1.0 GENERAL

1.1 Related UBC Guidelines & Documents

.1 Section 23 00 00 HVAC (and all subsections)
.2 Section 20 00 00 Mechanical - General Requirements
.3 All other Tech Guidelines as may be applicable to a given project.

1.2 Related Documents External to UBC

.1 BC Plumbing Code and all references contained there within
.2 BC Building Code and all references contained there within
.3 Work Safe BC Occupational Health and Safety Regulation

1.3 Description

.1 The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
.2 In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify UBC Mechanical Engineer.
.3 These guidelines are intended to be read by designers and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
.4 It is the requirement of the mechanical designer to coordinate these requirements with other disciplines.

2.0 MATERIAL AND DESIGN REQUIREMENTS

These are requirements specific to UBC that may not exist in code or other jurisdictions. Any deviation from these guidelines requires a variance be granted.

2.1 Design Requirements

.1 Glycol use in air handlers:
  .1 This point and all sub-bullets for UBC Okanagan Only: All air handlers that are exposed to outdoor air (including mixed air units) are to use 30% uninhibited propylene glycol. Supplied glycol is to meet requirements of 23 25 00.
  .2 This point and all sub-bullets for UBC Vancouver Only: All air handlers that are used for 100% outdoor air shall have glycol coils.
    .1 Glycol loops shall be separated from the main building hydronic loop by heat exchangers.
    .2 If the air handler has heat recovery (heat wheel, plate to plate or tempeff), is fully controlled by BMS and has a freeze stat directly wired to disable the fan VFD and has a pumped coil then glycol may be omitted at the designer’s discretion.

.2 Provide shutoff valves on the supply and return of all equipment. Use of balancing valves for isolation is not acceptable.

.3 Triple duty valves are not acceptable. Install, instead a balancing valve (or other flow measuring device), isolation valve and a check valve.

2.2 Equipment Requirements

.1 Pumps
- .1 All critical pumps shall be installed in duty/standby configuration. Lead/lag is not acceptable unless installing a triplex pump set lead/lag/standby.
  - .1 Critical pumps include most heating/cooling pumps and any pump with a possible freeze protection application as well as all other pumps of notable size or as identified by the consultant.
- .2 All pumps shall be displayed on BMS graphics showing the command and the feedback status. If a pump fails to run, an alarm shall be displayed on the front page of the graphics.

.2 Fluid Coolers and Cooling Towers
- .1 Closed loop fluid coolers are preferred to cooling towers. Where sizing pushes a project towards an open loop cooling tower, submit a variance application.
- .2 Cooling towers/fluid coolers over 8 ft high shall have service platforms with permanent ladders.
- .3 Multi-cell cooling towers with separate sumps shall have equalizing line of sufficient size to maintain water level in all sumps.
  - .1 Provide external equalizing lines c/w isolation valves. Do not provide internal equalizing flume as these are challenging to close off to drain and clean individual basins.
- .4 Provide a multifunction controller for chemical treatment complete with:
  - .1 Conductivity based bleed
  - .2 Makeup scale and corrosion inhibitor
  - .3 Dual biocide feed based on calendar clock
- .5 Cooling towers/fluid coolers over 100T shall have BACnet connected BTU meters installed on the inlet/outlet which log instantaneous power (kW) and cumulative energy (kWh)
- .6 *All closed loop fluid coolers or dry coolers that are not drained/winterized in the winter shall run a glycol mixture.*
  - .1 *In buildings that incorporate the fluid coolers into the heating water loop as part of a heat recovery setup, the fluid cooler shall be separate from the main loop with a heat exchanger.*

.3 Chillers
- .1 Specify minimum five year warranty.
- .2 Where chillers with brazed plate heat exchangers are used, provide parallel strainers selected for full flow c/w isolation valves so that each strainer can be cleaned independently. Strainers shall meet chiller manufacturer requirements (typically 60 mesh). Provide pressure gauges piped across the strainers for measuring pressure drop (one set of gauges for both strainers is okay).
- .3 Barreled chillers where the shell and tube hex can be opened at both ends are preferred to modular chillers

