ADDENDUM 1

This Addendum is issued by DIALOG® prior to Bid Closing Date to provide revisions, clarification or supplemental terms or conditions. All such revisions, clarifications or supplemental terms or conditions forms part of the Bid and Contract Documents, and amends the original Bid Documents titled:

Project:	**RDNO Athletic Park Amenities Building**
Project No.:	**Project No.:04228V0100**
Dated:	**2014-06-02 IFB**

The effects of this Addendum shall be included in the Bid Price.

Bid Closing Date: Thursday, August 21, 2014 **Time of Bid Closing: Before 14:00:00**

Reason for Addendum: Mechanical Primary Bid and Alternate Bid Specifications

Addendum Issue Date: 2014-07-29 **Total of Pages (Including Cover and Att): 86**

Number of Attachments: 84 pages

Issued By:

Ms. Victoria Kusznir
DIALOG®
406 – 611 Alexander Street,
Vancouver, BC V6A 1E1

CONTENTS OF THIS ADDENDUM FOLLOW THIS COVER SHEET

1 General

Bidders are reminded that with respect to the Bid Form, should any items be omitted or be illegible, should any alteration be made to the text, or should any condition be added on or submitted with the Bid Form that was not requested by the Consultant, their Bid may be declared invalid and rejected by the Owner.

Ensure that all parties submitting bids are aware of items in this Addendum and any affect on other work. Perform Work affected by this Addendum in accordance with the Contract Documents.

List of Attachments:

Mechanical Specifications – Primary Bid, 42 pages

Mechanical Specifications – Alternate Bid, 42 pages

2 Attachments from Consultants

2.1 MECHANICAL CONSULTANT

2.1.1 Correspondence prepared by Williams Engineering Canada, dated May 30, 2014 and titled “Mechanical Specification” consisting of 42 pages forms part of this Addendum.

2.1.2 Correspondence prepared by Williams Engineering Canada, dated May 30, 2014 and titled “Mechanical Specification – Alternate Price” consisting of 42 pages forms part of this Addendum.

END OF ADDENDUM No. 1

Mechanical Specification

Prepared for:

Dialog BC Architecture Engineering

406-611 Alexander Street
Vancouver, BC

Prepared by:

Williams Engineering Canada Inc.
Suite 304, 1912 Enterprise Way | Kelowna, BC | V1Y 9S9
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Project #: 029042.00

RDNO ATHLETIC PARK AMENITIES BUILDINGS

Michael Raiva P.Eng

Table of Contents

1 GENERAL

1.1 It is the intention of these specifications and drawings to provide for a complete and fully operating mechanical system as described herein, and in complete accord with applicable codes and ordinances. The work to be done shall include the provision of all labour, materials, tools and equipment as well as the application of a competent knowledge of construction, required for the installation, testing and commissioning of the complete mechanical system.

1.2 The drawings and specifications are a guide to establishing quality of equipment, materials, workmanship and performance. Drawings and specifications are complementary to one another. The term "provide" shall mean to supply and install.

1.3 References to “Consultant” in this document shall mean Williams Engineering Inc.

1.4 Any discrepancies between drawings and specifications leaving in doubt the true intent of work shall be brought to the attention of the Consultant immediately.

1.5 Before submitting his tender, the Contractor shall examine the site and all existing conditions affecting the work under this contract. He shall investigate and satisfy himself that he can supply and install this work without any additional charges after award of the Contract.

1.6 The mechanical system shall comply with the requirements of the local municipal building by-laws, the current edition of the British Columbia Building Code, British Columbia Plumbing Code, British Columbia Fire Code and all revisions and amendments thereto. The Contractor shall pay all fees, obtain all permits required, and obtain inspections and approvals from the inspection authority.

1.7 Furnish a written guarantee stating that all equipment supplied and all work executed under this contract will be free from defects of materials and workmanship for a period of one (1) year from the date of acceptance of the completed contract, and further that any defective materials that become evident during the guarantee period will be corrected at no additional cost to the Owner.

1.8 Employ only tradesmen having valid provincial trade certificates related to their work. All work shall be executed in a workmanlike manner and shall present a neat and finished appearance when completed. Workmanship shall be in accordance with recognized trade standards.

1.9 All materials used shall be new and the best of its respective kind. All equipment installed shall be in accordance with the manufacturer's printed installation directions.

1.10 The Contractor shall familiarize himself with the building plans and shall cooperate with the Owner so that the work will not conflict with operations. Any conflicts or defaults which arise during the construction period must be resolved immediately.

1.11 Without additional charge or expense, make any necessary changes or additions to accommodate the structural, electrical and architectural conditions that are required for the completion of the work.

1.12 Insurance coverage shall be provided by the Contractor unless otherwise indicated.

1.13 Leave systems operating with work areas clean and to the satisfaction of the Consultant.

1.14 All demolished materials and equipment are the property of the contractor and shall be removed from the site, unless otherwise directed by the Owner.

1.15 Patch and make good any materials and equipment.

2 DESCRIPTION OF WORK

2.1 Be responsible for all work identified or implied by the drawings and specifications, including but not limited to;

.1 Installation and commissioning of all systems, including the equipment provided by the Owner where noted.

.2 Balancing of the air and water systems. Make provisions for easy access for air and water balancer.

.3 Revision and testing of the heating, ventilation, plumbing and sprinkler systems in the area.

.4 Disposal of all unused material.

.5 Be responsible for the performance and commissioning of all equipment supplied and installed for the project (including all equipment supplied by the Owner where applicable).

3 STANDARD OF ACCEPTANCE

3.1 Means that item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

3.2 Where two or more manufacturers are listed, the manufacturer's name shown underlined or shown with a model name and/or number, was used in preparing the design. Tenders may be based on any one of those named, provided that they meet every aspect of the drawings and specifications.

3.3 Where other than the underlined manufacturer or named manufacturer is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.

3.4 Where two or more items of equipment and/or material, of the same type, are required, provide products of a single manufacturer.

3.5 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

4 ADDITION OF ACCEPTABLE MANUFACTURERS

4.1 Material/products considered to satisfy the specification, but of a manufacturer other than those named in the Specification may be submitted to the Consultant for consideration not later than five (5) working days prior to closing of tender

4.2 Addition of manufacturer's names to the specifications will be in writing by the Consultant.

5 EXISTING SERVICES

5.1 Confirm locations and routings of all existing services which might be affected by the work. Protect existing and repair any damage occasioned by the work. Accommodate work changes in location and routing as may be necessary.

6 CUTTING & PATCHING

6.1 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Make good all revisions to match the original condition.

6.2 Verify the location of existing service runs and structural reinforcement within existing roof, floors and walls prior to cutting. Cutting of structural building components shall only take place upon the receipt of specific written approval of the Structural Consultant. Repairs to existing services damaged as a result of cutting is included in this section of the work.

7 MISCELLANEOUS METAL

7.1 Be responsible for all miscellaneous steel work relative to the Specifications, including but not limited to support of equipment.

7.2 All steel work shall be prime coated, ready for paint finish.

8 ACCESSIBILITY

8.1 Install all work so as to be readily accessible for adjustment, inspection, operation and maintenance.

9 ACCESS DOORS

9.1 Install at all concealed dampers, traps, unions, valves, water hammer arrestors, special equipment, and trap primers.

9.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation and maintenance.

9.3 Do not locate access doors in feature wall or ceiling construction without the prior approval of the consultant. Locate in service areas wherever possible.

10 GUARDS AND COVERS

10.1 Provide removable protective guards on all exposed V-belt drives and shaft couplings in accordance with Worker's Compensation Board requirements.

10.2 Removable access covers shall be provided for all equipment installed under this project.

11 LUBRICATION OF EQUIPMENT

11.1 Lubricate all equipment prior to being operated, except sealed bearings, which shall be checked.

11.2 Use the lubricant recommended by the manufacturer for the service for which the equipment is specified.

12 ESCUTCHEONS

12.1 Provide escutcheons on all pipes passing through finished walls, floors and ceilings.

12.2 Escutcheons shall be chrome plated or stainless steel suitable for dimensions of piping and insulation.

13 PAINTING

13.1 Clean exposed bare metal surfaces supplied under Division 15 removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal. Paint all exposed ducts, equipment and supports with two finishing coats of paint; color to be as directed by the Owner.

13.2 Paint all pipe hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.

13.3 Repaint all marred factory finished equipment supplied under Division 15, to match the original factory finish.

14 PENETRATION OF FIRE SEPARATIONS

14.1 Seal all pipe and duct penetrations through fire separations with "3M Fire Barrier" system or equal U.L. Listed system.

15 TEMPORARY USE OF MECHANICAL SYSTEMS

15.1 Obtain written permission from the Consultant if it is desired to use the mechanical systems for temporary heat.

15.2 The following conditions must be confirmed prior to the use of the mechanical systems for temporary heating.

- .1 Any equipment start-ups shall comply with specified procedures.
- .2 All sanding must be complete, spray painting must be complete.
- .3 The contractor must pay for the gas/electricity.
- .4 All inspectors approvals must be received.
- .5 Lubricate all equipment operated.
- .6 Alarms/controls must be operational.

15.3 During the temporary heating period, comply with the following conditions:

- .1 Keep all rooms broom clean.
- .2 Maintain chemical treatment of piping systems.
- .3 Maintain the systems.
- .4 Operate the units utilizing 100% outside air if possible to avoid pulling building air into the return ducts and the units.

15.4 Before handing the systems over to the Owner, comply with the following conditions:

- .1 Bring plant to" as-new" conditions.
- .2 Replace all panel type air filters installed under this contract with new filters.
- .3 Re clean ductwork as necessary and provide a report from the approved duct cleaning agency certifying that the ductwork is clean.

16 SYSTEMS COMMISSIONING, VERIFICATION AND DEMONSTRATION

16.1 Be responsible for the performance and commissioning of all equipment provided under Division 15. Commissioning is the process of advancing the installation from the stage of static completion to full working order to specified requirements. It is the activation of the completed installation.

16.2 Acceptable Commissioning Contractors: BC Tech Engineering Services, R.A. Bruce Associates, Inland Technical Services, MDT Systems, Western Mechanical Services, KD Engineering.

16.3 In consultation with the General Contractor, ensure that sufficient time is allowed and fully identified on the construction schedule for the proper commissioning of all mechanical systems.

