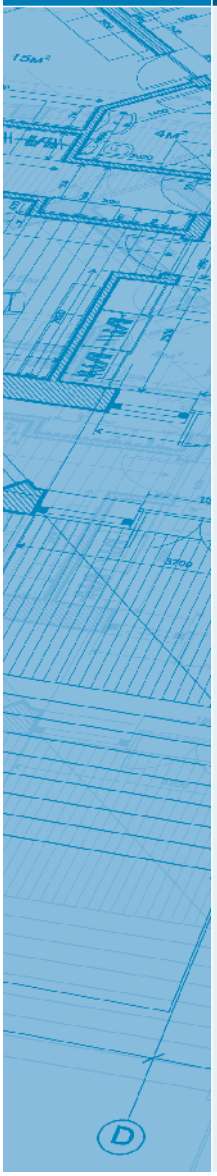
August
2017

TECHNICAL BULLETIN NO. 2-2017

SUBJECT: REVISIONS to **BC Housing's Mechanical Sections** as described in

REFERENCE: **BC Housing's Design Guidelines & Construction Standards 2014, Section 5 Division 21 – Fire Protection, Division 22 - Plumbing and Division 23 - Heating Ventilation and Air Conditioning**



PURPOSE:

To incorporate BC Housing's building and energy performance target in accordance with the new Provincial Energy Step Code and other sustainability requirements.

Delete three mechanical divisions under Section 5 Divison 21 - Division 21-Fire protection, Division 22 - Plumbing and Division 23 - Heating Ventilation and Air Conditioning, BC Housing Design Guidelines and Construction Standards 2014, page 216 – 238 of 306 and replace with attached 3 mechanical divisions, 32 pages.

DESCRIPTION:

The highlights to new changes are:

- Mechanical systems commissioning;
- passive design strategies;
- Ventilation requirements within residential units;
- Heat recovery ventilation;
- Building control systems;
- Higher energy efficient equipment;
- Mixing valves.

BRITISH COLUMBIA

BC HOUSING

21 00 00 - Fire Protection

1 General

.1 Provide a complete sprinkler system for the building in accordance with the requirements of BC Building Code (BCBC), National Fire Protection Association Standards (NFPA), code equivalencies and as required by the Authority Having Jurisdiction..

.2 Refer to Section 1 – Design Guidelines, Fire and Life Safety Measures, for a summary of all fire and life safety system requirements. Note that these requirements must meet or exceed the requirements of the BCBC and/or the Authority Having Jurisdiction.

.3 QUALITY ASSURANCE

.1 Sprinkler systems and all equipment shall be installed by qualified contractors licensed and regularly engaged in the installation of automatic fire sprinkler systems. Refer to Division 23 00 00 HVAC for details on tradesmen qualifications.

.2 All pipe, sprinklers, valves, fittings, gauges, pipe hangers, and other accessories to be of a type which is listed or labeled by Underwriters Laboratories of Canada (ULC). Use of such materials and equipment shall conform to all requirements and limitations of their listings and the manufacturer's specifications. If suitable ULC listed or labeled products are not available, products listed by other testing agencies (FM, UL, Warnock Hersey, etc.) may be used subject to the prior written approval of the Consultant, Owner, BC Housing and Authority Having Jurisdiction.

.3 With the exception of Part 9 buildings, the mechanical systems shall be commissioned by an Independent Commissioning Agency hired by the Owner. Refer to Division 23 00 00 HVAC for details on Commissioning.

.4 In order to provide a better quality assurance of the mechanical design, BC Housing may retain an independent consultant to provide a design review at the end of the design development stage. The mechanical Engineer of Record will be asked to provide all relevant information for the independent review and will be requested to address any potential design issues and comments brought up by the reviewer before moving to next design stage.

.4 SUBMITTALS

Sprinkler system shop drawings complete with hydronic calculations as outlined in NFPA Standard shall be sealed by the fire protection system design engineer who is a Professional Engineer Registered in BC.

.5 WARRANTY

Provide full 2 years warranty for all labour and materials along with full 2 years of service contracts for the project. Refer to Division 23 00 00 HVAC for details on Warranty.

2 Products

.1 AIR COMPRESSORS

.1 Supply and install air compressors, ULC approved for the dry sprinkler systems and complete with low pressure switch, starter and transformer for low voltage wiring to pressure switch..

.2 Compressors to be sized in accordance with the requirement of NFPA Standard, for capacity as determined by hydraulic calculation design of dry sprinkler systems.

.2 DRY PIPE VALVES

ULC listed dry pipe valve to be iron body, bronze/galvanized trim, complete with quick opening device if needed, and all accessories, interconnecting piping and subassembly valves and trims in accordance with NFPA Standard.

.3 PIPING

Piping to be Schedule 40, Schedule 10, Schedule 7 or lightwall threadable pipe. Use threadable fittings for Schedule 40 or lightwall threadable pipes only. Use Victaulic grooved fittings for Schedule 40, Schedule 10 and lightwall Schedule 7 pipes or MegaPress fittings for Schedule 10 to Schedule 40 pipes. Blazemaster PVC pipe may be used if installed in accordance with the ULC listing, NFPA Standard and Authority Having Jurisdiction.

.4 PRESSURE GAUGES

Provide pressue gauges at the following locations and additional gauges as required by NFPA, Authority Having Jurisdiction and system configuration;

.1 Water entry valve station both upstream and downstream of backflow preventer.

.2 Upstream and downstream of pumps.

.3 At top of fire standpipe and sprinkler risers.

.5 FIRE DEPARTMENT CONNECTIONS

Provide Siamese or Storz type fire department connection. The Siamese connection shall consist of a rough brass body with polish swivels and polished chrome caps with chains. The Storz connection shall include a powder coated inlet connection with a cap and chain on one side and female pipe thread on the other side. The fire department connections shall be ULC listed and approved by the local fire department. Ensure that tread pattern matches local fire department hose connections.

.6 STANDPIPES

Provide fire standpipe system within the building, as required by the building code, NFPA Standard and Authority Having Jurisdiction. Piping shall be concealed except for standpipe risers located within stairwells or piping within mechanical rooms and parkades.

.7 SPRINKLER HEADS

.1 Sprinkler heads within residential suites, corridors, and common areas shall be "residential" type sprinklers except where prohibited by NFPA Standard or the sprinkler listing.

.2 Provide quick-response heads where required by NFPA Standard.

.3 Provide standard brass upright or pendant heads on 25 mm (1") connection for unfinished areas. Provide mechanical protection in areas susceptible to damage (mechanical rooms, low headroom, etc.).

.4 Provide dry heads, standard brass upright or pendant, for areas subject to freezing.

.5 Provide high temperature fast response sprinkler heads rated at 150°C protected with wire guards for a bed bug heat treatment room and vestibule.

.6 Provide spare sprinkler heads in a steel cabinet as required by NFPA Standard.

.8 SPRINKLER SYSTEM ZONING

Provide zoning in accordance with NFPA Standard and in accordance with the requirements of Authority Having Jurisdiction. As a minimum, provide separate zones for each floor and the attic. Valve assemblies to be in accordance with NFPA Standard, shall be accessible and provided with a monitored shut off valve and flow alarm switch connected to the fire alarm panel.

.9 VALVES

All valves to be Underwriter's Laboratories Canada listed for minimum 1200 kPa (175 psi) working pressure on sprinkler and standpipe systems (Note: Maximum allowable working pressure is 1140 kPA (165 psi) for the sprinkler system and 1200 kPA (175 psi) for the stand pipe system). All valves inside the building must be provided with supervisory switches connected to the fire alarm panel.

.10 FIRE EXTINGUISHERS

Provide Fire Extinguishers in accordance with NFPA-10 Standard with Fire Extinguisher type to suit building area hazard. Location of fire extinguishers is subject to approval of the local fire department.

.11 BACKFLOW PREVENTER

Main fire line shall be separated from the potable water source by a ULC listed double check valve backflow preventer.

.12 FIRE PUMP

.1 The Consultant must verify the available flow and pressure in the municipal water main to determine basis for the design of the sprinkler/standpipe system. This information might be available from the local Engineering Department or might require arranging for a water flow test at the closest fire hydrant

.2 The Consultant shall obtain sufficient fire flow/pressure data to determine if a fire pump is or is not required for the project.

.3 If the Consultant determines that there is no sufficient fire flow/pressure available to maintain a minimum residual pressure at the highest point in the building to satisfy the sprinkler flow requirements, a fire pump shall be provided for the project. The fire pump shall be designed in conformance with NFPA-20 Standard.

3 Execution

.1 INSTALLATION

.1 Use materials that bear the manufacturer's identification mark in addition to all other markings required by the specifications.

.2 All tests and adjustments required by NFPA Standards shall be performed. Copies of completed Aboveground and Underground Contractor's Material and Test Certificates shall be delivered to the consultant at least five (5) full working days prior to the building takeover inspection.

.3 Supply and install cabinet containing spare sprinkler heads corresponding to the types and temperature ratings as installed in the building. The cabinet shall be located as indicated on site and shall include sprinkler wrench suitable for each head type. Provide a minimum of six spare heads for each type of head installed.

.4 Ensure that the sprinkler system is protected from freezing in accordance with the requirements of the Authority Having Jurisdiction. The dry sprinkler system shall be installed in unheated attic and parkade areas (Note: for buildings designed to the requirements of NFPA-13D or NFPA-13R, sprinklers in the attic spaces are not required). Stand pipe distribution piping located in unheated areas shall be insulated and provided with electric heat tracing monitored by the fire alarm panel.

.5 Fire extinguisher cabinets shall be installed no more than 1219 mm (4'-0") above the floor. Fire extinguishers shall be provided in recessed enclosures in corridor walls. Do not compromise required fire separation or rating. Fire extinguishers to comply with NFPA Standard, BC Building Code and the Authority Having Jurisdiction.