.4 Brazed plate heat exchangers are not to be installed on piping systems connected to an open loop cooling tower.
.5 Modular chillers or heat pumps must be installed with isolation valves on condenser and chilled water heat exchangers.
.6 Chillers over 40T shall be provided with a BACnet connected power meter (electricity) which logs instantaneous power (kW) and cumulative energy (kWh).
.7 Installed chillers must have a Prime Mover Nameplate kW Rating, as defined by the BC Safety Authority Directive D-BP-2013-02, of less than 200 kW. Units over 200 kW nameplate rating fall under continuous supervision status plant operation and require a variance from the Technical Guidelines to be specified and installed.
.8 *Chillers connected to open loop cooling towers shall be specified with marine water box's on the condenser. These attachments make it easier to clean and test the tubes as the condenser can be accessed without disconnecting the adjoining piping.*
.1 *Note that this is anticipated most frequently on retrofits to existing buildings as new buildings typically have closed loop systems and this is indicated by TG 23 21 00 - 2.2.2*

.4 Boilers or chillers with aluminum heat exchangers are not acceptable because they do not align with UBC’s water treatment procedures.

.5 Expansion tanks shall be installed on all hydronic systems.
.1 Specify expansion tanks with the “bladder monitor” feature where available. This is offered by several major manufacturers and provides a pressure gauge and a bladder leak indicator which changes colour from white to red when a leak occurs.
.2 *All expansion tanks shall have an isolation valve from the system. Between the isolation valve and the expansion tank there shall be a drain valve.*
.1 *This is necessary to accommodate maintenance of expansion tanks which requires to first isolate, then drain the expansion tank before proceeding with maintenance such as checking the bladder pre-charge.*

.6 *Avoid oversizing chillers/heatpumps and select equipment with enough stages that compressor cycling is minimized.*
.1 *Chillers/heatpumps shall operate with an average cycle time of greater than double the minimum cycling time recommended for the unit by the manufacturer. Average cycling time shall be calculated per equipment stage as the annual operating hours divided by the number of annual starts.*

.7 *Heat tracing is to be monitored by the BMS. Dedicated heat trace controller must include hardwired alarm contact to BMS or bacnet communication interface for monitoring. CT based alarm for BMS is not acceptable as it is considered unreliable for self-regulating heat trace.*

2.3 Construction and Material Requirements

.1 Acceptable piping systems (this section is a work in progress, please email andrew.porritt@ubc.ca to request updates – most industry standard, non-proprietary systems will be accepted)
.1 Heating Water
.1 Black iron (all manufacturers with local support and proven track record)
.1 Grooved for 3” and above
.2 Threaded for 2” and below (with regular use of unions)

.3 Welded with flanges

.2 Type K Copper (solder, grooved or flanged)

.3 Uponor (up to 3”)

.1 Not acceptable within 20’ of district energy heat exchangers

.2 A fail safe control valve must be in place to shutoff flow if the water temp approaches Uponor temp limits. This valve should alarm to BMS but must require a manual reset on site. There must be a clear sign at the location of the push button explaining what the valve exists for.

.3 There must be substantial labelling (on BMS graphics and on site) stating the max temperature and implications of higher temps

.2 Cooling Water

.1 Black iron (all manufacturers with local support and proven track record)

.1 Grooved for 3” and above

.2 Threaded for 2” and below (with regular use of unions)

.3 Welded with flanges

.2 Type K Copper (solder, grooved or flanged)

.3 Uponor (up to 3”)

.3 Condenser Water

.1 Black iron (all manufacturers with local support and proven track record)

.1 Grooved for 3” and above

.2 Threaded for 2” and below (with regular use of unions)

.3 Welded with flanges

.2 Type K Copper (solder, grooved or flanged)

.3 Uponor (up to 3”)

.2 Insulation Requirements

.1 Chilled water and condenser water piping shall have continuous vapour barrier.