16.4 Commissioning is concluded when mechanical systems have been balanced and the installation is in full working order and acceptable for use. The work will include the following:

.1 Balancing of the air systems as specified.
.2 Balancing of the liquid systems as specified.
.3 Balancing of domestic hot water recirculation systems.
.4 Set up air diffusers, registers and grilles for optimum distribution/comfort.
.5 Plug all air pressure and flow measuring holes.
.6 Adjust vibration isolators and seismic restraints for optimum performance. Provide letter of certification.
.7 Verification of tight closure of outside air dampers.
.8 Verification and certification of operation of all fire dampers.
.9 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations.
.10 Verification of water tightness of all roof and exterior wall penetrations.
.11 Verification that all coil drain pans operate.
.12 Verification that equipment is not short cycling.
.13 Verification of fire extinguisher pressures.
.14 Verification of operation of all mechanical related fire alarm functions.
.15 Set up all automatic control valves/dampers and automatic temperature control devices.
.16 Testing and debugging of the Building Automation System.
.17 Set up and test all alarm and protective devices.
.18 Obtain and review trend logs for all control points. Submit trend logs to Consultant with detailed comments after verification of proper operation of all control sequences.
.19 Verification and certification of sewage and septic system installations.

16.5 At the conclusion of commissioning, demonstrate the operation of the systems to the Consultant and then to the Owner's Operating Staff.

16.6 At the completion of the commissioning, testing, balancing and demonstration submit the following to the Consultant:

.1 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specification and drawings.
.2 Completed copies of all commissioning check lists plus copies of start-up reports from specialty contractors and vendors.
.3 Signed off Williams Engineering Inc. field reports.
.4 "AS-BUILT" record drawings, as specified.
.5 B.C. Boiler Inspection Dept. approval of boiler, pressure vessels and pressure piping installations.
.6 B.C. Gas Inspection Dept. approval of boiler on gas firing.
.7 Fire Commissioner's approval of oil fuel installations.
.8 A list of all alarm and protective devices tested, with the final operating settings.

16.7 The verification process shall include instructional seminars to demonstrate all systems and to explain the operation of each. The instruction shall include the following:

.1 Ease of access provided throughout for servicing coils, filters, motors, drives, fusible link fire dampers, control dampers and damper operators.
.2 Operation of all equipment and systems under each mode of operation and failure, including:
    .1 Building Automation System control features.
    .2 Boilers and associated fuel systems.
    .3 Air conditioners and refrigeration systems.

.4 Pumps, fans, heaters, unit heaters and coils.
.5 Sprinkler fire protection systems.
.6 Sewage and septic installations.
.7 Tanks - domestic hot water and expansion.

.3 After demonstration obtain the Owner's signature certifying that the demonstration has been performed and completed to their satisfaction.

17 SUBSTANTIAL PERFORMANCE REQUIREMENTS

17.1 Before the Consultant is requested to make an inspection for Substantial Performance of the work:

.1 Commission all systems and prove out all components, interlocks and safety devices.
.2 Submit a letter certifying that all work (including calibration of instruments and balancing of systems) is complete, operational, clean and all required submissions have been completed.

17.2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:

.1 All life safety items are completed and fully functional.
.2 All reported deficiencies have been corrected.
.3 Testing and balancing completed.
.4 Operating and Maintenance Manuals completed.
.5 "As Built" Record Drawing ready for review.
.6 System Commissioning has been completed and has been verified by Consultant.
.7 All demonstrations to the Owner have been completed.

18 OPERATING & MAINTENANCE MANUALS

18.1 Prepare instruction manuals which include equipment manufacturers' operating and maintenance bulletins, a report on the balancing of the air and water systems and a report on chlorination of water mains. The manuals shall be prepared by the Commissioning Contractor.

18.2 The manufacturers' bulletins shall include:

.1 General description of the equipment and their operation.
.2 Normal maintenance and minor trouble-shooting of each major item.
.3 Wiring diagrams.
.4 Control diagrams.
.5 Spare parts list.
.6 Local source of supply.

18.3 Submit three copies in suitably labeled hard cover binders, to the Consultant at least ten days prior to the Substantial Performance inspection date.

18.4 Provide a CD-ROM based copy of the Operating & Maintenance Manuals described above.

.1 The CD-Rom shall consist of all data in the manuals, arranged in a “pdf” format file, with an interactive menu system of bookmarks to match the manual format.
.2 Include the latest version of Adobe Acrobat Reader.
.3 Include “pdf” format copies of the as-built project drawings (contact the consultant for files).

.4 Submit the CD-ROM to the consultant for review and comment. Incorporate any suggested revisions.

19 SYSTEMS BALANCING

19.1 Adjust duct and terminal balance dampers, adjustable air turning devices and adjust or change drive sheaves to balance supply, return and exhaust air systems to provide the design air quantities (within +/-10%) at each outlet and inlet and to maintain the design relationship between the supply and exhaust air system quantities. Refer to the drawings for air quantities.

19.2 Acceptable Balancing Contractors: BC Tech Engineering Services, R.A. Bruce Associates, Inland Technical Services, MDT Systems, Western Mechanical Services, KD Engineering.

19.3 Adjust all air terminals to obtain the optimum air distribution pattern.

19.4 Adjust all air flow and pressure sensing devices.

19.5 Adjust the new water systems to design flow conditions.

19.6 Adjust the domestic hot water recirculation system flow rates.

19.7 Include 3 copies of a balance report for inclusion into the manuals.

20 SHOP DRAWINGS

20.1 The Contractor shall provide 6 copies of shop drawings of all equipment for the Consultant's review. Submit clear and descriptive control sequences prior to installation.

21 AS-INSTALLED RECORD DRAWINGS

21.1 Maintain one set of record drawings at the site. Clearly mark in red any changes or deviations from the original design intent. Record all changes to the work as the installation progresses.

21.2 At the completion of the work, certify the drawing as being accurate, mark the drawing as "AS-BUILT", and send to the Consultant upon Substantial Performance of this Contract.

21.3 Include in the tender price an allowance of $850.00 to transfer changes to the original documents. Coordinate changes to the original documents with the Consultant.

22 IDENTIFICATION

22.1 Each piping system shall be colour coded for identification and labeled with the system identification code letters, including temperature and pressure, if applicable, and directional flow arrows.

.1 Identify all new piping to existing building identification standards.

.2 Identify piping adjacent to valves and where valves are in series at no more than 2m [6'-6"] intervals. Identify piping at least once in each room and at 15m [50ft.] maximum spacing in open areas. Exception: gas piping to be identified at 2m [6'-6"] intervals in ceiling plenums.

.3 Identify piping both sides where piping passes through walls, partitions and floors. Identify piping at point of entry and leaving each pipe chase and/or confined space. Identify piping accessible at each access opening.

.4 Identification labels may be stenciled. Identification arrows labels and letters may be vinyl cloth (Brady B500) or vinyl film (Brady B946), with adhesive compatible with the surface temperature.

.5 Identification colour bands for primary and secondary colours to indicate the type and degree of hazard shall be applied to overlap a minimum of 50mm [2"]. Bands shall be Brady B550 vinyl cloth tape or Brady B946 vinyl tape, with adhesive compatible with the surface temperature.

22.2 Each piece of equipment shall be identified with its equipment schedule identification, e.g. supply fan SF-1, cooling coil CC-1, pump P-1.

.1 Provide laminated plastic plates with black face and white centre of minimum size 90mm x 40mm x 2.5mm [3-1/2" x 1-1/2" x 3/32"] engraved with 12mm [1/2"] high lettering. Use 25mm [1"] high lettering for major equipment.

.2 Apply nameplates securely in conspicuous places, on cool surfaces.

22.3 Secure 6mm [1/4"] self adhesive coloured dots, (Brady Quik Dots or Avery Data Dots), to the ceiling, to identify the location of access to equipment concealed above the ceiling

23 SPARE PARTS

23.1 Provide spare parts for the Owner as follows:

.1 one set of v-belts for each new piece of equipment.

.2 one set of filter media for each filter or filter bank installed.

.3 One box (12 cartridges) for each water filter installed.

24 VIBRATION ISOLATION

24.1 Provide vibration isolation on all motor driven equipment with motors of ½ HP and greater power output (as indicated on the motor nameplate) and on piping and ductwork, as specified herein. For equipment less than ½ HP, provide neoprene grommets at the support points.

24.2 Provide 20mm [3/4"] thick continuous perimeter closed cell foam gasket to isolate base of package type equipment, AHU's, exhaust fans, etc. from floors, roofs and roof curbs. Select width for nominal 3 psig loading under weight of equipment and allow for 25% compression, 5mm [3/16"]. Increase width of curb using steel shim if necessary to accommodate gasket. For light equipment such as exhaust fans, deflection should be a minimum of 0.05". Use hold down bolts selected for seismic loads. Isolate bolts from base of unit using neoprene hemi-grommets. Avoid compressing gasket (eg. use Hilti HVA adhesive set bolts, or equal, with steel washers and lock nuts, adjusted finger tight to the hemi-grommets). Size bolt and hemi-grommet for minimum lateral clearance. Standard of Acceptance: American National Rubber-EPDM-SBR blend SCE 41 type self-extinguishing neoprene, Mason Industries Type HG Hemi-Grommets

25 SEISMIC RESTRAINTS

25.1 Provide cable restraints on all isolated equipment and seismic restraint on all other equipment, piping and ductwork, all in general accordance with SMACNA Guidelines

25.2 Include in the Tender the services of a BC Professional engineer, regularly employed in the design of restraint systems to review and sign-off on all seismic supports and restraints. Submit "sealed and signed" Letters of Assurance from the Seismic Engineer.

25.3 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

25.4 All resiliently mounted equipment, including piping and ductwork, shall be provided with seismic restraining devices (snubbers).

25.5 Air terminals installed in grid ceilings on flexible duct shall have at least two galvanized steel seismic restraint wires attached to the building structure or to ceiling hanger wires. Attach security bridles at opposite corners of each air terminal and in such a manner that the air terminal cannot fall.

25.6 Air terminals installed in grid ceilings on rigid duct shall have at least two screws securing the air terminal to the duct.

25.7 Air terminals installed in grid ceilings not attached to ducts shall have at least two screws securing the air terminal to the ceiling support or at least two galvanized steel seismic restraint wires attached to the building structure or to ceiling hanger wires.

25.8 Provide galvanized steel seismic restraint wires for radiant ceiling panels attached to either building structure or to ceiling hanger wires.

25.9 Roof top unit systems shall have roof curb/support bolting restraint systems designed by a BC Professional engineer, regularly employed in the design of restraint systems. Submit "sealed" shop drawings for review by the Consultant.

25.10 Slack Cable Systems

.1 Slack cable restraints as supplied by Vibra-Sonic Control.