.2 EARTHQUAKE PROTECTION

.1 Provide seismic bracing in accordance with the requirements of the BC Building Code, CSA S832 Standard and NFPA Standards.

.2 Provide Letter of Assurance from Seismic Professional Engineer registered in BC confirming that the design and installation of seismic restraints meet all regulatory requirements.

.3 PERFORMANCE

.1 The construction documents shall indicate the location of sprinkler heads in finished areas, main piping distribution and location of all supervised valves and flow alarm switches. The Sprinkler Contractor shall be responsible for the final layout of the sprinkler system and submission of shop drawings complete with hydronic calculations for review by the Consultant and approval by the Authority Having Jurisdiction. Sprinkler shop drawings shall be stamped/

signed by Supporting Professional Registered in BC and issue Schedule S-B and S-C upon complete.

.2 The Sprinkler Contractor shall provide the hydraulic design for the system in accordance with NFPA Standard and, where applicable, code equivalency requirements.

.3 Hydraulic calculations are to include for 20% more in volume than the total sprinkler demand and 10% more pressure at the base of the riser is required by Authority Having Jurisdiction and NFPA Standard.

.4 Hydraulic calculations and working drawings to be presented in a manner acceptable to the Authority Having Jurisdiction. The Sprinkler Contractor to note and confirm compliance with all requirements of NFPA Standards, including which edition of NFPA Standard was used in the design and, where applicable, code equivalency requirements.

.5 The Sprinkler Contractor shall test the system flow to provide the final data for the sprinkler system design and shall report the results of the flow test to the Consultant.

End of Section

22 00 00 – Plumbing

1 General

.1 Provide complete sanitary and storm drainage systems, including clean-outs, manholes, catch basins, piping, pumps, sumps, fixtures and all other equipment connected to local drainage. Avoid sump pumps for storm and sanitary wherever possible. If pumps are needed, route only that drainage through the pump that cannot be drained by gravity. Design, construct and install storm and sanitary drainage systems to conform to applicable codes and good engineering principles. The plumbing system shall be designed to comply with the requirements of the BC Plumbing Code and Local Authority Having Jurisdiction.

.2 Insulate all plumbing system components including, but not limited to, hot water mains, recirculation and run outs to comply with ASHRAE 90.1 – 2010 and National Energy Code for Buildings (NECB) 2011. Provide a continuous vapour barrier for all cold water and chilled water piping to prevent condensation.

.3 Low water consumption plumbing fixtures shall be specified, e.g., water closets, sink and lavatory faucets, and shower heads.

.4 QUALITY ASSURANCE

.1 All equipment shall be installed by qualified contractors licensed and regularly engaged in the installation of plumbing systems. Refer to Division 23 00 00 HVAC for details on tradesmen qualifications.

.2 With the exception of Part 9 buildings, the mechanical systems shall be commissioned by an Independent Commissioning Agency hired by the Owner. Refer to Division 23 00 00 HVAC for details on Commissioning.

.3 In order to provide a better quality assurance of the mechanical design, BC Housing may retain an independent consultant to provide a design review at the end of the design development stage. The mechanical Engineer of Record will be asked to provide all relevant information for the independent review and will be requested to address any potential design issues and comments brought up by the reviewer before moving to next design stage.

.5 WARRANTY

Provide full 2 years warranty for all labour and materials along with full 2 years of service contracts for the project. Refer to Division 23 00 00 HVAC for details on Warranty.

.6 POTABLE WATER SYSTEM

.1 Street pressure system is to be used whenever possible. If the following conditions apply, install a booster system:

.1 minimum street water pressure, discounted 35 kPa (5 psi) for future unknowns, does not meet all building requirements or,

.2 if the street pressure is below 276 kPa (40 psi).

.2 Install a pressure reducer if the street pressure is greater than 551 kPa (80 psi).

.3 Provide an approved double check valve backflow preventer as per CSA and code requirements.

.4 Provide Reduce Pressure Backflow Preventer for water main for site.

.5 Where a permanent irrigation system is approved for the project by BC Housing, provide. Reduce Pressure Backflow preventer for irrigation system.

.6 Water supply piping in outside walls is not permitted. Route piping in a furred-out chase completely outside of the exterior wall. Do not embed piping in the wall insulation.

.7 Avoid drainage piping in outside walls. If unavoidable, ensure that the exterior wall insulation is between the pipe and the exterior wall, that the pipe is not embedded in the insulation and that the R value of the insulation complies with the required value for the assembly. Use EPS or polyisocyanurate insulation if the pipe must be installed in an exterior wall stud space.

.8 Provide a shut off for each riser in apartment buildings. Valves 57 mm (2") and less in diameter must be ball valves. Shutoffs to be easily accessible.

.9 Provide a shut-off valve for each unit. Provide a prefabricated, keyed metal access panel. Shut offs to be easily accessible.

.10 Provide pre-manufactured water hammer arrestors as per BC Building Code (Sentence 2.6.1.9.) and at the termination of all hot and cold water branch lines serving groups of fixtures or any fixture with a solenoid valve such as a dishwasher or clothes washer. Field fabricated arrestors are not permitted.

.11 Provide plastic sleeves for pipes through concrete 25 mm (1") larger than pipe, packed with insulation and smoke seal per code.

.12 Provide frost free hose bibs c/w automatic draining vacuum breakers/backflow preventer at the following locations:

.1 garbage enclosures

.2 main entry

.3 near landscaped areas – provide minimum one per building face; maximum spacing 30.5 m (100'-0")

.4 locate hose bibs to avoid conflict between hose and sidewalks

.13 Provide individual curb shut-offs to each building and a main water shut-off within each building. Provide a curb stop and key.

.14 Provide a total building water meter. Where applicable, provide separate water sub-meters to areas with separate lease agreements. Confirm requirements for water sub-metering with BC Housing.

.7 DOMESTIC HOT WATER SYSTEMS

.1 Hot water temperature must not exceed 49°C (120°F) at points of use by tenants. Hot water storage shall not be below 60°C (140°F) to control the propagation of Legionella bacteria. On

central domestic water heating systems provide hot water recirculation system. Care shall be taken to minimize dead legs to outlets (2 m is the maximum allowable).

.2 Provide hot water distribution to common kitchen areas and for janitor sinks at 60°C (140°F).

.3 Where low temperature pre-heating storage tanks are utilized, provide means of automatically re-heating water to 60°C (140°F) for a period of 1-hour every 24 hours for sanitation purposes.

.4 All residential showers shall be provided with thermostatic mixing valves. All residential bathroom and kitchen faucets shall be provided with temperature limit stops. The shower valves and faucets shall be set to maximum hot water temperature of 49°C (120°F).

.5 Thermostatic mixing valves for residential faucets should be considered in lieu of temperature limit stops for applications where increased level of anti-scalding protection is required such as group homes or care facilities. A central whole-building thermostatic mixing valve and central tampered hot water distribution should be considered for buildings with special need tenants where regular monitoring of domestic hot water temperature is required.

.6 Boiler and Storage Tank System – the use of a boiler and storage tank system is the preferred hot water system for projects. Boilers used as a main source of hot water heating shall be separate from the domestic hot water system. Where boilers are used as a supplementary or backup source of heating only, it is acceptable to utilize heating boilers for generation of domestic hot water.

.7 If a solar hot water system is specified, install according to the guidelines from CanSIA's Solar Ready program and the CAN/CSA-F383 Installation Code for Solar Domestic Hot Water Systems and comply with BC Regulation 163/2013.

.8 DRAINAGE SYSTEMS

.1 Locate roof drains to minimize number of stacks from roof to storm sewer. Balance this requirement with the need to provide minimum 2 way drainage to roof areas.

.2 Provide floor drains with trap primer in common laundry.

.3 Floor Drains for:

.1 Sheet vinyl flooring shall be dura-coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with polished nickel bronze strainer and complete with trap primer connection.

.2 Ceramic tile floor shall be dura-coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with "Type Y" polished nickel bronze square strainer with stainless steel screws and complete with trap primer connection.

.4 Provide a membrane under any ceramic tiled shower areas and clamp the membrane into the membrane clamp of the floor drain. The membrane shall be in accordance with Part 7 of the BC Building Code.

.5 Provide a bi-level drain in suite areas if required by Authorities Having Jurisdiction. Coordinate with other trades for provision of waterproofing membrane under the concrete topping and/or resilient flooring subtrade for installation of clamping drain.

.6 Utilize cast iron DWV piping for all vertical drainage risers, horizontal drainage over areas with

noise sensitivity (especially bedroom and sleeping areas) and for all drainage in parkade areas. Non-metallic DWV can be considered in less noise sensitive areas, but the drainage layout shall be reviewed and commented on by an acoustic consultant. Waste stacks and rain water leaders (RWL's) must not touch the structure and should be resiliently supported at floor penetrations on neoprene pad isolators sized for a minimum of 3mm of static deflection.

.7 Provide a drainage system for covered or underground parking areas. Comply with the City of Vancouver Bulletin 2008-007-EV/PL Parkade Drainage Treatment System.

.9 COMMON LAUNDRY

Contractor to provide plumbing rough-in for tenant laundry equipment, including a utility sink.

2 Products

.1 POTABLE WATER PIPING

.1 Use Type L copper pipe for all hot and cold water supply piping.

.2 Use Type K copper pipe on hot water recirculation piping when recirculation system is used.

.3 Use only lead free solder in copper piping systems.

.4 Non-metallic pipe and fitting systems, i.e. cross linked polyethylene (PEX), chlorinated polyvinyl chloride (CPVC), polypropylene (PP-R) shall be accepted as alternates for potable hot and cold water mains and risers applications as per the BC plumbing code 2012 Division B – Appendix A.

It is the responsibility of the consultant to ensure they are suitably specified and detailed to comply with BCBC 2012 Sentence 3.1.5.16.(1) combustible piping materials in buildings required to be of noncombustible construction with regard to flame spread rating and smoke developed classification.

