipe-marking/protection shall be to municipal requirements.

DRY FIRE SUPPRESSION

- Dry Fire Suppression Systems or clean agent systems for main computer and telephone equipment rooms shall be provided where required by GO Transit.
- Not found in Station Buildings.

FIRE EXTINGUISHERS

The Consultant shall specify fire extinguishers to be available during construction and identify and locate fire extinguishers that are required to be supplied and installed by GO Transit for occupancy of premises.