.2 Restraint systems as detailed in SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems" as reviewed by the "Office of the State Architect, Structural Safety Section" for California. If lesser restraint than recommended by SMACNA is proposed to meet local NBCC seismic requirements, provide shop drawings of details certified by a B.C. registered structural consultant.

26 DUCTWORK AND ACCESSORIES

26.1 Galvanized steel, lock forming quality. All ductwork to be constructed, braced, connected and jointed according to ASHRAE and SMACNA.

26.2 Provide stainless steel ductwork where noted on the drawings.

26.3 Snaplock seams and crimp joints are not acceptable.

26.4 All duct joints, indoor and outdoor, shall be completely sealed with an approved sealant. Sealants shall meet acceptable smoke and flame spread ratings.

26.5 Provide gauge of metal and bracing as required for 500 Pa [2" w.c.] static pressure or greater.

26.6 Install duct necks before grilles, registers and diffusers and cushion heads after diffuser take-offs. Provide maximum of 24" of flexible connection. Do not use flex to change directions.

26.7 Where flexible ductwork is used, provide factory fabricated insulated flex.

.1 Flexible vinyl coated steel helix bonded to inner duct liner. Fibrous glass thermal insulation.

.2 Outer jacket of metalized fire-resistant vapour barrier.

.3 Suitable for up to 500 Pa [2" w.g.] positive static pressure and/or 250 Pa [1" w.g.] negative static pressure.

.4 UL or ULC labeled, Class 1, duct connector.

.5 Connect to ductwork using two wraps of duct tape and stainless steel worm drive clamps or Panduit adjustable diameter clamps or Thermaflex duct strap.

26.8 Provide backdraft dampers where indicated on the drawings.

.1 Minimum Requirements:

.1 1.4 mm thick [16 ga] galvanized steel or aluminum channel frame.

.2 1.2 mm thick [15 ga] aluminum blades, complete with stiffening ribs/bends.

.3 Full blade length shafts; brass, ball or nylon bearings.

.4 Felt or neoprene anti-chatter blade strips.

.5 Blade connecting linkage with eyelet and pin bearings.

.6 Maximum blade length of 760 mm [30"], use multiples for larger dimensions.

.7 Manufacturer's label.

.8 Where a balanced backdraft damper (BBD) is indicated the damper shall incorporate an adjustable counterbalance weight and lever.

.9 Maximum pressure drop across damper at 4.06 m/s [800 FPM] shall be 45 Pa [0.18" w.g.]

.10 Standard of Acceptance: Airolite 625, Penn CBD-6.

26.9 Provide heavy duty opposed blade balance dampers with locking quadrant on each run out to a grille or diffuser and where indicated on the drawings.

.1 Identify the airflow direction and blade rotation and open and closed position.

.2 Provide sheet metal bridge to raise quadrant type operators above the insulation thickness. Provide open end bearings where bridges are used.

.3 The damper operating lever shall be arranged parallel with the damper blade.

26.10 Wire Mesh Screens

.1 Provide wire mesh screens in all air intake openings where noted on the drawings.

.2 Screens shall be constructed from aluminum wire 1.3 mm diameter [16 ga].

.3 Screen mesh shall be 12.7 mm [1/2"].

26.11 Provide fire stop flaps where indicated on the drawings. Fire stop flaps shall be single damper flap with spring catch, U.L.C. tested and labeled. Construct of minimum 1.35 mm [16 ga] thick sheet steel with 1.6 mm [1/16"] thick [asbestos] on unexposed side and corrosion-resistant pins and hinges. Arranged so as not to reduce duct free area. Provide thermal blanket as required. Standard of Acceptance: Ruskin CFSF.

26.12 Provide fire dampers where indicated on the drawings.

.1 Fire dampers shall be U.L.C. or Warnock Hersey tested and labeled. Fire dampers shall be curtain type, fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type in horizontal position with vertical air flow. Curtain fire dampers shall have blades retained in a recess so free area of connecting ductwork is not reduced. Standard of Acceptance: Ruskin, Nailor Hart, Controlled Air.

.2 Install in accordance with the SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems - Fourth Edition 1992.

.3 Size so that the free area of the duct is maintained through the assembly.

.4 Install in galvanized steel sleeve, retained in place with retaining angles on all four sides at each face of wall.

.5 Connect ductwork to damper sleeves using break-away duct joints on all faces.

.6 Fire dampers must be installed within wall thickness of fire separation.

.7 Use ULC approved fire stop sealant to caulk all joints between the fire damper sleeve angles and the sleeve and between the fire damper sleeve angles and the fire separation.

26.13 Duct and Plenum Access

.1 Provide access doors and panels as follows:

.1 Doors: where shown on the drawings.

.2 Panels:

.1 Every 12 m [40 ft] on all ductwork.

.2 At the base of each duct riser.

.3 Both sides of equipment blocking the duct, (e.g. air flow measuring stations, coils)

.4 At or to one side of other equipment in duct, (eg. Backdraft dampers, balancing dampers serving multiple inlets/outlets,

.5 Panels need not be provided where access is available through a door or a register mounted on the side of the duct.

.2 Products:

.1 Doors - construct in accordance with SMACNA Duct Standards Fig. 6-12 except for latch type. 40mm [1-1/2"] thick insulation.

.2 Panels - Nailor Hart, Ventlok, 25 mm [1"] thick insulation.

.3 Gaskets - neoprene or foam rubber.

.3 Hardware:

.1 Panels up to 400mm x 300mm [16"x12"] - 2 sash locks.

.2 Panels - 380mm x 500mm [15"x20"] - 4 sash locks.

.3 Doors - piano hinge and Ventlok 310 latches c/w front and inside handles and front door pull.

.4 Installation:

.1 Seal frames airtight.

.2 Install so as to not interfere with airflow.

.3 Install to provide easiest possible access for servicing and cleaning.

.4 Do not use sheet metal screws for attaching access panels to ductwork.

.5 Round ducts 330mm [13”] and larger shall include a short collar for the installation of access panels.

.6 Small rectangular ducts shall be transitioned for the installation of access panels.

26.14 Provide thermal breaks at all roof and wall penetrations.

26.15 Provide flexible canvas duct connections on all fan equipment.

26.16 Before handing the systems over to the Owner, comply with the following conditions:

.1 As a condition of acceptance all new and /or existing air ductwork systems shall be clean. The Contractor shall confirm system cleanliness in writing and shall assume responsibility for misinformation and correction of damage. Before starting fan systems, all supply outlets shall have clean cheesecloth attached to them.

.2 Final systems cleaning shall be performed by an approved Cleaning Agency.

.3 The cleaning shall be to the satisfaction of the Consultant and Owner.

.4 Provide a report from the approved duct cleaning agency certifying that the ductwork is clean.

.5 Provide new filters for all air handlers after cleaning has been completed.

27 PIPING INSTALLATION

27.1 Ream pipe ends. Clean scale and dirt, inside and outside before and after assembly.

27.2 During construction, protect all openings in piping and equipment, by capping or plugging to prevent entry of dirt.

27.3 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

27.4 Slope supply piping up (1:480) in direction of flow and drain from low points. Slope return piping down (1:480) in the direction of flow.

27.5 Use eccentric reducers at pipe size change installed to provide positive drainage.

27.6 Provide clearance for access for maintenance of equipment, valves and fittings.

27.7 Install unions or flanges in connections to all equipment and specially components.

27.8 Arrange piping connections to allow ease of access and for removal of equipment.

27.9 Align and independently support piping connections adjacent to equipment to prevent piping stresses being transferred.

27.10 Install valves with stems upright or horizontal unless approved otherwise.

27.11 Install valves to isolate each piece of equipment, and as indicated.

27.12 Construct piping to allow for expansion and contraction.

27.13 Tests and Cleaning

.1 Hydrostatically test all pipes for at least 8 hours prior to insulating.

.2 Repair all leaks as required for zero loss.

.3 Chemically clean and flush all new hydronic and steam piping prior to reconnection to equipment.

.4 Thoroughly flush all new domestic water piping.

27.14 Provide chemical treatment to match existing as required to refill system.

27.15 Provide chemical treatment and test kit for the hot water heating system.

.1 The Chemical Treatment Agency shall provide supervision of installations, set-up and adjustment and shall submit a written report on system operations.

.2 The Chemical Treatment Agency shall instruct the maintenance personnel before Substantial Performance. Written instructions of the treatment, dosages, control charts and test procedures shall be included in the maintenance manuals.

28 THERMOMETERS AND GAUGES

28.1 Select thermometers and gauges so that their operating range falls in the middle half of the scale range.

28.2 Thermometers shall be pipe mounted stem type in copper, brass or bronze well installed so as not to restrict flow. Thermometers shall be non-mercury actuated adjustable angle type, 225 mm [9"] scale length, white background with black lettering, with both Celsius and Fahrenheit scales.

28.3 Pressure gauges shall be 115mm [4 1/2"] diameter, phosphor bronze bourdon tube type with white background and black lettering. Provide needle valve ahead of each gauge. Provide kPa and PSIG scales. Use extensions where gauges are installed through insulation.

29 INSULATION - DUCTWORK

29.1 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Standards Manual" as a reference standard if sufficient detail/information is not specified herein.

29.2 External

.1 Flexible glass fibre insulation with integral vapour barrier.

.2 Thermal Conductivity at 24°C. - 0.042 W/m/°C.

.3 Acceptable Manufacturers: Certainteed STP Ductwrap #75, Fiberglas AF300 (type II) RFFRK, Knauf FSK Ductwrap, Manson Alley-Wrap FSK.

29.3 Acoustic Duct Liner

.1 Internal flexible glass fibre acoustical insulation with sealer coating on one face.

.2 Thermal Conductivity at 24°C. - 0.040 W/m/°C.

.3 Acceptable Manufacturers: Certainteed Ultralite #150, Knauf Duct Liner M, Manson Akousti-liner.

29.4 Insulation Accessories

.1 All insulation accessories (adhesives, tape, coatings, etc.) shall be approved for the specific application.

29.5 Duct Insulation Schedule:

.1 Provide 25mm [1"] thermal insulation for outside air ducts.

.2 Provide 25mm [1"] thermal insulation for exhaust ducts for 2.5m [8'] from roof or wall penetration.

.3 Provide 25mm [1"] thermal insulation for all interior supply ducts.

.4 Provide acoustic duct liner where noted on drawings (25mm [1”] minimum, 50mm [2”] where noted).

.5 Adhere insulation with insulation adhesive applied in 150mm [6”] wide strips at 300mm [12”] on centre and secure with twine at 300mm [12”] on centre.