The Consultant shall coordinate specifications and detailing for the installation of the system and confirm that all components meet the local authority's requirements including referenced standards, fire stopping and STC rating.

The thermal expansion and supports shall be as per the pipework manufacturers requirements.

.5 The Consultant shall submit written confirmation of approval for the specified system from the authority having jurisdiction and, where applicable, a copy of the approved equivalency, to BC Housing prior to approval of the construction documents.

.6 The potable water system shall be designed to ensure that the maximum design temperatures and pressure of the piping material are not exceeded. Provide pressure reducing valves and controls if required to ensure that approved pressures and temperatures are not exceeded.

.7 The Contractor shall provide a 25 year manufacturer's warranty on all piping, in line fittings and domestic water distribution manifolds which includes coverage for consequential damage.

.8 Cross linked polyethylene (PEX) may be used for potable water piping for in-suite run outs from fixtures to manifold subject to the following conditions:

.1 Approved PEX piping systems are acceptable in lieu of copper for in-suite run-outs to fixtures provided the potable water piping distribution is contained within an individual

residential suite. The PEX piping and fitting system shall conform to CSA BI37.5 and shall be approved for potable water use.

.2 Distribution manifolds shall be manufactured of brass or copper, approved for use in the system by the piping manufacturer and covered by the manufacturer's 25 year warranty.

.3 In-line fittings shall be approved for use in the system by the piping manufacturer and covered by the manufacturer's 25 year warranty.

.4 Where PEX potable water piping is installed in structural slabs, a larger diameter polyethylene sleeve is required. Polyethylene bags are not acceptable.

.5 PEX potable water piping shall not be installed in slabs used for radiant heating/cooling, due to potential problems with heat gain in the DCW and conflict with the heating pipe layout. PEX piping shall not be exposed to UV prior to or during installation and must be warranted for a minimum of 30 days exposure.

.6 Protect piping and manifolds from entry of contaminating material by installing suitable plugs in all open ends until installation. Where possible, connect pipes to assembled manifolds to eliminate possibility of contaminants.

.7 Provide lockable metal access covers for all manifold locations.

.8 The Contractor shall submit the following for review and acceptance by the Consultant prior to installation: specifications for all components of the system, confirmation of compliance with referenced standards, confirmation of municipal approval, confirmation in writing from the manufacturer that the installer is trained and approved to install the system and a copy of the manufacturer's warranty.

.9 All piping shall be installed so that it will in no way be strained or distorted by thermal expansion. Anchors and expansion loops shall be provided where necessary to protect equipment / piping and regulate expansion. This shall be the responsibility of the Mechanical Consultant and Contractor

.2 FIXTURES

.1 Provide fixtures of same make, model and colour throughout project.

.2 All faucets shall meet the American Disabilities Act Guidelines and ANSI A117.1 requirements for the physically disabled.

.3 Provide aerated low flow fixtures for the bathroom: 2 LPM/0.5 GPM.faucet, and 5.7 LPM/1.5 GPM showerhead. Fixtures shall display CSA approval. Refer to Section 3 – Energy and Environmental Design.

.4 Plumbing fittings shall be to CAN/CSA B125, Plumbing Fittings.

.5 Plumbing fixtures shall be to CAN/CSA B45, 'General Requirements for Plumbing Fixtures.'

.6 Vitreous china plumbing fixtures shall be to CAN/CSA B45.1, 'Ceramic Plumbing Fixtures.'

.7 Enameled cast iron plumbing fixtures shall be to CAN/CSA B45.2, 'Enameled Cast Iron Plumbing Fixtures.'

.8 Porcelain enameled steel plumbing fixtures shall be to CAN/CSA B45.3, 'Porcelain Enameled

Steel Plumbing Fixtures.'

.9 Stainless steel plumbing fixtures shall be to CAN/CSA B45.4, 'Stainless Steel Plumbing Fixtures.'

.10 Plastic plumbing fixtures shall be to CAN/CSA B45.5, 'Plastic Plumbing Fixtures.'

.11 Cartridge shall be brass with ceramic disc and 5 years warranty.

.3 WATER CLOSETS

.1 Low Flush Water Closets: Vitreous China, ADA compliant, free standing elongated rim, wash-down bowl, china bolt caps, single flush 4.8 LPF (1.3 GPF), min. 54 mm (2-1/8") fully glazed trapway, and comply with the latest edition Maximum Performance (MaP) testing rated at 1000 gram of waste per flush. Refer to Section 3 – Energy and Environmental Design.

.2 Water closets shall be closed front with cover seat that shall be rugged, high impacted solid plastic that is highly stain and chemical resistant with stainless steel hardware package and factory-installed top tite hinges.

.3 Water closets shall be supplied with chrome-plated supply line, escutcheon plate and ball-valve type fixture stop.

.4 KITCHEN SINKS

.1 Sinks shall be grade 18-8 stainless steel, single bowl counter mounted sink complete with back ledge, self-rimming, sound deadening, mounting kit, strainer, and 89 mm (3-1/2") crumb cup.

.2 Faucets shall be deck mounted, solid cast brass lead-free body complete with washerless, ceramic drip-free disc valve cartridge, 240 mm (9-1/2") long cast swing spout with vandal-resistant, 5.7 LPM (1.5 GPM) flow pressure compensating aerator outlet, removable brass escutcheon plate, single control metal lever handle, flexible copper supplies and less hand spray (cap provided for non-spray application).

.3 Where a faucet is installed on a island type counter the faucet is to have a maximum swing of 180 degrees

.4 Provide temperature limit stops set not to exceed 49°C (120°F) hot water temperature. For project where increased level of anti-scalding protection is required, consider utilizing thermostatic mixing valves.

.5 Sink Dimensions

.1 Standard applications: 521mm x 508mm x 178mm (20-1/2" x 20" x 7") deep complete with mirror finished rim, satin finished bowl, and 38 mm (1-1/2") tailpiece.

.2 Wheelchair accessible applications: 522mm x 511mm x 127mm (20-9/16"x 20-1/8" x 5") deep , satin finished rim and bowl, and with rear corner 38 mm (1-1/2") tailpiece, located in left hand back corner. Provide sanitary covering that is vandal-resistant flexible seamless construction, anti-microbial, to exposed piping (to protect against heat/contusions) as per local codes.

.5 AMENITY AREA

.1 Sink for the recreation area shall be a double compartments, 18-8 grade stainless steel counter

mounted sink complete with back ledge. It shall be self rimming, with 89 mm (3-1/2") crumb cup, strainers, sound deadening coating and come complete with mounting kit.

.2 Faucet shall be deck mounted, and have a solid cast brass lead-free body, washerless, ceramic drip-free disc valve cartridge, 240 mm (9-1/2") long cast swing spout with vandal-resistant, 5.7 LPM (1.5 GPM) flow pressure compensating aerator outlet. The faucet shall also come with a removable brass escutcheon plate, single control metal lever handle, flexible copper and omit the hand spray (cap is to be provided for non-spray application).

.3 Provide temperature limit stops set not to exceed 49°C (120°F) hot water temperature. For project where increased level of anti-scalding protection is required, consider utilizing thermostatic mixing valves.

.4 Sink Dimensions

.1 Standard application: 521mm x 794mm x 178mm (20-1/2" x 31-1/4" x 7") deep with mirror finished rim, satin finished bowl, spillway, and 38 mm (1-1/2") tailpieces.

.2 Wheelchair accessible applications: 521mm x 794mm x 127mm (20-1/2" x 31-1/4" x 5") deep with satin finished rim and bowl, and a 38 mm (1-1/2") tailpiece, located center back. Provide sanitary covering that is vandal-resistant flexible seamless construction, anti-microbial, to exposed piping (to protect against heat/contusions) as per local codes.

.6 LAUNDRY

.1 Utility sink for the laundry shall be a single compartment, deep bowl, grade 18-8 stainless steel 560mm x 651mm x 305mm (22-1/16" x 25-5/8" x 12") deep counter mounted sink, with back ledge, mirror finished rim, satin finished bowl, self rimming, with crumb cup strainer, 38 mm (1 -1/2") tailpiece, sound deadening and mounting kit, 89 mm (3-1/2") crumb cup and strainers.

.2 Faucet shall be deck mounted, and have a solid cast brass, lead-free body, washerless, ceramic drip-free disc valve cartridge, 240 mm (9-1/2") long cast swing spout with vandal-resistant, 5.7 LPM (1.5 GPM) flow pressure compensating aerator outlet. The faucet shall also come with a removable brass escutcheon plate, single control metal lever handle, flexible copper supplies and omit the hand spray (cap is to be provided for non-spray application).

.3 Provide temperature limit stops set not to exceed 49°C (120°F) hot water temperature. For project where increased level of anti-scalding protection is required, consider utilizing thermostatic mixing valves.

.7 JANITOR ROOMS

.1 The janitor room shall be provide with precast terrazzo floor mounted, mop sink, 610mm x 610mm x 254mm (24" x 24" x 10") deep, and Integral Cast Brass Drain with stainless steel strainer 75 mm (3") outlet.

.2 The faucet shall be wall mounted, cast brass body, with metal handles, integral vacuum breaker, integral stops, hose end, pail hook and top brace.

.3 Provide bracket and 915 mm (3') hose with coupling, bumper Guards, 3 stainless steel mop hangers, drain gasket, connection for 75mm (3") pipe, stainless steel back splash panels, on two sides and 'p' Trap.

.8 BATHTUBS (FAMILY PROJECTS)

Bathtubs must be non-slip, stain resistant, porcelain enameled steel with plug and chain drain, sound deadening, overflow, over-rim spout and cast brass trap. Fiberglass bathtubs are not acceptable. Provide tub spout with diverter and single lever, non-scalding. Thermostatic mixing valve with integral stops set not to exceed 49°C (120°F) hot water temperature.