.2 All piping 3” and over shall have h-block supports at the hangers.

.3 Indoor piping

.1 Insulation shall have paper wrap (even in existing mech rooms which have canvas)

.2 Pre-formed PVC elbows

.4 Outdoor piping

.1 Insulation shall have continuous pvc wrap which is UV stable and sealed to prevent water ingress into the insulation.

.2 Pre-formed, PVC elbows

.5 Chilled and condenser water pump bodies shall be insulated with pre-formed foam (preferred) or closed cell adhesive foam.

.6 Thickness and additional specifications by consulting engineer.

.7 Heat exchangers, valves 3” and over and other special fittings shall have removable insulation blankets.

.8 Plastic pipe shall have the same insulation requirements as metal pipe except that additional supports shall be used when required by code.

.1 Trays shall always be used when the pipe is flexible.

.3 Provide valve handle extensions on all chilled and condenser water valves where they penetrate piping insulation.

.4 Wafer style valves are not acceptable. All valves shall be capable of end of line isolation.

.5 Provide pressure test plugs (Petes Plugs or Winters Test Plugs) at all locations that a pressure gauge is installed and on both sides of all differential pressure sensors. The reason for this is that pressure gauges are notoriously inaccurate and this can be used to validate them and also to commissioned differential pressure sensors.

.6 *Where filters are required, the housings must either have:*
- .1 *Twist off shells (ex. typical hydronic sidestream filter with ¾" connections)*
- .2 *Swing-bolt lids (ex. large specialty water system filters, central side stream filters with 2" connections)*
  - .1 *Band-clamp closures are not acceptable.*

2.4 Testing and Commissioning Requirements

.1 This point and all sub-bullets for UBC Vancouver Only: UBC Building Official shall be invited to witness all tests that are required by code or the tech guidelines.

.2 Hydraulically test steam and hydronic piping systems at 1-1/2 times system operating pressure.
- .1 Maintain test pressure without loss for 48hr.

.3 For renovation projects, all new lines shall be flushed and pressure tested prior to connecting to the base building system.

.4 This bullet and all sub bullets shall apply to UBC Vancouver Only: Projects that do work on building hydronic systems shall be responsible for chemical treatment. The mechanical engineer is responsible for specifying the water treatment protocol and which chemicals are required. The contractor is responsible to hire a specialized water treatment company to supervise and direct, at a minimum the below:
- .1 New Buildings
  - .1 Flush and clean each loop including circulating a cleaning/dispersant chemical for 24 hours or as recommended by the chemical cleaning company. Provide a report of completed flushing by the chemical treatment company indicating that the water has been tested to confirm that the cleaning chemicals have been removed from the system.
  - .2 Supply and install appropriate chemicals as determined by the engineer and the water treatment company - chemical scale and corrosion inhibitor (closed loops) or algaecides (open loops)
  - .3 Provide final test report after all treatment and flushing indicating that the system is clean and at normal levels.
- .2 Existing buildings
  - .1 At project outset, take a sample water quality reading. Use this sample to identify any existing deficiencies in water quality. If water quality is sub-par, provide the Project Manager with a proposed plan to remediate. UBC may, at their discretion choose to proceed with this work.

.2 If required (as determined by the engineer and water treatment company), flush and clean each loop including circulating a cleaning/dispersant chemical for 24 hours or as recommended by the chemical cleaning company. Provide a report of completed flushing by the chemical treatment company indicating that the water has been tested to confirm that the cleaning chemicals have been removed from the system.

.3 At project completion, supply and install appropriate chemicals as determined by the engineer and the water treatment company - chemical scale and corrosion inhibitor (closed loops) or algaecides (open loops)

.4 Provide final test report after all treatment and flushing indicating that the system is clean and has achieved, at a minimum levels equal to the project outset testing.

.3 Each analysis shall include at a minimum:

.1 Total suspended solids
.2 Total suspended iron
.3 Total hardness
.4 Total dissolved solids
.5 Magnetite
.6 pH
.7 Conductivity

*****END OF SECTION*****