.6 Provide 50mm [2”] insulation with waterproof jacket on all cooling and heating supply ducts located outdoors.

30 INSULATION - PIPING

30.1 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Standards Manual" as a reference standard if sufficient detail/information is not specified herein.

30.2 Preformed pipe covering with integral vapour barrier.

.1 Thermal Conductivity at 24°C. - 0.033 W/m/°C.

.2 Acceptable Manufacturers: Certainteed 500 ASJ/SSL, Fiberglas 850 ASJ/SSL or equal.

30.3 Flexible Foamed Elastomeric (refrigerant piping only):

.1 Thermal Conductivity at 24^{o}C - 0.040 W/m/ ^{o}C.

.2 Acceptable Products: AP Armaflex, Rubatex R-180-FS.

30.4 Insulation Accessories

.1 All insulation accessories (adhesives, tape, coatings, etc.) shall be approved for the specific application.

.2 Install flexible foamed elastomeric or flexible closed cell preformed piping insulation. Secure longitudinal and butt joints with adhesive. Insulate all fittings and components. To obtain the specified thickness, apply in layers with staggered joints.

30.5 Insulation Termination Points

.1 Terminate insulation 75 mm [3"] back from all uninsulated fittings to provide working clearance and terminate insulation at 90^{o} and finish with reinforced scrim cloth and vapour barrier mastic system. Cover onto pipe and over the insulation vapour barrier. On concealed hot services terminate insulation 75mm [3"] back from all uninsulated fittings, cut off at 90^{o} and apply reinforced scrim cloth and breather mastic system.

.2 Cut back insulation at 45^{o} and finish with a silicone caulking sealant around the base of thermometer wells, pressure gauges, flow switches and pressure and control sensors.

30.6 Pipe Insulation Schedule:

.1 Insulate plumbing vents for 2.5m [8'] from roof penetration. Do not use flexible duct wrap insulation.

.2 Insulate rainwater leaders for the entire length including roof drain bodies. Do not use flexible duct wrap insulation.

.3 Insulate all valves and pipe mounted equipment.

.4 Provide 25mm [1"] insulation for all heating pipes 50mm [2"] and smaller. 40mm [1.5"] for all heating pipes greater than 50mm [2"].

.5 Provide 40mm [1.5"] insulation for all steam and condensate pipes 50mm [2"] and smaller, 50mm [2"] for all steam and condensate greater than 50mm [2"].

.6 Provide 25mm [1"] insulation for all domestic hot water and hot water recirculation pipes 50mm [2"] and smaller. 40mm [1.5"] for all domestic hot water hot water and recirculation pipes greater than 50mm [2"].

.7 Provide 25mm [1"] insulation for all domestic cold water pipes.

.8 P-traps, waste arms and water supplies at all handicap accessible lavatories and sinks shall be insulated with a manufactured insulation kit or 12mm [½"] of fiberglass insulation and finished with a polyvinyl chloride jacket in a neat and workmanlike manner. Acceptable Manufactured Products: Truebro 'Handi Lav-Guard', Brocar Products Inc. 'Trap Wrap', Sexauer 'Handi Lav-Guard'

31 INSULATION - EQUIPMENT

31.1 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Standards Manual" as a reference standard if sufficient detail/information is not specified herein.

31.2 Flexible glass fibre insulation with integral vapour barrier.

.1 Thermal Conductivity at 24°C. - 0.042 W/m/°C.

.2 Acceptable Manufacturers: Certainteed STP Ductwrap #75, Fiberglas AF300 (type II) RFFRK, Knauf FSK Ductwrap, Manson Alley-Wrap FSK.

31.3 Rigid glass fibre insulation with integral vapour barrier.

.1 Thermal Conductivity at 24°C. - 0.042 W/m/°C.

.2 Acceptable Manufacturers: Certainteed STP Ductwrap #75, Fiberglas AF300 (type II) RFFRK, Knauf FSK Ductwrap, Manson Alley-Wrap FSK.

31.4 Insulation Accessories

.1 All insulation accessories (adhesives, tape, coatings, etc.) shall be approved for the specific application.

31.5 Equipment Insulation Schedule:

.1 Provide 40mm [1.5"] foil faced glass fibre insulation on top of each radiant panel to fully cover panel and interconnecting piping.

32 DOMESTIC WATER SYSTEMS - PIPING, VALVES AND FITTINGS

32.1 Piping and Fittings

.1 Hot and cold water and hot water recirculation piping: Type L copper with wrot copper fittings and 95/5 Sn/Sb, Silvabrite 100 or other lead free solder joints.

32.2 Gate Valves

.1 Solder or screwed end joints 50mm [2"] and smaller: Crane 1320 or 428, Jenkins 300P or 810, Lunkenheimer 2133 or 2127, Red & White 281A or 280, Neuman-Hattersley A41SE or A40AT / 33X, Kitz 41 or 40.

.2 Flanged ends 65mm [2½"] and larger: Crane 465-1/2, Jenkins 404, Lunkenheimer 1430C, Red & White 421A, Neuman-Hattersley 504, Kitz 72.

32.3 Ball Va**L**ves

.1 Ball: (in lieu of gate valves or as specified)

.2 50mm [2"] and smaller, brass two piece body, blow-out proof stem, PTFE seats, brass chrome plate ball, lever handle operator, 1035 kPa [150 PSIG] rating.

.3 Acceptable Products:

.1 Solder joint type: Red & White / Toyo 5049A, Apollo, Crane, Jenkins, Kitz, Lunkenheimer 746FS or 747FS, Neuman-Hattersley, Nibco, Watts, Worcester.

.2 Threaded joint type: Red & White / Toyo 5044A, Apollo-70 Series, Crane 93-TF, Grinnell 3700 full port, Jenkins-1101-T, Kitz 58, Lunkenheimer 746F or 747F, Neuman-Hattersley 1969AT, Nibco T-580-BR, Watts B-6000, Worcester 4211-RT.

32.4 Balance: (for domestic hot water recirculation)

.1 30mm [1¼"] and smaller, globe lockshield, for maximum system temperature, bronze body and trim, Teflon; polytetrafluoroethylene (PTFE), disc, female by male union connection, 690 kPa [100 psig] rating. Acceptable Products: Dahl 13012 or 13013 with memory stop, Dunham Bush 840A, Red & White / Toyo 250LS or 251LS, Grinnell GBV-T threaded.

.2 40mm [1½"] and larger, plug type, wrench adjustable stop, for maximum system temperature, semi-steel body, resilient plug seals, EPT or RS 55, max. 120°C [250°F] operating temperature, 860kPa [125 psig], threaded end connections for up to 50 mm [2"], flanged end connections on 65mm [2½"] and larger. Acceptable Products: DeZurik 435 with 487 adjustable stop, Homestead Ballcentric, Neuman-Hattersley 170M or 171M, Grinnell GBV-T or GBV

32.5 Vacuum relief: (for hot water tanks installations)

.1 Up to 12 mm [½"], 860 kPa [125 psig] rating. Acceptable Products: 12 mm [½"] Watts 36A, Cash Acme.

.2 19 mm [¾"] and larger, 860 kPa [125 psig] rating. Acceptable Products: 18 mm [3/4"] Watts 36A, Cash Acme.

32.6 Pressure Reducing Valves:

.1 6 mm [¼"] to 9 mm [3/8"] ,860 kPa [125 psig] rating. Acceptable Products: Watts 215, Cash Acme, Singer.

.2 12 mm [½"] to 50 mm [2"], 860 kPa [125 psig] rating. Acceptable Products: Watts 223, Braukman, Conbraco, Cash Acme, Singer.

.3 65 mm [2½"] and larger, 860 kPa [125 psig] rating. Acceptable Products: BCA 317 PR, Clayton 90 or 90B, Singer 106PR.

32.7 Pressure reducing valve with integral low flow bypass:

.1 40 mm [1½"] and larger, 860 kPa [125 psig] rating. Acceptable Products: Watts PV-10-06M, Clayton, Singer.

32.8 Water Meter:

.1 The water meter shall be supplied by the Contractor and shall be to Municipal Standards.

.2 Hermetically sealed direct reading centre sweep register, one piece cast bronze main case, nutating disc measuring chamber with flow control adjustment, magnetically driven, rated for 1035 kPa [150 psig] service, reading in cubic metres and flanged ends conforming to AWWA C700.

.1 Acceptable Products: Neptune Trident 8, Rockwell, Hersey

.3 Self generating remote meter reader to suit municipal requirements.

.4 Size meter for a maximum of 35 kPa [5 psig] pressure drop at design flow rates.

32.9 Pressure Reducing Valves Installation:

.1 Pressure reducing valve stations, as a minimum shall consist of the following:

.1 A high flow or main pressure reducing valve; which shall be one pipe size smaller than the incoming or outflowing building service, and shall be provided with a strainer, a reducer and a shut off valve on the inlet side and a reducer and a shut off valve on the outlet side.

.2 A low flow pressure reducing valve; which shall be 25 mm [1"] in size, and shall be provided with a strainer and a shut off valve on the inlet side and a shut off valve on the outlet side.

.3 A bypass around both pressure reducing valves with a normally closed globe valve; which shall be of the same pipe size as the incoming or outflowing building service, and a pressure gauge on each side of the globe valve.

.4 Where a pressure reducing valve with integral low flow bypass is used the piping, fittings and accessories shall be arranged as described above.

.2 Set main pressure reducing valve at 415 kPa [60 psi] outlet pressure.

.3 Set small flow pressure reducing valve at 35 kPa [5 psi] higher outlet pressure than main pressure reducing valve.

33 DRAIN, WASTE AND VENT SYSTEMS - PIPING AND FITTINGS

33.1 Piping and fittings - above grade

.1 Waste and vent piping 50mm [2"] and smaller: DWV copper with cast brass fittings and solder joints.

.2 Waste and vent piping 65mm [2.5"] and larger: Cast iron soil pipe and fittings with mechanical joint couplings.

33.2 Piping and fittings - below grade

.1 Acrylonitrile-Butadiene-Styrene (ABS) Drain Waste and Vent Pipe Fittings conforming to CSA CAN 3-B181.1.

.2 Polyvinyl Chloride (PVC) Drain Waste and Vent Pipe and Pipe Fittings conforming to CSA B181.2.

33.3 Install cleanouts as shown on the drawings and as required by the B.C. Plumbing Code.

34 REFRIGERATION SYSTEMS

34.1 Do refrigeration system work in accordance with latest version of B.C. Power Engineers and Pressure Vessels Safety Act and Regulations ("Refrigeration Code"), CSA B52 and ANSI B31.5.