.9 PRE-FABRICATED SHOWER UNIT – FOR ADAPTABLE AND SENIOR TENANT'S SUITES

.1 One piece, Gelcoat finish, reinforced with fibreglass, to minimum 914 mm x 1521 mm (3' x 5'). Includes three grab bars, wall hook and low curb at floor. In lieu of acrylic grab bar install 32 mm diameter, 914 mm long stainless steel grab bar (1-1/4" x 3'). For Renovation project, two or three piece shower unit can be considered, if one-piece cannot be installed due to existing bathroom configuration. Make sure the potential leak sources are sealed properly to prevent water damage.

.2 Provide single lever, non-scalding thermostatic mixing valve with integral stops set not to exceed 49°C (120°F) hot water temperature. Provide a push button hand-held showerhead and vacuum breaker. Shower heads shall be low flow, limiting water flow to 5.7 LPM (1.5 GPM) or less.

.10 PRE-FABRICATED SHOWER UNIT – FOR WHEELCHAIR ACCESSIBLE SUITES

.1 One piece barrier-free, fibreglass or custom non-slip showers for wheelchair accessible suites, to minimum 974 mm x 1586 mm (3' 2-3/8" x 5' 2-1/2"). Includes three grab bars, folding seat, and rollover threshold to maximum 13 mm (1/2"). Conform to recommendations of CSA B651. Provide single lever, non-scalding thermostatic mixing valve with integral stops set not to exceed 49°C (120°F) hot water temperature. For Renovation projects, two-piece shower unit can be considered, if one-piece cannot be installed due to existing bathroom configuration. Make sure the potential leak sources are sealed properly to prevent water damage.

.2 Provide a combination stainless steel slide/grab bar with 1778mm (5'-10") long hose, push button hand showerhead and vacuum breaker. Shower heads shall be low flow, limiting water flow to 5.7 LPM (1.5 GPM) or less.

.3 Confirm with tub/shower supplier that reinforcing or backing is provided behind the tub/shower wall to support the installation of the slide/grab bar.

.11 LAVATORIES

.1 Lavatories shall be vitreous china self-rimming lavatory basin with rear overflow.

.2 Lavatories shall be supplied with chrome single lever washerless faucet with ceramic disc cartridge and temperature limit stops set not to exceed 49°C (120°F) hot water temperature. For project where increased level of anti-scalding protection is required, consider utilizing thermostatic mixing valves.

.3 Low-flow faucet aerators must be provided for bathroom sinks and any faucet used primarily for hand washing, limiting water flow to 2 LPM (0.5 GPM) or less.

.12 MANHOLE COVERS AND CATCH BASINS

.1 Provide manhole covers and catch basins with circular precast sewer cover sections with top sections having eccentric cone or flat slab top type with opening offset for vertical ladder installation. All bolt down applications must have pentagon style heads.

.2 Provide light duty type manhole and catch basin frames and covers for landscape service and heavy duty traffic type for all other applications.

.3 Castings to be coated with two applications of asphalt varnish after being sand blasted or cleaned and ground to eliminate surface imperfections.

.4 Set frame and cover to required elevation on no more than 4 courses of brick. Bricks to be jointed and bonded to frame with cement mortar. Parge brickwork and make smooth and watertight.

3 Execution

.1 Damaged or repaired bathtubs will not be accepted.

.2 Penetrations through exterior walls must be sealed to the water barrier of the wall assembly using self-adhesive bituminous membrane and/or expanding foam sealant suitably applied to protect from weather penetration. The method of sealing penetration must be acceptable to the building envelope consultant.

.3 Caulk plumbing fixtures where fixture contacts wall, floor or vanity. Refer to Division 07 92 00 – Joint Sealants, for acceptable products.

.4 Piping

.1 Installation shall comply with the manufacturer's specifications and be carried out by a trained installer, certified by the manufacturer.

.2 Insulate all domestic hot cold and recirculation piping with preformed glass fibre type insulation. Insulate all domestic hot and recirculation piping as required ASHRAE 90.1 – 2010 and NECB 2011. PEX piping in slab is not required to be insulated but shall be sleeved.

.3 Provide supports for pipes. Maintain required grading by adjustment; allow for expansion and contraction and produce a neat appearance. Design supports to suit loading and services. Prevent undue stress to structural members. Supports must secure pipe and prevent vibration.

.4 For all copper horizontal piping use wrought clevis hangers 25 mm (1") larger than pipe diameter suitable for vertical adjustment, isolated from pipe with plastic tape.

.5 Provide access panels to concealed valves and clean-outs. ULC rating required in rated assemblies.

.6 Install escutcheon plates at piping penetrating wall and at exterior hose bibs.

.7 Provide a metal access panel for all hose bibs with concealed isolating valves.

.8 Drain connection for a water closet shall be minimum 100 mm (4") diameter.

.5 SEISMIC RESTRAINT

.1 Seismic restraint must be provided for all mechanical equipment and accessories including attachment to structural members where required by code.

.2 Letter of Assurance from Seismic Engineer on commencement of design and completion of field review must be provided where required.

.6 ACOUSTICAL CONSIDERATIONS

.1 Consultant to review acoustic requirements and incorporate or revise the following standards to achieve required STC ratings:

.1 Plumbing (including RWL's) shall be installed without direct contact to drywall or studs. Position risers/wastes in centre of wall chase to meet this requirement. Where concrete penetrations (cans) are not centred on plumbing chase advise site superintendent.

.2 Oversize sleeves through structure. Use firestopping and smoke seal in accordance with Section 5 – Division 07 80 00 – Firestopping and Smoke Seals. Support plumbing at floor level only.

.3 Where risers serve suites on each side, provide individual take-offs from riser. Do not service two suites through single "T" connection off riser. Minimum size for end of riser is 19 mm (3/4") for 13 mm (1/2") takeoffs on each side. Provide premanufactured water hammer arrestor at all riser terminations and at appliances with solenoid activated valves.

.4 To avoid contact with studs and drywall, orient all pipe clamps parallel to walls. Only use plastic pipe clamps on 13 mm (1/2") diameter supply piping with suite being served. Attach wing back elbows, shut off valves, faucets, etc., to separate wood plates in separate rows of studs in party walls. Provide clearance and use resilient (fire) caulking where piping passes through party walls and floors. The intent of these requirements is to minimize bridging of wall by plumbing system.

.5 Where supply pipes serve suites above, suspend piping from hangers from the floor above. On supply piping, use oversized hangers/straps and include layer of resilient, 13 mm (1/2") thick neoprene, pipe insulation between hanger and insulated pipe, with metal shim to distribute load (20% maximum compression). Fibreglass pipe insulation is also acceptable provided manufacturer's loading criteria are met.

.6 Where main wastes are offset, isolate pipe clamp at offset floor using 6 mm (1/4") thick 60 durometer neoprene pads. Cut pads to size of clamp with clearance on each side, e.g., about 51 mm x 75 mm (2" x 3"). Load pads evenly not exceeding 4140 kPa (600 psi). If necessary, provide trowel finish topping under pads if concrete floor is not smooth. Provide layer of resilient, 13 mm (1/2") thick neoprene pipe insulation (20% maximum compression) in oversize pipe clamps for first two hangers after bend.

.7 Maintain minimum 13 mm (1/2") clearance between pipes and studs, electrical conduit, or other pipes. If clearance is minimal, use resilient neoprene insulation to avoid contact. This requirement is to avoid rattling between pipes.

.8 Do not use foam spray-on products for insulation.

.9 Approval of the plumbing system is required before insulation and drywall work is started.

Do not commence final boarding until plumbing has been reviewed for clearance.

.10 Submit shop drawings showing equipment and installation details to isolate equipment. Supplier to visit site as necessary to ensure an acceptable installation.

.11 Isolate pumps and other equipment which may generate vibration on Mason BC neoprene isolators or neoprene hangers, unless otherwise specified. Immediately upstream and downstream of all 3500 rpm pumps, provide flexible pipe connectors (multi-layered nylon tire cord fabric reinforced with EPDM cover and liner). Provide shut-offs to allow replacement of connectors without draining system.

.12 Isolate piping for 10 m (32'-10") upstream and downstream of all pumps and other equipment generating vibration. Isolate main water supply pipe from street supply to 10 m (32'-10") downstream of booster pump using thermal insulation of neoprene hangers. Use oversize clevises outside insulation with high density block rated for pipe weight pipe support insulation. Do not use rigid ceramics, etc. Where pipes pass through walls, avoid rigid contact and provide continuous insulation. If fire rating is necessary do not grout. Use soft fireproof caulking.

.13 Isolate all vibrating equipment, pumps and piping in mechanical rooms as described above. In penthouses, isolate boilers, hot water tanks, etc. on rubber pads (Durometer 50 with a max 15% deflection per 50mm x 50mm at 80kg/s) pads with hold down bolts and grommets.

.14 Use cable restraints only on isolated piping and equipment. Do not bridge isolation elements.

.15 Avoid all contact between plumbing and framing/drywall. Frame all plumbing chases and drop ceiling plumbing cavities at least 25 mm (1") larger than the maximum insulated collar size of the piping in the cavity. Loosely insulate cavity with R8 or R10 Fibreglass Home Insulation on each side of pipe. Avoid compression of the insulation between piping and drywall. Where plumbing chases are in bedrooms or living rooms, provide two layers of drywall.

.16 Where bathrooms/kitchens occur above critical spaces such as bedrooms/living rooms, provide suspended ceiling consisting of framing spanning between walls and two layers of drywall with R10 insulation in cavity. To avoid rigid connection of metal framed walls to kitchen/bathroom floors above, include deflection header detail in wall framing incorporating interlocking tracks with isolating tape between flanges 5 mm x 25 mm (3/16" x 1") standard tape. Ensure no contact of any drywall/framing to plumbing and do not compress insulation under pipes.