34.2 Ensure that a permit is obtained before anyone commences to install or alter any refrigeration system.

34.3 Every person who installs or makes alterations or repairs to a refrigeration system shall be the holder of a valid and subsisting refrigeration contractor’s license and all persons repairing equipment with ODS/CFC's shall have completed an Environment Canada approved training program.

34.4 Refrigerant Tubing

.1 Provide processed tubing for refrigeration installation, deoxidized, dehydrated and sealed.

.2 Hard copper tube, type L, to ASTM B88M.

.3 Annealed copper tube to ASTM B280, with minimum wall thickness as per CSA B52.

34.5 Fittings

.1 Service: design pressure 2070 kPa [300 psig] and temperature 121^{o}C [250^{o}F]

.2 Brazed: wrought copper to ANSI B16.22 or cast bronze to MIL-F-1183E.

.3 Flare: Bronze or brass, for refrigeration, to ANSI B16.26.

.4 Long radius type for elbows and return bends.

34.6 Joints

.1 Brazing materials shall be SIL-FOS-15 phosphor-copper-silver alloy for copper piping jointed by copper fittings and silver solder for brass fittings.

.2 Flexible connections: 3/8" nominal or less shall be made using coiled soft copper tubing. For larger sizes, use seamless flexible bronze hose with bronze wire braid covering. Use factory sealed neoprene jacket unit where freezing may occur.

34.7 Shut-Off Valves:

.1 Line size; selected for low pressure drop.

34.8 Solenoid Valves:

.1 With field replaceable coil, serviceable without removing valve from line.

.2 Coil voltage to suit field requirements.

.3 Provide upstream of thermostatic expansion valves.

.4 Acceptable Products: Alco 240 RA series.

34.9 Expansion Valves:

.1 Thermostatic type with external equalizer, adjustable superheat setting, capacity and bulb charge to suit operating conditions.

34.10 Water Regulating Valves:

.1 Pressure activated two-way straight-through type.

.2 For three-way regulators, install balancing valve in by-pass, adjusted to maintain constant system flow rate irrespective of valve position.

34.11 Charging and Purging Valves

.1 Valves to be the same size as line size into which they are connected or ½" whichever is the larger.

.2 Valve complete with a removable seal cap chained to the valve body.

.3 Acceptable Products: Henry Standard type, Mueller Linemaster Special.

34.12 Sight Glass

.1 Provide sight glass in liquid line following filter drier.

.2 Sight glass shall be combination moisture-liquid indicator and with a protective removable cap.

.3 Sight glass to be fitted in-line.

.4 Acceptable Products: Henry Dri-Vue, Mueller Vuemaster, Sporlan See All.

34.13 Access Fittings

.1 Provide Schraeder access fittings in each suction connection from an evaporator, located adjacent to the superheat sensing element of the expansion valve.

.2 Fittings to be used for checking the superheat of the suction gas.

.1 Access fitting shall be soldered into a tee and shall be complete with a quick-seal cap.

34.14 Filter Drier

.1 Provide a filter drier in the liquid line from the condenser. Shut-off valves shall be installed on each side of drier and sight glass.

.2 Filter drier shall be selected to have a pressure drop of not more than 13 kPa [2 psig] when passing 150% of the system flow rate.

.3 Removable core with flare connections.

.4 Acceptable Products: Alco Extra-Klean, Catch-All, Henry Dri-Cor, Mueller Drymaster II, Sporlan.

34.15 Flexible Connections

.1 Braided tin-bronze convoluted flexible connections.

.2 Design pressure 2070 kPa [300 psig].

.3 Acceptable Products: Anaconda

34.16 Install the following accessories:

.1 Ball check isolating valves at receiver sight glass.

.2 Charging valve for high and low side filter drier, solenoid valve and thermostatic expansion valve.

34.17 Refrigerant Tests

.1 Each refrigerant system shall be tested as follows before operation with dry nitrogen gas to a pressure not less than 1.5 times the system working pressure. During the test, each joint shall be tested for leaks with a solution of soap and water. Compressors with refrigerant holding charge shall remain isolated from system.

.2 The system shall then be evacuated to not less than 33.25 Pa (250 microns) absolute and left for 24 hours, during which time the pressure shall not have increased more than 33.25 Pa (250 microns). The system shall then be pressurized to 14 kPa [2 psig] with refrigerant to be used and shall be evacuated to 66.5 Pa [500 microns] absolute and then shall be immediately fully charged with the refrigerant to be used in the system and each joint checked with an electronic testing device. Tests shall be performed before insulation is applied.

.3 All damaged or defective components shall be replaced with new (not reconditioned) components.

34.18 Start-Up and Adjustment

.1 Provide necessary instruments, gauges and testing equipment required. Adjust controls, to obtain design requirements and manufacturer's ratings.

.2 Test and record cooling apparatus entering and leaving air temperatures, dry bulb and wet bulb.

.3 Test and record voltage and running amperes and compare to motor nameplate data, and starter heater rating against design requirements.

.4 Ensure that refrigerant temperatures are accurate to within $0.5^{o}C$ [$0.9^{o}F$] of design requirements.

.5 In cooperation with controls contractor's representative, set and adjust automatic control system to achieve required sequence of operations.

.6 Bring equipment into operation, trial run and make up any loss of oil and refrigerant.

.7 Test reports to be submitted for review and inclusion in Maintenance Manuals.

35 NATURAL GAS SYSTEM - PIPING, VALVES AND FITTINGS -

35.1 Do all piping system work in accordance with CAN1-B149.1 and B.C. Code Amendments.

35.2 Submit to the Provincial Gas Inspection Department, drawings, applicable sections of specifications and detailed drawings as required to obtain approval for the gas installation before the work commences.

35.3 Pipe: Schedule 40 to ASTM A53-84a Grade B.

35.4 Pipe Fittings: Screwed, flanged or welded:

.1 Malleable iron screwed fittings (banded pattern): Class 150 to ANSI B16.3-1977.

.2 Steel pipe flanges and flanged fittings: to ANSI B16.5-1981.

.3 Steel butt-welding fittings: to ANSI B16.9a-1981.

.4 Unions, malleable iron, brass to iron ground joint type: to ANSI B16.3-1977.

35.5 Gas Valves

.1 NPS 50mm [2"] and under, screwed.

.2 NPS 75mm [3"] and over, flanged.

.3 Suitable for the temperature to which exposed.

.4 Registered and bearing Province of British Columbia, Gas Inspection Department approval.

.5 Acceptable Manufacturers: Emco, Homestead, Mueller, Newman Milliken, Wallaceburg

35.6 Roof Supports

.1 Support piping on roof with an engineered prefabricated Pipe Hanger System designed for installation without roof penetrations, flashing or damage to the roofing material. The system shall consist of bases and made of high-density polypropylene plastics with UV Protection. System shall be custom designed to fit piping and conduit to be installed and the actual conditions of service.

.2 Install using Pro Pipe Support system and Clamps. Follow manufacturer's instructions to adhere supports to roof.

.3 Field fabricated wood supports will not be accepted.

35.7 Piping Installation

.1 Install piping in accordance with applicable code.

.2 Use dielectric type fittings where buried service enters and connects to building piping.

.3 Slope piping down in direction of flow to low points.

.4 Install valve on the main gas service entering the building. Valve to have locking lugs.

.5 Prime, paint and label piping.

35.8 Testing

.1 Test system in accordance with applicable code.

.2 Notify the Consultant and the Inspection Authority having jurisdiction, 48 hours in advance of intended test date.

.3 Examine piping for leaks. Remake all leaking connections and joints.

35.9 Purging

.1 Purge after pressure test in accordance with applicable code.

36 ROOF DRAINS AND FLOOR DRAINS

36.1 Acceptable manufacturers of spun copper or aluminum roof drains: Menzies Metal Products

36.2 Acceptable manufacturers of full body floor and roof drains: Watts, Zurn, Mifab, Smith

36.3 Trap Seal Primers:

.1 Provide pressure actuated type priming device for all floor drains. Locate at locations that are readily accessible by the building maintenance staff. Provide isolation valve. (alternative: consider DDC controlled solenoid valves as they are more dependable)

.2 Acceptable Products: Precision Plumbing Products Model P-1, Mifab 500

36.4 Floor Drain FD-1:

.1 Floor drain shall include trap primer connection and trap primer device.

.2 Acceptable Products:Zurn, Ancon, Enpoco

37 PLUMBING FIXTURES AND TRIM

37.1 Acceptable Manufacturers

.1 Acceptable manufacturers of plumbing fixtures: American Standard, Crane, Kohler, Toto.

.2 Acceptable manufacturers of plumbing faucets and trim (except hands-free): Symmons, Cambridge Brass, Teck, Chicago, Crane, Zurn.

.3 Acceptable manufacturers of hands-free plumbing faucets and flush valves: Sloan.

.4 Acceptable manufacturers of stainless steel sinks: Aristaline, Kindred, Elkay, Steel Queen, AMI, Metcraft.

.5 Acceptable manufacturers of water closet seats: Olsonite, Moldex, Bemis, Centoco

.6 Acceptable manufacturers of fixture carriers: Smith, Zurn, Watts, Enpoco.

.7 Acceptable manufacturers of flush valves (except hands-free): Zurn, Teck, Chicago, Crane, Sloan.

.8 Acceptable manufacturers of floor mounted janitor sinks: Fiat, Stern-Williams.

.9 Acceptable manufacturers of drinking fountains: Haws, Elkay, Western, Sunroc, Aquarius, Halsey Taylor

.10 Acceptable manufacturers of mixing valves: Powers, Symmons, Leonard, Lawler

.11 Acceptable manufacturers of emergency eye washes and safety showers: Western, Haws, Guardian, Bradley, Encon

37.2 Handicap Fixtures

.1 Water Closets

.1 Install all wall hung water closets designated for handicap use at an elevation above the finished floor level of 460mm [18"] to the rim of the fixture.

.2 Install offset on handicap watercloset flush valve connection to eliminate any interference with grab bar mounting.

.3 Install the flush valve such that the handle is facing the transfer or non-grab bar side of the water closet.

.2 Lavatories and Sinks

.1 Offset P-traps shall be installed with the run of the P-trap parallel to and close to wall.

.2 Supplies on handicap lavatories shall be offset to accommodate the offset P-trap.

.3 P-traps, waste arms and water supplies at all handicap accessible lavatories and sinks shall be insulated with a manufactured insulation kit or 12mm [½"] of fiberglass insulation and finished with a polyvinyl chloride jacket in a neat and workmanlike manner.