End of Section

23 00 00 - Heating, Ventilating and Air Conditioning

1 General

The HVAC systems in multi-unit residential buildings more than three-storeys shall be designed to meet all applicable requirements of ASHRAE Standard 90.1-2010 "Energy Standard for Buildings except Low-Rise Residential Buildings" and the BC Building Code or Vancouver Building By-law for Part 3 buildings, including all additional re-zoning and energy by-law requirements of the Municipalities Having Jurisdiction for Part 3 buildings.

Multi-family buildings of three storeys or less shall be designed to meet all applicable requirements of the BC Building Code or Vancouver By-law for Part 9 buildings, including all additional re-zoning and energy by-law requirements of the Municipalities Having Jurisdiction for Part 9 buildings.

Consult the re-zoning and energy by-law requirements before establishing the performance criteria for the project. Projects are required to exceed the minimum mandatory requirements and achieve higher energy efficiency and sustainability targets where BC Housing requirements are more stringent.

Unless governed by more stringent local by-laws, all new projects shall meet the minimum building and energy performance targets as stated in Section 3 - Energy and Environmental Design.

Passive design strategies and a better performing building envelope shall be chosen ahead of utilizing complex and difficult to operate/maintain HVAC systems. The strategies of harnessing solar radiation and capturing internal gains for heating, and utilizing mechanical ventilation overnight to cool the warm building structures should be considered. Refer to Section 3 - Energy and Environmental Design.

BC Housing is committed to achieving optimal energy performance on equipment and materials that are specified for our existing buildings and in new developments. As such, BC Housing is committed to selecting energy efficient materials and securing all rebates and incentives associated with these energy efficient choices. The Consultant is to ensure that any of these applicable programs are included and captured in all projects.

Designing and specifying material and/or equipment must account for local servicing availability and accessibility of parts for future maintenance and replacement.

.1 QUALITY ASSURANCE

.1 All heating, ventilating and air-conditioning systems must be designed and inspected by a professional mechanical engineer registered in the Province of B.C.

.2 Only tradesmen holding valid Provincial Trade Qualification Certificates can be employed on the project. Tradesmen shall only perform work that their certificates permit. Apprentice tradesmen shall work under the direct supervision of an experienced journeyman tradesman. Apprentice-to-Journeyman Ratio should not exceed 3:1 on site and shall be recorded regularly as a proof of compliance. As required, installers must be trained and certified by system and equipment manufacturers to conform to warranty provisions.

.3 With the exception of Part 9 buildings, the mechanical systems shall be commissioned by an

Independent Commissioning Agency hired by the Owner. Refer to Section 3.6 Commissioning.

.4 In order to provide a better quality assurance of the mechanical design, BC Housing may retain an independent consultant to provide a design review at the end of the design development stage. The mechanical Engineer of Record will be asked to provide all relevant information for the independent review and will be requested to address any potential design issues and comments brought up by the reviewer before moving to next design stage.

.2 WARRANTY

.1 Provide full 2 years warranty for all labour and materials along with full 2 years of service contracts for projects under Part 3 buildings **for new construction and as appropriate for renovation projects for overall mechanical systems including control systems**. For Part 9 projects, provide one year warranty with full one year of service contracts.

.2 The service contracts are to follow the manufactures recommended annual maintenance recommendations and running inspections throughout the service terms. They shall include one major annual maintenance visit and a minimum of three running inspections each year. All findings and work completed shall be recorded in a report format and issued to the owner.

.3 Consideration should be given to further extended warranties on all products in northern and more remote regions of the province.

.3 DESIGN REQUIREMENTS

.1 Design Temperatures (Heating): Design heating systems to maintain indoor temperature of 21°C (70°F). Design outdoor temperatures shall be based on BC Building Code climatic data for the 1% January design temperature for the location.

.2 Design Temperatures (Cooling): For common areas (excluding corridors), design cooling and ventilation systems to maintain maximum indoor temperature of 24°C (75.2°F) when outside air is 30.5°C (87°F). Maintain a difference of 8.5°C (15°F), when outside temperature exceeds 30.5°C (87°F). For residential suites, design systems to maintain indoor operative temperatures within 80% acceptable limits as per the current edition of ASHRAE Standard 55 "Thermal Environmental Conditions for Human Occupancy". Design outdoor temperatures shall be based on BC Building Code climatic data for the 2.5% July design temperature for the location.

Unless addressed by implementing passive design strategies, provide mechanical cooling for the amenity / office areas in the Lower Mainland, Vancouver Island, Northern Interior and North Regions, and provide mechanical cooling for the amenity / office areas and residential suites in the Southern Interior Region. Where mechanical cooling is required, window mounted air conditioning units are not permitted.

.3 Take into consideration project specific factors such as climatic data, microclimate conditions, building envelope thermal resistance, orientation, glazing area and other relevant factors that affect heat gain to determine heating and cooling requirements for the project and to ensure compliance with the Design Temperature performance requirements. Implementing the passive design strategies, as per Section 3 – Energy and Environmental Design, shall be considered to reduce requirements for heating and reduce or eliminate requirements for mechanical cooling.

.4 Take into consideration redundancy in the design of the mechanical systems. When centralized

mechanical systems serve multiple dwelling units a failure of equipment shall not cause a total failure of that system. i.e. provide multiple circulation pumps, provide multiple boilers, multiple hot water tanks etc.

.4 VENTILATION

.1 Design of ventilation systems shall comply with the requirements of ASHRAE Standard 62-2001 "Ventilation for Acceptable Indoor Air Quality" except Addendum N as referenced in the BC Building Code and Vancouver Building By-law.

.2 Ventilation of residential suites shall comply with the requirements of Part 9 "Housing and Small Buildings", Section 9.32 "Ventilation" of the BC Building Code and Vancouver Building By-law. This applies to all Part 9 and Part 3 buildings.

.3 Where tobacco smoking is permitted inside residential suites, BC Housing requires IPALR (l/s/m2 @ 50Pa) to be 1.2 for Part 3, 1.5 ACH for Part 9 to ensure that adequate indoor air quality is maintained. Refer to Section 3 – Energy and Environmental Design.

.5 CONTROLS

.1 Where applicable, provide a Direct Digital Controls (DDC) system to control and monitor the mechanical systems and to maintain building performance to the desired comfort levels. The DDC system shall be non-proprietary and control and monitor all main equipment and temperature of all common areas.

.2 Where the DDC system is used, make sure the following requirements are met:

.1 All system controllers must be BACnet and BACnet testing laboratory tested and certified. There shall be at least one BACnet Building Controller (B-BC) device profile on the site for connection to the internet and OWS (Operator's workstation) via BACnet IP. All mechanical equipment including individual smaller equipment (i.e. RTU's, fancoils, etc.) shall be controlled by a BACnet Advanced Application (B-AAC) level controller. Zone level control may be either a BACnet, B-AAC controller or a BACnet Application Specific controller (B-ASC). A B-ASC must meet the local controller BACnet trending requirements specified within this specification. Direct trending of points from a B-ASC or B-AAC to a higher level controller B-BC via network polling is not acceptable..

.2 The system design should take into account the regional consideration, local availability of servicing and accessibility of the equipment, capacity of the operator to effectively maintain and use the equipment and cost associated to operate and run the facility. Provide a list of preferably minimum three contractors capable of servicing the controls system and located within the province as a part of the tender submission.

.3 The building Owner/Operator shall maintain an internet service with a static IP address to allow connection of the building automation systems via BACnet IP to allow remote servicing and troubleshooting of the controls system. Provide a direct connection between the DDC system and OWS. Each building will have its own operator workstation PC and B-AWS operator workstation software on site and directly connected to the BAS network without the need for firewalls except in the case of BC Housing directly managed buildings. In BC Housing directly managed buildings, the buildings shall be connected to the approved service provider via BACnet IP. BC Housing approval is required and shall arrange for a

secure VLAN connection for the BMS network

.4 The successful contractor shall be required to provide applied dynamic graphics and network addressing, connect to the site and arrange historical archiving. The touch-screen user interface must be directly connected to the local area BAS network with a local graphical user interface to allow basic operation of the connected systems.

.5 All controls to be clearly labelled, easy to locate and networked together. Detailed network layout with panel locations, network/circuit numbers to be provided by the Controls Contractor.

.6 All field hardware points, weekly schedule status, setpoint variable status, schedule shall be trended in a BACnet trend log resident on the host controller. All points associated with any mechanical equipment shall reside on one controller. Sharing points across multiple controllers for a single piece of equipment is not acceptable. All mechanical equipment status shall be placed in an accumulated runtime log. All hardware and software points shall be trended with 5 minute trend intervals.

.7 Each controller must have a minimum trend sample buffer of at least 300 samples per BACnet object trended on board the controller and communicate with the archiving software/appliance as required to allow storage of this data long term (minimum 4 years). The operator must be able to view a trend log or multi-trend through the B-AWS software on his desktop seeing active point direct from the controller and being able to scroll backward in time seamlessly while viewing the trends from active points to archived points.

.8 Provide a PC (or combined PC with B-AWS) with operating software, historical data archiving software or an embedded archiving appliance with integral software sized to collect trend log data on an ongoing basis automatically directly from the building automation network and communicate directly with the B-AWS workstation for trend log displays for a minimum of 4 years of data from all trend logs on site.

.9 Provide automatic fault detection and analytics and system operator use reporting software and reports utilizing the building automation system trend logs and controller databases be employed from the start of warrantee and through the full warranty year. The Owner may or may not choose to continue the services past the warrantee year. An alternate price to continue this service can be requested at the time of bid. The resulting reports shall be provided to the client's designate representative to assist in identifying mechanical, electrical and/or control systems issues while in warrantee. The Consultant should identify DDC system inputs and outputs in the building that require fault detection routines. Provide automated reports identifying these instances on a quarterly basis. In addition, provide an executive summary report to identify and prioritize the most critical instances that would be recommended to be repaired or investigated further.