.4 Acceptable Manufactured Products: Truebro 'Handi Lav-Guard', Brocar Products Inc. 'Trap Wrap', Sexauer 'Handi Lav-Guard'

37.3 Water Closet 'WC-1':

.1 **American Standard Afwall Millennium Flowise Elongated #3351.101.020 HET Toilet**, white vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, Wall Hung, siphon jet flush action, operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, condensate channel, 305 mm x 254 mm (12" x 10") water surface area, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, back outlet, 38 mm (1-1/2") dia. Top spud. **Centoco #500STSCC.001 toilet seat**, heavy duty, for elongated bowl open front, white solid plastic, less cover, reinforced stainless steel check hinges, metal flat washers stainless steel posts and nuts. **Sloan #111-1.28 SMO, Exposed Flushometer** for Top Spud toilet, 4.8 L (1.28 US Gal) factory set flow, fixed volume piston with filtered O-ring bypass, infrared sensor, courtesy flush over-ride button, vandal resistant stop cap on back-check angle stop (screwdriver operated), flush tube for 292 mm (11-1/2") rough-in, vacuum breaker, four 'C' batteries (included) serviceable without shutting off water with 'Low Battery' flashing LED. **Watts #ISCA-101-M11, single horizontal, Adjustable Toilet Carrier**, mounted on concrete floor, all epoxy coated cast iron fitting, adjustable ABS slide nipple with integral test cap and neoprene bowl gasket, wasted plated hardware, chrome cap nuts, tiling frame, 102 mm (4") no hub waste, 51 mm (2") no hub vent. 305 mm (12") finished metal stud wall to back of pipe space.

37.4 Water Closet 'WC-2':

.1 **American Standard Afwall Millennium Flowise Elongated #3351.101.020 HET Toilet**, white vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, Wall Hung, siphon jet flush action, operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, condensate channel, 305 mm x 254 mm (12" x 10") water surface area, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, back outlet, 38 mm (1-1/2") dia. Top spud. Mount fixture 16"(406mm) above finished floor to rim of toilet (or as required by local code).**Centoco #500STSCC.001 toilet seat**, heavy duty, for elongated bowl open front, white solid plastic, less cover, reinforced stainless steel check hinges, metal flat washers stainless steel posts and nuts. **Sloan Royal Optima #111 ES-S-CP, Exposed Flushometer** for Top Spud toilet, chrome plated, 6 L (1.6 US Gal) factory set flow, quiet action 'PERMEX' diaphragm type with dual filter by-pass, infrared sensor located on a 125 mm x 125 mm (4-15/16" x 4-15/16") stainless steel plate, courtesy flush over-ride button, V.P. Smooth design stop cap on back-check angle stop (screwdriver operated), flush tube for 292 mm (11-1/2") rough-in, high pressure vacuum breaker, sensor located above the toilet, 5 VA Power Required per unit. **Provide 4" (102 mm) square electrical box for mounting sensor plate. Sloan #EL-154, box mount hard wired transformer**, 120 VA / 24 VA 50 A. **Franke Commercial Midland #CM16104**, back rest, satin finish type 304 18 GA. (1.2mm) stainless steel bar 32 mm (1-1/4") diameter, antique white solid core plastic laminate panel. **Watts #ISCA-101-M11, single horizontal, Adjustable Toilet Carrier**, mounted on concrete floor, all epoxy coated cast iron fitting, adjustable ABS slide nipple with integral test cap and neoprene bowl gasket, wasted plated hardware, chrome cap nuts, tiling frame, 102 mm (4") no hub waste, 51 mm (2") no hub vent. 305 mm (12") finished metal stud wall to back of pipe space.

37.5 Urinal ‘UR-1’:

.1 **American Standard Decorum Flowise #6042.005.020 Urinal**, white vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, 1.9 L (0.5 US Gal) per flush, Wall Hung, washdown action, 19 mm (3/4") dia. Top spud, integral P-trap, outlet connection 51 mm (2"), wall hanger. Mount fixture between 19-1/4" and 20-1/8" (488mm and 512mm) above finish floor to front rim of urinal (or as required by code).**Sloan** Optima **Plus #8186-0.5-CP, Exposed Flushometer** for Top Spud urinal, chrome plated, 1.9 L (0.5 US Gal) factory set flow, quiet action 'PERMEX' diaphragm type with linear filtered by-pass and Vortex Cleansing Action, infrared sensor with multiple-focused lobular sensing fields for high and low target sensing, courtesy flush over-ride button, vandal resistant stop cap on back-check angle stop (screwdriver operated), flush tube for 292 mm (11-1/2") rough-in, vacuum breaker, patented 'Isolated Operator' for superior performance under a heavy duty metal stylish cover with plastic optical face, four 'AA' batteries (included) serviceable without shuting off water with 'Low Battery' flashing LED. **Watts #CA-321, Urinal Carrier**, mounted on concrete floor, epoxy coated with heavy gauge steel uprights with welded feet supports and with top and bottom universal steel hanger plates with plated hardware, heavy gauge epoxy coated steel offset uprights. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space. **Watts #WU-CO Urinal Wall Access Cleanout**, two piece expandable plug with 102mm (4") diameter stainless steel access cover and secured with vandal proof stainless steel screw

37.6 Lavatory ‘LAV-1’:

.1 **American Standard Mezzo #9960.403 Basin,** 546 mm x 559 mm x 210 mm (21-1/2" x 22" x 8-1/4") deep, fireclay, semi-counter, rear overflow, faucet ledge, space saving design, mounting kit. Provide basin rim sealant. **Sloan Optima #ETF-600-LT-VPB-SL-BDT-LF Electronic Faucet**, chrome plated, 4" (102mm) centerset, cast brass, 1.9 LPM (0.5 GPM) aerator spray outlet, infrared sensor with screw adjustable range, undercounter filtered solenoid valve with serviceable strainer filter, module control assembly with splashproof junction box and mounting kit, 24VAC 50/60Hz, vandal proof box, 12" (305mm) sq. Recessed metal box with 13"(330mm) sq. V.P. S.S face, located in wall under basin. Flexible copper supply, Below Deck lead free Thermostatic Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlet and outlet FNPT connection, integral checks, offer temperature range between 95 C (203 F) and 46 C (114.8 F). Set valve temperature at 46 C (114.8 F). **Provide tee, adaptors and flex. copper tubing to suit installation.** 15 VA power required per unit. **Sloan #EL-154, box mount hard wired transformer**, 120 VA / 24 VA 50 A. **McGuire #155WCC Offset Open Grid Drain,** chrome plated cast brass one piece top, 17 GA. (1.5mm) mm tubular 32 mm (1-1/4") tailpiece. **McGuire #8872C P-Trap,** heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. **McGuire PROWRAP #PW2000WC Sanitary Covering vandal-resistant,** flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.

37.7 Lavatory ‘LAV-2’:

.1 **American Standard Cadet #0236.004 Basin,** 622 mm x 508 mm x (24-1/2" x 20" x 8") deep, vitreous china, for carrier with "U" bracket, rear overflow, faucet ledge, generous shelf area. **Sloan Optima #ETF-600-LT Electronic Faucet**, chrome plated, 4" (102mm) centerset, cast brass, 1.9 LPM (0.5 GPM) aerator spray outlet, infrared sensor with screw adjustable range, undercounter filtered solenoid valve with serviceable strainer filter, module control assembly with splashproof junction box and mounting kit, 24VAC 50/60Hz, vandal proof box. **Provide tee, adaptors and flex. copper tubing to suit installation.** 15 VA power required per unit. **Sloan #EL-154, box mount hard wired transformer**, 120 VA / 24 VA 50 A. **Lawler #TMM-1070, Point Of Use Mechanical Water Mixing Valve**, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop (automatic shuts down flow of water when temperature reaches 48 deg.C (118 deg.F) with automatic reset, shut-off with automatic reset when temperature exceeds 120F (48.8C), integral checks, offer temperature range from full cold through 46 °C (114.8 °F). **Provide tee, adaptors and flex. copper tubing to suit installation. McGuire #155AC Open Grid Drain,** chrome plated cast brass one piece top, 17 GA. (1.5mm) tubular 32 mm (1-1/4") tailpiece. **McGuire #LFH170BV, Faucet Supplies**, chrome plated polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handle, escutcheons and flexible copper riser. **McGuire #8872C P-Trap,** heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. **Watts #CA-421, Fixture Carrier**, steel hanger plate, heavy gauge epoxy coated steel uprights with welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

37.8 Mop Sink ‘MS-1’:

.1 **American Standard #7692.000 service / Mop sink**, 457 mm (18") x 559 mm (22") x 515 mm (20-1/4") deep, Wall Hung, faucet on wall, enamelled cast iron construction porcelain finish, 229 mm (9") high plain backsplash, stainless steel rim guard, wall hanger. **Chicago Faucets #897-369VP-XK wall mounted Two Handle Manual Faucet**, chrome plated, 8" (203mm) centerset, solid brass exposed body, ceramic 1/4 turn cartridges, unrestricted hose end outlet, 200 mm (7-7/8") from wall to outlet reach, integral atmospheric vacuum breaker, metal red and blue index buttons 60 mm (2-3/8") long lever handles with vandal resistant screw. Wall brace support. **American Standard #7798.030 Pedestal P-Trap with adjustable foot,** cast iron with metallic open grid strainer, 76 mm (3") outlet, flange and nipple by other and F.N.P.T. Connection.

37.9 Mop Sink ‘MS-2’:

.1 **Stern Williams #EB-54 square service / Mop sink**, 610 mm (24") x 610 mm (24") x 152 mm (6") deep, Floor Mounted, terrazzo composed of pearl gray marble chips and Portland cement ground smooth, sealed to resist stain, cast brass drain with stainless steel strainer, 3"(75mm) outlet. **Chicago Faucets #897-369VP-XK wall mounted Two Handle Manual Faucet**, chrome plated, 8" (203mm) centerset, solid brass exposed body, ceramic 1/4 turn cartridges, unrestricted hose end outlet, 200 mm (7-7/8") from wall to outlet reach, integral atmospheric vacuum breaker, metal red and blue index buttons 60 mm (2-3/8") long lever handles with vandal resistant screw. Wall brace support. **Stern Williams T-35 Hose and Wall Hook** hose 36" (914mm) long with 3/4" (19mm) chrome coupling, stainless steel wall bracket. **Stern Williams T-40 Mop Hanger** stainless steel #4 finish, 24" (610mm) long with 3 rubber spring loaded clips. **Stern Williams BP Back Splash Panel** 20 gauge type 304 stainless steel. **Provide P-Trap,** same material as the connecting pipe drain.