.10 Provide a key performance indicator report to compare zone control performance to allow the client to focus their maintenance resources on the worst performing zone for maintenance.

.11 A completely engineered and commissioned graphics package shall encompass all input/output points of the DDC systems. It shall include graphics of the floor plans showing locations of all space sensors and graphics of all major mechanical equipment and systems indicating status and operating points and setpoints. Graphics shall display a clear, accurate and complete overview of all mechanical plant systems. Overviews shall be segmented to

provide detailed views of the individual system components. The software licence shall include graphics viewing and program editing options.

.12 The Operator shall be trained in using and operating the DDC System as a part of the commissioning process and during the extended service and maintenance contract provided

.13 The Controls Contractor shall be a recognized firm regularly employed in the engineering and installation of the DDC systems. The Controls Contractor and the controls manufacturer are subject to the approval by the Consultant and BC Housing. Acceptable control systems: Delta Controls, Automated logic or approved equal by Owner and Consultant. The network will be BACnet IP and/or BACnet MS/TP only.

.6 MANDATORY COMMISSIONING OF MECHANICAL SYSTEMS

.1 All mechanical systems shall be commissioned by an Independent Commissioning Agency. Depending on the local re-zoning by-laws and size/complexity of the project, there are three options of implementing the commissioning process:

- Option 1 – Enhanced Commissioning by Commissioning Authority (hired by Owner)
- Option 2 – Independent Commissioning, Balancing and Testing Agency (hired by Owner)
- Option 3 – Commissioning, Balancing and Testing Agency (by Mechanical Contractor)

.2 OPTION 1 — Enhanced Commissioning by Commissioning Authority (hired by Owner)

.1 Where the project is required to achieve LEED certification or where Enhanced Commissioning is required by the local re-zoning by-laws, the commissioning process shall follow the requirements of LEED v4 Fundamental Commissioning and Verification Prerequisite, Enhanced System Commissioning and Envelope Commissioning. Before the design development phase is complete, the Owner shall retain the Commissioning Authority who will review the design requirements/concepts and overlook/implement the enhanced commissioning process of the mechanical, electrical and building envelope components as related to functionality, energy performance and durability. Refer to LEED v4 rating system.

.2 The commissioning process shall follow ASHRAE Guideline 0-2005 "The Commissioning Process", ASHRAE Guideline 1.1-2007 "HVAC&R Technical Requirements for The Commissioning Process" and NIBS Guideline 3-2012 "Exterior Enclosure Technical Requirements for the Commissioning Process".

.3 The Mechanical Contractor shall provide full assistance in executing functional performance tests as directed by the Commissioning Authority. He shall retain the services of the independent Testing and Balancing (TAB) Agency to provide all required services for air and water flow measurements in accordance with ASHRAE Handbook "Testing, Adjusting and Balancing".

.3 OPTION 2 – Independent Commissioning, Testing and Balancing Agency (hired by Owner)

.1 Recognizing the desire to utilize the passive design strategies and a better performing building envelope in lieu of complex and difficult to operate/maintain mechanical systems and where the enhanced commissioning process is not required by the local re-zoning by-laws, the commissioning of the mechanical systems for Part 3 buildings shall be performed by an independent Commissioning Agency hired by the Owner. It is preferred that the

same company provides the Commissioning Agency and TAB Agency work on the project, provided they are done by different personnel.

.2 The Commissioning Agency is to coordinate and carry out the commissioning of all mechanical equipment and systems into full and complete operation. This shall include all HVAC, Plumbing and Fire Protection systems.

.3 The commissioning process shall follow ASHRAE Guideline 0-2005 "The Commissioning Process" and ASHRAE Guideline 1.1-2007 "HVAC&R Technical Requirements for The Commissioning Process". The scope of work by the independent Commissioning Agency shall include the services of the Testing and Balancing (TAB) Agency to provide all required services for air and water flow measurements in accordance with ASHRAE Handbook "Testing, Adjusting and Balancing". The Commissioning Agency and TAB Agency work on the project shall be provided by different personnel of the same company.

.4 The Commissioning Agency shall be a leader of the Commissioning Team consisting of: TAB Agency, Mechanical Contractor, Mechanical Consultant, Building Owner, Controls Contractor, Electrical Contractor and all other related trades.

.5 The Commissioning Agency shall review the design and operation of the mechanical systems and shall prepare and submit the Commissioning Plan. The Commissioning Plan shall detail the commissioning procedures and scheduling for each equipment and system in the project.

.6 The commissioning of the electrical systems is the responsibility of the Electrical Contractor. The commissioning of the building envelope is the responsibility of the Envelope Consultant.

.7 The commissioning process shall be divided into five distinct phases as follows:

- **Phase 1 – Equipment and Systems Readiness:**

  The Commissioning Agency shall verify that specific equipment or system is ready for starting, that all tests and certificates have been completed and all equipment have been checked and is ready to operate, including all wiring and controls.

- **Phase 2 – Equipment and Systems Start-up, Testing and Balancing;**

  The Commissioning Agency shall supervise start-up and check out operation, calibration, testing and adjusting of all equipment and systems. This includes all air and water balancing performed by the TAB Agency. All deficiencies shall be recorded and reviewed by the Commissioning Team and shall be corrected and verified prior to proceeding further. The Commissioning Agency shall perform a detailed inspection and testing of equipment and systems and shall certify the operations as complete.

- **Phase 3 – Verification of Equipment and Systems Operations and Performance:**

  The Commissioning Agency shall submit all test certificates and the Commissioning Completion Certificate at the time of requesting commencement of the verification process. The Commissioning Agency shall draw up a schedule for the verification inspection by the Consultant. The schedule shall list all equipment and systems and the estimated time required for verifying the operation of each item. This phase includes reviewing the project Record Drawings for accuracy and completeness, preparation

of Operating and Maintenance Manuals and submitting all testing/start-up reports and certificates/approvals from the Authorities Having Jurisdiction. When all required documents and certificates are complete and all equipment and systems are in full and satisfactory operation, the Substantial Completion may be declared by the Consultant.

• Phase 4 – Demonstration of Operations and Instructions to Owner's Personnel:

The Commissioning Agency shall prepare a schedule for the demonstration and instructional process, which shall be reviewed and approved by the Consultant and the Owner prior to implementation. The operation and maintenance requirements of all equipment and systems shall be demonstrated and explained in detail to the Owner's operating personnel. The Controls Contractor shall provide a separate demonstration/ training for controls and sequences of operation. On completion of the demonstration and instructional process, the Commissioning Agency shall obtain a signed statement of satisfaction from the building Owner.

• Phase 5 – Post-Substantial Performance Follow-up and Verification of Systems Operations:

The Commissioning Agency shall allow for a minimum of two separate site visits, scheduled for approximately five months and 10 months after the date of Substantial Completion, for general trouble-shooting and verifying the operation and maintenance of all equipment and systems. These site visits are over and above normal trouble and warranty call-backs. Following each site inspection, the Commissioning Agent shall submit a detailed report to the Consultant and the Owner outlining his findings, any problems encountered with the operation and maintenance of equipment and systems and any required repair work or correctional action.

.4 OPTION 3 – Commissioning, Testing and Balancing by Mechanical Contractor

.1 For Part 9 buildings, the commissioning, testing and balancing can be provided by the Mechanical Contractor

.2 The requirements for the commissioning, testing and balancing of the mechanical systems shall be included in the scope of work by the Mechanical Contractor. This shall include all HVAC, Plumbing and Fire Protection systems. The Contractor shall include for the services of the independent TAB Agency to provide water and air balancing services, if required. The Contractor shall provide the commissioning report, air / water balancing report and Operating & Maintenance Manuals prior to Substantial Completion

2 Products

.1 HVAC SYSTEMS

The HVAC systems shall meet the requirements of Section 1 – 8.2 Building and Energy Performance, Mechanical and Electrical Systems and Section 3 – Energy and Environmental Design.

.2 HEATING SYSTEMS

The heating system and its selection is the responsibility of the design team and the Owner / Housing Operator. It shall be selected to suit the building construction and the Energy Performance Targets. The selection of the systems shall take into account system operation and maintenance with the aim of simplicity. The chosen system shall be discussed and explained to the building owner/operator during the schematic design phase. BC Housing and the Owner / Housing Operator shall provide the signoff for the conceptual design prior to the commencement of the working drawings. This is to ensure that the passive design strategies have been considered and implemented and that the proposed mechanical systems are within the capability of the service team who will operate and run the facility. BC Housing may retain an independent consultant to provide a design review at the end of the design development stage.

For renovation projects, consideration should also be given to the existing equipment, systems and overall condition of the building before selecting the heating system and equipment.

All piping shall be installed so that it will in no way be strained or distorted by thermal expansion. Anchors and expansion loops shall be provided where necessary to protect equipment / piping and regulate expansion. This shall be the responsibility of the Mechanical Consultant and Contractor.

.1 Electric Heating

.1 Utilizing passive design strategies and a better building envelope allows considering use of electric baseboard heaters for heating of residential suites in a majority of new projects in the Lower Mainland and Vancouver Island regions, and for selected projects in other regions.

.2 Electric baseboard heaters shall be located under windows in bedrooms and living areas so not to interfere with the furniture layout. Avoid installation of heaters in kitchens due to cleaning problems and lack of wall space.

.3 Electric heaters in residential suites shall be controlled by wall-mounted thermostats. Built-in thermostats are not permitted in residential suites. Thermostats must not be installed in locations susceptible to drafts, direct sunlight or near heat sources.Thermostats controlling electric heaters with 1,500 Watts or more output per one area in a suite shall be programmable thermostats with a setback controls option..

.4 The mechanical consultant is responsible for sizing electric heaters based on heating load calculations. Even though this is not the industry standard, it is recommended that the mechanical consultant assumes also the responsibility for specifying the electric heaters and thermostats. This is to accommodate the option of using better, more robust and better looking electric baseboard heaters where the project can accept the cost premium.

.2 Forced Air Heating

.1 All furnaces shall be ENERGY STAR® rated high-efficiency condensing appliances with minimum 95% Annual Fuel Utilization Efficiency (AFUE).

.2 Flue vent and combustion air intake shall be connected directly to the furnace to provided operation with a sealed combustion.

.3 At least one heating outlet per each occupied room shall be provided and located, preferably, at the floor level. For each floor /dwelling unit there shall be at least one return

duct. Do not locate heating ducts under refrigerators or food storage cabinets.

.4 Each furnace shall be controlled by a wall mounted low voltage programmable thermostat with a setback controls option.

.3 Hot Water Boilers

.1 All boilers shall be high-efficiency appliances with minimum 94% Annual Fuel Utilization Efficiency (AFUE):

- ENERGY STAR® rated for 299 MBH and less;
- Listed on Fortis BC Eligible Commercial Boiler List for condensing boiler with 300 MBH and greater.

.2 For buildings with multiple residential suites and where boilers are the main source of heating, the boiler plant shall consist of at least two boilers, each sized for a minimum of 60% of the peak heating demand.

.3 Where possible and practical, utilize a concentric venting system (inner flue exhaust and outer combustion air intake) to increase efficiency by pre-heating intake air and reduce number of envelope penetrations.

.4 Use of wall-hung low-mass condensing boilers is acceptable and encouraged on smaller projects and where boilers act as a supplementary or backup source of heating only. For larger projects where boilers are a main source of heating, utilizing high-mass boilers without minimum water flow requirements is preferred.

.5 Boilers used as a main source of hot water heating shall be separate from the domestic hot water system. Where boilers act as a supplementary or backup source of heating only, it is acceptable to utilize boilers for generation of domestic hot water.

.4 Hot Water Baseboard Heating

.1 Where using low temperature heating water source and to increase efficiency where using condensing boilers, consider utilizing high-efficiency baseboard heaters in lieu of standard heaters with fin-tube elements. The high-efficiency heaters shall be capable of providing high heating output with lower temperature heating water.

.2 All baseboard heaters shall be provided with a shut-off valve, balancing valve and control valve. Each riser shall have an automatic air vent at the top.

.3 All bedrooms and a living area in a residential suite shall be provided with individual wall mounted thermostats. Thermostats must not be installed in locations susceptible to drafts, direct sunlight or near heat sources. Thermostats controlling hot water heaters with 1,500 Watts or more output per one area in a suite shall be programmable thermostats with a setback controls option.

.4 Consider utilizing a single hot water riser per each suite with in-slab PEX piping distribution from a manifold to all perimeter heaters. The shut-off, balancing and control valves shall be all provided as a part of the pre-assembled manifold.

.5 Infloor Heating

.1 Provide detailed design information on the drawings for all heating zones including, but not limited to, room identification, room-by-room heat loss calculations, floor covering insulation value, supply water temperature, design temperature drop, flow rate required per

each zone, location of headers and thermostats.

.2 Supply water temperature in the in-floor loop shall be controlled based on the outdoor temperature reset schedule and maximum allowable floor surface temperature to avoid overheating. Carefully consider run-outs of in-slab piping to individual floor heating loops. Where there is many run-outs located in the interior areas (e.g. corridors), insulate run-out piping with 13mm Armaflex insulation to prevent overheating.

.3 All installations shall be tested with minimum twice the working pressure, the test shall stay on during the construction period.

.4 All tubes and recommended fasteners shall be placed as per the manufacturer's specifications. Tube spacing should not exceed 305 mm (12") centre to centre. Each loop must be fastened at each bend, and spacing between each fastener should not exceed 914 mm (3'). The length per loop in a zone for 12.7 mm (1/2") tubing shall not exceed 76.2 m (250').

.5 No pipework tubing joints are permitted under the slab. . Fittings shall be PEX-A cold expansion type fittings in accordance with ASTM F1960 "Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) Tubing". Use of crimped fittings is not permitted. Tubing shall not be placed under any area where a fridge or freezer may be placed, or under any cabinets. The preference is to locate the heating manifolds in common corridor areas. Access shall be provided through lockable access doors from outside of residential suites.

.6 Topping should be gypsum concrete, or equivalent. Minimum 19 mm (3/4") coverage shall be provided by the topping. Exposed PEX piping shall be protected from UV exposure during construction.

.7 At exterior walls, tubing should be installed 150 mm (6") on centre up to 1200 mm (4') from the wall.

.8 All tubing shall be in accordance with ASTM F876 "Standard Specification for Cross-Linked Polyethylene (PEX) Tubing" and shall be provided with an oxygen barrier.

.9 Solid PVC sleeves shall be provided where tubes pass through concrete floors.

.10 Provide a separate zone with a control valve and wall mounted non-programmable thermostat for all bedrooms and a living area in a residential suite.

.11 Each radiant zone shall be equipped with the following:

- **.1** supply and return manifold, complete with a lockable metal access cover
- **.2** manual air vent on the return manifold
- **.3** balancing, or isolating valves on each loop, supply and return
- **.4** zone control valve
- **.5** labels, or tags indicating room, and area of service, and length of each loop

.12 PEX tubing shall carry a 25-year and manifolds a 5-year non-prorated warranty against failure due to defect in material or workmanship. Warranty shall provide for repair or replacement of any tube or fittings which are proven to be defective and pay for consequential damages.

.3 HEAT PUMP SYSTEMS

.1 Where justified by climatic conditions, heating and mechanical cooling requirements, energy targets, cost analysis and budget constraints, consider utilizing heat pump equipment in a form of central air-to-water or geothermal heat pump systems. In moderate climatic conditions of the Lower Mainland and Vancouver Island, the air-to-water heat pumps (air-cooled reversible chillers) can provide efficient operation for generating chilled water for cooling and low temperature heating water for heating. For the North, Northern Interior and Southern Interior regions, a closed loop geothermal system utilizing central water-to-water or distributed water-to-air heat pumps can be considered. BC Housing shall provide signoff for the conceptual design prior to the commencement of the working drawings for any designs proposing this type of system.

.2 Air-to-Water Heat Pumps

.1 Consider utilizing central air-to-water heat pumps for projects located in the Lower Mainland or on Vancouver Island. For projects using in-suite electric baseboard heaters and a central heat recovery system for ventilation, consider utilizing an air-to-water heat pump system for heating and cooling of the common and amenity areas and for supplementary heating and mechanical cooling of ventilation air. Consider utilizing a larger air-to-water heat pump system for projects using in-floor heating.

.2 Each central air-to-water heat pump system shall be provided with a full backup from gas-fired boilers. The boiler system shall be designed to provide supplementary heating to the heat pump loop when the heat pumps cannot cover all heating loads by themselves and to provide a sole source of heating in case of a heat pump failure or at extremely cold outdoor conditions.

.3 Noise generated by air-to-water heat pumps located, in most cases, on the roof shall be taken into account when considering using this system. Obtain comments from the acoustical consultants and consider using acoustical screens, low-noise condenser fans and additional noise attenuation for compressors.

.4 Air-to-water heat pumps shall be protected from freezing. For buildings, which do not have emergency power provide minimum 25% polypropylene glycol solution in the heat pump source loop. Separate the heat pump source loop from the building load loop with a heat exchanger. For buildings, which have emergency power it is up to the Engineer of Record to choose between an option of providing glycol solution or using heat tracing connected to emergency power for freeze protection.

.5 Provide a buffer tank in the heat pump loop to allow for minimum runtime of compressors. Size a buffer tank as per the manufacturer's recommendations. A switchover heating-to-cooling system with a single buffer tank is acceptable but the system shall be designed to provide a minimum 10 hours delay between switching from a cooling to a heating mode and vice versa. Prevent the startup in the cooling mode until temperature in the buffer tank is less than 26°C (80°F).

.6 Consider utilizing the air-to-water heat pump system for preheating of domestic hot water.

.3 Geothermal Heat Pumps

.1 An option of utilizing a closed loop geothermal heat pump system shall be carefully

analyzed against the extra initial cost of installation. Verify the existing database of drilling conditions in the area of the project before proposing this option. Consider utilizing a small geothermal system for heating and cooling of the common and amenity areas and for supplementary heating and mechanical cooling of ventilation air. Avoid designs with a largely unbalanced cooling loads in summer and heating loads in winter as this can result in a gradual degradation of the ground loop performance.

.2 For projects exceeding 15 vertical geothermal wells and for all projects in areas without the confirmed database of drilling conditions, arrange for drilling a test well including a Formation Thermal Conductivity (FTC) test. The test well shall be located in an area, which would allow re-using the test well and connecting it to the final ground loop.

.3 The design and installation of the geothermal heat pump system shall comply with CSA Standard C448 Series 02 "Design and Installation of Earth Energy Systems", CSA Standard C446 "Performance of Ground Source Heat Pumps" and International Ground Source Heat Pump Association (IGSHPA) standards.

.4 All ground loop piping shall be high density polyethylene piping manufactured from resin compound PE3408 and extruded to CSA Standard B137.1. All polyethylene piping shall carry CSA identification.

.5 The ground loop shall be charged with 20% polypropylene glycol antifreeze solution. For boreholes with depth up to 100 m (330 ft), use 25 mm (1") diameter polyethylene SDR-11 pipes rated at 1,107 kPa (160 psi). For boreholes exceeding depth of 100 m (330 ft), use 32 mm (1-1/4") diameter polyethylene SDR-9 pipes rated at 1,730 (250 psi). The boreholes shall be pressure grouted with thermally enhanced grout. Connect piping from individual boreholes to supply and return horizontal headers not exceeding 50mm (2") diameter in a "reverse return" configuration. Provide multiple headers and design the ground loop not to exceed the maximum pressure drop of 150 kPa (50 ft) up to and including manifolds inside the building.