37.10 Sink 'SK-1':

.1 **Franke Commercial #LBD6808-1/1 Double Bowl Countertop Mount Sink**, 1 hole, 522 mm (20-9/16") x 995 mm (39-3/16") x 203 mm (8") deep, counter mounted, backledge, 18-10 type 302 20 GA. (0.9mm) stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece. **Chicago Faucets #430-ABCP Single Lever Faucet**, chrome plated, center hole only, lead free cast brass body, 5.7 LPM (1.5 GPM) aerator outlet, long cast spout 229 mm (9") projection reach, lever handle, adjustable volume control, adjustable hot limit stop. **McGuire #LFH170BV, Faucet Supplies**, chrome plated polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handle, escutcheons and flexible copper riser. **Provide P-Trap,** adjustable all metal construction, 38 mm (1-1/2") size, and escutcheon.

37.11 Sink 'SK-2':

.1 **Franke Commercial #LBS6808-1/1 Single bowl Countertop Mount Sink**, 1 hole, 521 mm (20-1/2") x 508 mm (20") x 203 mm (8") deep, counter mounted, backledge, 18-10 type 302 20 GA. (0.9mm) stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece. **Chicago Faucets #430-ABCP Single Lever Faucet**, chrome plated, center hole only, lead free cast brass body, 5.7 LPM (1.5 GPM) aerator outlet, long cast spout 229 mm (9") projection reach, lever handle, adjustable volume control, adjustable hot limit stop. **McGuire #LFH170BV, Faucet Supplies**, chrome plated polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handle, escutcheons and flexible copper riser. **Provide P-Trap,** adjustable all metal construction, 38 mm (1-1/2") size, and escutcheon.

37.12 Shower Valve and HandShower 'SH-1':

.1 **American Standard Ceramix #T000.500/R120SS, pressure balancing mixing valve, brass body, washerless ceramic drip-free disc valve cartridge, integral hot limit stop, screwdriver stops with separate checks.** brass wall escutcheon, metal lever handle. Comply to local codes for Shower Control location and Trim Kit requirements. **American Standard #1662.551 3 function spray hand shower,** 9.5 LPM (2.5 GPM) maximum flow rate, spray pattern adjust from gentle rain to hard rain to massage, easy clean rubber nozzles, integral checks. **American Standard #1660.400 HandShower Vacuum Breaker,** between supply outlet and personal shower hose. **Watts #FD-100-C-A Floor Drain,** epoxy coated cast iron, anchor flange, 5" (127mm) adjustable round nickel bronze strainer, reversible clamping collar with primary & secondary weepholes. **Provide P-Trap,** same material as the connecting pipe drain.

37.13 Drinking Fountain 'DF-1':

.1 **Elkay Model VRC8WS** Unit shall include electric water cooler with bottle filling station. VRC8WS shall deliver 8 GPH of 50°F drinking water at 90°F ambient and 80°F inlet water. Units shall be stainless steel construction and include vandal-resistant pushbutton activation. Cooler shall include vandal-resistant bubbler. Bottle filling unit shall include an auto 20-second shut-off timer. Shall include Green Ticker™ displaying count of plastic bottles saved from waste. Bottle filler shall provide 1.1-1.5 gpm flow rate with laminar flow to minimize splashing. Shall include integrated silver ion anti-microbial protection in key areas. Unit shall meet ADA guidelines. Unit shall be lead-free design which is certified to NSF/ANSI 61 and 372 and meets Federal and Provincial low-lead requirements. Unit shall be certified to UL399 and CAN/CSA 22.2 No. 120.

37.14 Drinking Fountain Bubbler'DF-2':

.1 **Chicago Faucets No. 748-665ABCP**, Deck Mounted Single Hole Drinking Fountain, Chrome Plated solid brass construction. 1-3/4" Metal Vandal Proof MVP Metering Push handle(s) with Blue or Red Button. 1/2" NPSM Supply Inlet and Coupling Nut for 3/8" or 1/2" Flexible Riser. Anti-Rotational Pins for Optional Field Installation. Vandal Resistant Recessed Manual Volume Control. All metal projector head. ECAST® construction with less than 0.25% lead content by weighted average.

37.15 Hosebib 'HB-1':

.1 **ZURN Z1300** Encased Ecolotrol "anti-siphon" automatic draining wall hydrant for flush installation. Complete with non-freeze type integral backflow preventer, bronze casing, all bronze interior parts, non-turning operating rod with free-floating compression closure valve, replaceable bronze seat and seat washer, and combination 3/4 [19] female or 1 [25] male straight IP inlet. Nickel bronze box and hinged cover with operating key lock and "WATER" cast on cover.

38 DOMESTIC WATER HEATER (DWH-1/2)

38.1 Natural gas water heater(s) shall be A. O. Smith Cyclone HE model # BTX-80, with 90% thermal efficiency, a storage capacity of 50 gallons, an input rating of 76,000 BTUs per hour, a recovery rating of 83 gallons per hour at 100ºF rise and a maximum hydrostatic working pressure of 150 psi. Water heater(s) shall be of power vent design, using 2", 3" or 4" PVC pipe for horizontal and/or vertical vent runs. Water heater(s) shall have: 1: Glasslined steel tank construction and a spiral-shaped heat exchanger placed entirely inside the tank, which shall be glasslined on the flue gas side to protect against acidic condensate. 2: An Intelli-Vent™ gas control system with silicon nitride hot surface ignitor. 3: A 3-year limited warranty against tank leaks.

39 FIRE EXTINGUISHERS (FE)

39.1 Acceptable Manufacturers

.1 National Fire Equipment, General, Ansul, Chubb, Nystrom, Pyrene, Larsen

39.2 Fire Extinguisher and Cabinet 'FE-1':

.1 Extinguisher: Multipurpose stored pressure rechargeable fire extinguisher, rating for 4-A, 60-B, C and capacity of 4.5 kilograms [10 pounds], mounted in a fully recessed steel cabinet with prime coat finish and full glass panel, and of dimensions to suit the specified extinguisher.

.2 Acceptable Products: National Fire Equipment ABC-10F in NFE C-950 cabinet

39.3 Fire Extinguisher 'FE-2':

.1 Extinguisher: Multipurpose stored pressure rechargeable fire extinguisher, squeeze grip positive on/off operation, heavy duty glossy enamel finish steel cylinder, pull pin safety lock, forged valve, rating for 4-A, 60-B, C and capacity of 4.5 kilograms [10 pounds] with wall bracket.

.2 Acceptable Products: National Fire Equipment ABC-10F

40 DUCT CONTROLS GENERAL

40.1 Acceptable Manufacturers

.1 Delta, Siemens, Inland Comfort, Care Systems

40.2 Control system shall be an electronic system. The system architecture shall utilize intelligent distributed control modules, located at each piece of equipment, which will communicate on a peer to peer LAN trunk.

40.3 The system shall provide direct digital control, energy management and building automation for the heating, ventilating and air conditioning systems based upon heating and cooling demands as per the sequence of operations described herein.

40.4 The installation shall be performed by Contractors specializing in this type of control system installation and setup.

40.5 The Contractor shall be responsible for the following items:

.1 All conduit and wiring for the low voltage control system.

.2 Supply of control valves and external control dampers and operators to the Mechanical Contractor.

.3 All programming, commissioning and tuning of the complete control system.

.4 Shop drawings, as-built diagrams and operating manuals.

.5 Demonstration and instruction for the Owner.

40.6 Space Temperature Sensor

.1 Sensors shall be thermistor type.

40.7 Pump Status Indication

.1 Water flow switch shall have stainless steel paddles.

40.8 Air Handling Unit Status Indication

.1 Adjustable setpoint current sensing relay.

40.9 Control Dampers

.1 Low leakage outside air damper c/w side seals and edge seals.

40.10 Damper Actuators

.1 Gear drive direct coupled with spring return electronic actuators sized for a minimum of 15% excess torque for the damper area controlled.

41 CONTROLS SEQUENCE OF OPERATION

41.1 Washroom Building Control

.1 General:

.1 The Washroom system consists of the following major components:

.1 Make Up Air Unit MUA-1.

.2 Exhaust Fans EF-1, EF-2

.3 Temperature Sensors (averaging mode)

.4 Outdoor air damper

.5 Condensing unit CU-1

.2 Operation:

.1 Unoccupied Mode:

.1 During unoccupied mode:

.1 The Make Up Air (MUA-1) unit shall normally be off.

.2 The Control Damper CD-1 shall be closed.

.3 Exhaust fans EF-1 and EF-2 shall be off.

.4 When the washroom areas require heating during unoccupied mode (as sensed by the averaging sensors):

.1 Control Damper CD-1 shall open.
.2 MUA-1 shall start
.3 Exhaust Fans EF-1 and EF-2 shall start
.4 The system shall operate until space temperatures are achieved (as sensed by the averaging temperature sensors) and for a minimum of 15 minutes.

.2 Occupied Mode:

.1 MUA-1 shall operate in occupied/unoccupied mode according to a user defined schedule.
.2 When MUA-1 is operating in occupied mode the outdoor air dampers, fans and the refrigeration compressors shall operate in sequence to maintain the supply air temperature at setpoint.
.3 The space temperature setpoint shall be 14°C (58°F) in winter and 24°C (75°F) in summer.
.4 The refrigeration compressor shall be locked out from operating when the outdoor air temperature is below 10°C [50°F].
.5 The refrigeration compressor control sequences shall contain minimum on and minimum off times as recommended by the manufacturer.

.3 Fail safe Mode:

.1 In the event of a power failure, all systems shall revert to off position and restart when power is restored if required.
.2 System shall stop if SAT set point is not maintained. Revert to failsafe position.
.3 DDC provides alarm if failure or high/low space temperature alarm

41.2 Change Room Building Control

.1 General:

.1 The Change Room system consists of the following major components:

.1 Make Up Air Unit MUA-2.
.2 Exhaust Fan EF-3
.3 Temperature Sensors (averaging mode)
.4 Outdoor air damper CD-4
.5 Condensing unit CU-2

.2 Operation:

.1 Unoccupied Mode:

.1 During unoccupied mode:
.2 The Make Up Air (MUA-2) unit shall normally be off.
.3 The Control Damper CD-4 shall be closed.
.4 Exhaust fans EF-3 shall be off.
.5 When the washroom areas require heating during unoccupied mode (as sensed by the averaging sensors):
.6 Control Damper CD-4 shall open.
.7 MUA-2 shall start
.8 Exhaust Fans EF-3 shall start
.9 The system shall operate until space temperatures are achieved (as sensed by the averaging temperature sensors) and for a minimum of 15 minutes.