.6 Provide a bypass connection separating the ground loop from the building loop. This is to allow commissioning of the ground loop before the building installation is complete. Pressure test piping in vertical wells, each header assembly and the entire ground loop. Purge and flush the entire loop prior to addition of antifreeze.

.7 The ground geothermal loop shall be installed by an experienced contractor with IGSHPA certification and approved by the Consultant.

.8 Consider utilizing the water-to-water heat pumps, distributed air-to-water heat pumps or a combination of both. Consider utilizing the water-to-water heat pump system for preheating of domestic hot water.

.4 VENTILATION

.1 The design of ventilation systems shall comply with the requirements of ASHRAE Standard 62-2001, Section 9.32 of the BC Building Code and Vancouver Building By-law and BC Housing standard for residential suites where tobacco smoking is permitted, as listed in Section 5 Construction Standards – Division 23, Sub-Section 1.4 - Ventilation.

.2 All major ventilation systems shall include heat recovery with a minimum sensible heat

recovery effectiveness of 75%. Option of air bypass or other means of stopping heat transfer should be provided for all heat recovery systems to utilize shoulder season or summer night time cooling. Wherever practically possible, all Part 3 buildings should be provided with a central HRV system or systems.

.3 The central heat recovery ventilation air handling units shall include supply and exhaust fans, enthalpy heat recovery energy wheel with variable speed controls, heating coil or a combination heating/cooling coil, filters and motorized dampers on outdoor air and exhaust intakes.

Utilizing a combination of heating/cooling coil and providing mechanical cooling of ventilation air is a preferred option as it improves indoor air quality in residential suites. Using a hybrid ventilation mode of mechanically cooled ventilation air supplemented by a properly designed passive natural ventilation will, in most cases, meet 80% acceptable indoor operative temperature limits as per ASHRAE Standard 55 in the climatic conditions of the Lower Mainland and Vancouver Island.

Exhaust air shall be ducted to the central heat recovery ventilation air handling unit from all bathrooms in residential suites. Supply air shall be distributed to all bedrooms and living areas. Supply and exhaust ducts should be, preferably, distributed in the corridor ceiling plenums. Limit size of the distribution ducts to maximum 150 mm (6") in height. For larger buildings, consider utilizing multiple air handling units to limit size of distribution ducts. Supply and exhaust connections to residential suites should be, typically, 125 mm (5") diameter flexible duct connections to help conserving headroom in corridors and to provide access to fire dampers required at wall penetrations. Non-insulated flexible duct connectors shall be made from heavy vinyl-coated fiberglass cloth mechanically locked together with a scuff protecting galvanized steel helix, Flexmaster Fabriflex type 4, or approved equal. Insulated flexible duct connectors shall be insulated reinforced aluminized trilaminate flexible ducts mechanically locked together by a galvanized steel helix with a flame retardant polyethylene vapour barrier, Flexmaster Fabriflex type 5T, or approved equal. It is mandatory to connect flexible to rigid ducts using stainless steel worm gear type clamps.

If the central ventilation system serves common and amenity areas in addition to residential suites, consider providing a separate heat recovery ventilation unit for the amenity areas to allow shutting it down during the unoccupied hours.

.4 IIndividual in-suite heat recovery ventilators (HRVs) shall be installed with proper access for maintenance and servicing. HRVs shall be provided with Electronically Commutated Motors (ECMs) on supply and exhaust fans. An air bypass option to utilize "free cooling" should be considered.

An HRV in a residential suite shall be ducted to all bathrooms on the exhaust side and to all bedrooms and a living area on the supply side.

In buildings with concrete construction located in the Lower Mainland or on Vancouver Island utilize in-slab ducts for outdoor air intake and exhaust discharge. Intake ducts shall be wrapped with a reflective type insulation for a minimum of 6 m (20 ft) from outside wall. Where possible, maintain a minimum 1.8 m (6 ft) separation between exhaust outlets and outdoor air intakes.

HRVs shall operate continuously at a low speed and shall automatically turn into a high speed by turning on a switch in any bathroom.

Consider providing a single HRV serving more than one residential suite and located in the common area.

.5 Utilizing corridor pressurization as means for providing ventilation for residential suites is not permitted. Corridors shall be ventilated as per the requirements of ASHRAE Standard 62-2001. Transfer of tobacco smoking and cooking odors between suites and to a corridor shall be controlled by proper airtightness of partition walls.

.6 Provide residential kitchens with range hoods as per Division 11 30 00 – Residential Equipment. The charcoal filtered range can be considered to achieve higher energy efficiency and passive house projects.

.7 Fresh air intakes must be galvanized steel or aluminum watertight hood type or weatherproof louver type with insect protection. Wall type grilles are not acceptable. All exhaust hoods must have a backdraft damper. Intakes must be designed to prevent rain penetration at design wind pressure for the location. Connections must be sealed to the weather barrier of the wall assembly. Each hood or louvre must be connected to the duct it serves by durable airtight connections. Screens must be removable for cleaning.

.5 TENANT LAUNDRY ROOMS

.1 Except where using condensing or heat pump dryers, include provisions for adequate make up air. Make up air shall match air exhausted by dryers. Consider means of heating make up air when using outdoor air. Transfer of air from surrounding areas may be used. Consider utilizing a concentric venting system (inner exhaust and outer make up air intake) as means of pre-heating make up air.

.2 Connect exhaust dryers directly to building exterior (outside). Do not use plastic or thin foil ducting, use rigid metal duct. Condensing or heat pump dryers require only a connection to a drain pipe.

.3 Provide dryer exhaust duct(s) to 102 mm (4") from floor level for subsequent connection to appliances.

.6 PARKING EXHAUST

Provide mechanical exhaust ventilation for common underground or enclosed parking areas, controlled by CO and combustible gas sensors. Install CO sensors 1.5 m and combustible gas sensors 150 mm above the floor level. Locate parking exhaust louvers a minimum of 3 m (10 ft) clear of any operable window or fresh air intake

.7 TEMPORARY USE OF SYSTEMS

.1 The Contractor shall obtain the Owners' permission prior to using any permanent heating or ventilation systems during construction.

.2 Prior to approval, the Contractor shall confirm in writing that use of heating equipment during construction does not void warranty. If approved, the Contractor must ensure that all filters are

in place prior to use of the equipment.

.3 The Contractor must also overhaul any mechanical equipment used for temporary heating or ventilation, prior to completion of project as follows:

.1 Replace all filters.

.2 Clean all pipes and ducts.

.3 Inspect, service and lubricate all equipment.

.8 LABELING

.1 In projects with a central distribution system, identify main valves, pipes and devices. In individual units identify each hot water heating zone indicating room, area of service and length of each loop if system is radiant in-floor heating.

.2 Band main piping with 51 mm (2") wide pressure sensitive self-adhering plastic coated tape, colour-coded. Provide colour code and arrows and words to identify pipe or duct function and flow direction.

.3 Provide colour-coded piping in boiler and equipment rooms complete with flow indication. Provide to each valve in these rooms a brass tag, embossed with valve number. Install charts listing these valves and their purposes, together with remarks concerning operation, in glassed-in frames fixed to the walls of rooms.

.4 Provide a directory of these valves.

3 Execution

.1 Connect natural gas supply lines to equipment with proper approved flexible connectors.

.2 Construction assembly penetrations:

.1 Fit wall finishes and cabinet backs with escutcheon around openings for supply and waste piping where pipes are hidden in cabinetry.

.2 Caulk gaps between wall finishes and pipes where the gap is less than 13 mm (1/2"). For gaps greater than 13 mm (1/2"), provide escutcheon plate.

.3 Where escutcheon plates are too small to cover the gap, neatly patch with the prefinished material used for cabinet backs or with the same wall finish as the pipe surround.

.4 All openings through fire separations shall be repaired to maintain the integrity of the fire separation. Any openings around piping or ductwork shall be sealed with a ULC listed fire-stop and smoke seal system. Refer to Division 07 80 00 – Firestopping and Smoke Seals.

.5 Provide vibration and acoustic isolation treatment for mechanical equipment, to prevent vibration and noise transference to adjacent living spaces.

.3 PIPING

.1 Insulate heating and cooling piping with preformed glass fibre type insulation. Insulate

all supply and return piping as required by ASHRAE 90.1 – 2010 and follow BC Insulation Contractors Associations approved insulation details.

.2 Provide supports for pipes. Maintain required grading by adjustment; allow for expansion and contraction and produce a neat appearance. Design supports to suit loading and services. Prevent undue stress to structural members. Supports must secure pipe and prevent vibration.

.3 For all copper horizontal piping use wrought clevis hangers 25 mm (1") larger than pipe diameter suitable for vertical adjustment, isolated from pipe with plastic tape.

.4 Provide access panels to concealed valves and clean-outs. ULC rating required in rated assemblies.

.5 Install escutcheon plates at piping penetrating wall.

.4 DUCTS

.1 All duct joints must be sealed with a water-based duct sealant to ensure no air leakage into surrounding space. Where required, ducts must be insulated with glass fibre wrap to ASHRAE 90.1 – 2010 and to prevent condensation within the duct.

.2 Ducts which penetrate the weather barrier of the exterior wall assembly must be sealed to the weather barrier using self-adhesive bituminous membrane, expanding foam sealant, and/or an accessory specifically designed to provide a water and air tight connection to the weather barrier of the exterior wall assembly.

.5 SEISMIC RESTRAINT

.1 Seismic restraint must be provided for all mechanical equipment and accessories including attachment to structural members where required by code.

.2 Letter of Assurance from Seismic Professional Engineer Registered in BC on commencement of design and completion of field review must be provided to confirm that seismic restraint meets regulatory requirements.

End of Section