.2 Occupied Mode:

.1 MUA-2 shall operate in occupied/unoccupied mode according to a user defined schedule.

.2 When MUA-2 is operating in occupied mode the outdoor air dampers, fans and the refrigeration compressors shall operate in sequence to maintain the supply air temperature at setpoint.

.3 The space temperature setpoint shall be 14°C (58°F) in winter and 24°C (75°F) in summer.

.4 The refrigeration compressor shall be locked out from operating when the outdoor air temperature is below 10°C [50°F].

.5 The refrigeration compressor control sequences shall contain minimum on and minimum off times as recommended by the manufacturer.

.3 Fail safe Mode:

.1 In the event of a power failure, all systems shall revert to off position and restart when power is restored if required.

.2 System shall stop if SAT set point is not maintained. Revert to failsafe position.

.3 DDC provides alarm if failure or high/low space temperature alarm

41.3 Classroom Control

.1 General:

.1 The Classroom system consists of the following major components:

.1 Fan Coil Unit FCU-1.

.2 Exhaust Fan EF-4

.3 Condensing Unit CU-3

.4 Temperature Sensor

.5 Occupancy Sensor c/w push button over-ride.

.6 Modulating outdoor air/return air damper

.2 Operation:

.1 Unoccupied Mode:

.1 During unoccupied mode the Fan Coil unit shall normally be off.

.2 When the classroom requires heating during unoccupied mode FCU-1 shall start and operate until space temperatures are achieved and for a minimum of 15 minutes. The outside air dampers shall remain closed and EF-4 off at all times during unoccupied mode.

.3 If a space sensor push button over-ride is activated, FCU-1 shall start and operate in occupied mode. Pushing and holding the over-ride button for more than 3 seconds shall return the classroom to unoccupied mode.

.2 Occupied Mode:

.1 FCU-1 shall operate in occupied/unoccupied mode according to a user defined schedule.

.2 When FCU-1 is operating in occupied mode the mixed air dampers, fan and the refrigeration compressors shall operate in sequence to maintain the supply air temperature at setpoint.

.3 The space temperature setpoint shall be 14°C (58°F) in winter and 24°C (75°F) in summer.

.4 The refrigeration compressor shall be locked out from operating when the outdoor air temperature is below 10°C [50°F].

.5 The refrigeration compressor control sequences shall contain minimum on and minimum off times as recommended by the manufacturer.

.3 Fail safe Mode:

.1 In the event of a power failure, all systems shall revert to off position and restart when power is restored if required.

.2 DDC provides alarm if failure or high/low space temperature alarm

42 EQUIPMENT SCHEDULES

UNIT NO	**MUA-1**	**MUA-2**
SERVICE	Washroom	Change Room
HEATING:		
CAPACITY (kW)	82.07	164.14
(BTUh)	280000.00	560000.00
EDB. (C)	-20.00	-20.00
(F)	-4.00	-4.00
TYPE:	Indirect Fired	Indirect Fired
SUPPLY FAN:		
AIR FLOW (L/s)	1415.70	2831.40
(CFM)	3000.00	6000.00
S.P. (Pa)	186.83	186.83
(ins)	0.75	0.75
FAN DRAW (BHP)	2.00	5.00
GAS FURNACE:		
INPUT (kW)	102.59	0.21
(MBH)	350.00	700.00
FAN MOTOR (HP)	3.00	5.00
VOLTS/PHASE/Hz	575/3/60	575/3/60
MANUFACTURER	Engineered Air	Engineered Air
MODEL NO	DJS40/C/V	DJS100/V/C
SEE NOTE(S)	1,2,3	1,2,3

NOTES:
1. GAS PRESSURE REGULATOR
2. SUPPLIER TO CONFIRM UNIT WILL FIT WITHIN AVAILABLE MECHANICAL SPACE
3. INDOOR UNIT

NOTATION	A	B	C
MANUFACTURER	E.H.PRICE	E.H.PRICE	E.H.PRICE
TYPE	Heavy Duty	Heavy Duty	Round Plaque
MODEL NO	96	90	RPD
BORDER	-	-	-
BLADE ORIENT.	L	L	
CORE STYLE	-	-	-
VANES	-	-	-
NO OF SLOTS	-	-	-
NOM. SIZE	Refer to dwgs	Refer to dwgs	250mm
VOLUME DAMPER	D	D	-
MOUNTING FRAME	-	-	-
FASTENING	A	A	-
FINISH	As per Arch.	As per Arch.	As per Arch.
SEE NOTE(S)	1	1	2

1. Duct mounted grille. Provide boot as required.
2. Inlet size to suit mechanical drawings

FOR LEGEND REFER TO SCHEDULE No MS141

UNIT NO	**CU -1**	**CU -2**	**CU -3**
SERVICE	MUA-1	MUA-2	FC-1
LOCATION	OUTSIDE	OUTSIDE	OUTSIDE
CAPACITY (kW)	24.74	51.85	10.49
(BTUh)	84400	176900	35800
REFRIGERANT	R-410a	R-410a	R-410a
CONDENSER FAN:			
AIR FLOW (L/s)	1416	2831	
(CFM)	3000	6000	
FAN MOTOR (HP)			
AMBIENT AIR:			
MAX TEMP.(C)	38	38	-18
(F)	100	100	
VOLTS/PHASE/Hz	575/60/3	575/60/3	208/60/1
MANUFACTURER	ENGINEERED AIR	ENGINEERED AIR	TITAN
MODEL NO	CUE83/O	CUE163	CCHG-36-DFN13
SEE NOTE(S)	1	1	1,2

1. CONDENSING UNIT TO BE MATCHED TO MAKE
2. UNIT SHALL BE HORIZONTAL DISCHARGE.

UNIT NO	**CD - 1**	**CD - 2**	**CD - 3**	**CD - 4**
SERVICE	MUA-1	FCU-1	FCU-1	MUA-2
AIR STREAM	O/A	O/A	R/A	O/A
FLOW (L/s)	1416	118	448	2831
(CFM)	3000	250	950	6000
SIZE:				
W X H (mm)	1050X950	500x500	600x450	1200x1200
VELOCITY (m/s)				
(F/M)				
NORMAL POSITION	CLOSED	CLOSED	OPEN	CLOSED
TYPE	2P	2P	2P	2P

DAMPER TYPE:
2P - 2 POSITION
MOD - MODULATING
NORMAL POSITION IS "BENCH" POSITION

UNIT NO	**EF-1**	**EF-2**	**EF-3**	**EF-4**
SERVICE	Washroom - Lower	Washroom - Upper	Change Room	Classroom
LOCATION	Washroom - Lower	Female WC 206	Mech Room 311	Classroom 309
FAN TYPE				
AIR FLOW (L/s)	590	543	2,831	118
(CFM)	1,250	1,150	6,000	250
FAN S.P. (Pa)	125	125	125	125
(ins)	0.5	0.5	0.5	0.5
FAN DRAW				
FAN (RPM)	1725	1382	734	1245
DRIVE TYPE	DIRECT	BELT	DIRECT	DIRECT
FAN MOTOR (HP)	0.25	0.5	1.5	0.5
VOLTS/Hz/PHASE	115/60/1	115/60/1	115/60/1	115/60/1
MANUFACTURER	GREENHECK	GREENHECK	GREENHECK	GREENHECK
MODEL NO	BDF-80-5	SQ-100-A	BSQ-240-15	SQ-80-4
SEE NOTE(S)	1	1	1	1

NOTES:
1 - Provide backdraft damper at outlet of fan.

UNIT NO	**FCU -1**
SERVICE	Classroom
LOCATION	Classroom 309
HEATING:	
TOTAL (kW)	8.29
(BTUh)	28278
COOLING:	
TOTAL (kW)	13.14
(BTUh)	44830
SENS. (kW)	9.15
(BTUh)	31220
EDB. (C)	26.7
(F)	80.0
EWB. (C)	19.4
(F)	67.0
LDB. (C)	13.5
(F)	56.3
LWB. (C)	12.8
(F)	55.0
COIL REFRIG. (C)	7.2
(F)	45.0
REFRIGERANT	R-410A
SUPPLY FAN:	
FLOW (L/s)	566
(CFM)	1200
EXT.S.P.(Pa)	125
(ins)	0.50
FAN RPM	
FAN MOTOR (HP)	0.75
VOLTS/PHASE/Hz	575/60/3
MANUFACTURER	Trane
MODEL NO	BCHC036H1
NOTES	SEE BELOW

SEE NOTE(S)
1. Stainless Steel drain pan. Confirm orientation on site
2. c/w 2" pleated MERV 8/ Mixing Box
3. c/w opposed blade dampers.
4. horizontal configuration
5. Motor, drive & control box on Same Side as Coil & Drainpan Connection

UNIT NO	**LV-1**	**LV-2**	**LV-3**	**LV-4**	**LV-5**
SERVICE	MUA-1	MUA-2	EF-1	EF-2	EF-3
LOCATION	Washroom Mechanical Room	ChangeRoom Mechanical Room	Storage Room	Female Washroom	ChangeRoom Mechanical Room
LOUVRE SIZE:					
WIDTH (mm)	1067	1219	457	610	
(ins)	42	48	18	24	
HEIGHT (mm)	660	1270	356	457	610
(ins)	26	50	14	18	24
DEPTH (mm)	102	102	102	102	
(ins)	4	4	4	4	
CAPACITY (L/s)	1416	3539	1416	512	
(CFM)	3000	7500	3000	1085	
FACE VEL.(m/s)	4.32	4.32	4.32	4.32	
(F/M)	850	850	850	850	
AIR P.D. (Pa)	25	25	25	25	
(ins)	0.10	0.10	0.10	0.10	
BORDER	B	B	B	B	
FASTENING	A	A	A	A	
FINISH	B	B	B	B	
MANUFACTURER	EH Price	EH Price	EH Price	EH Price	EH Price
MODEL NO	ZE439	ZE439	ZE439	ZE439	BCJE443
SEE NOTE(S)					1,2

LEGEND:

BORDER
- A - NO FLANGE
- B - FLAT FLANGE
- C - ANGLE INSIDE
- D - ANGLE OUTSIDE

FASTENING
- A - BOLTED FLANGE
- B - BOLTED FRAME
- C - STRAP ANCHOR

FINISH
- A - MILL
- B - BAKED ENAMEL TO ARCHITECT'S CHOICE
- C - PRIME COAT

NOTES:
1. C/W ROOF CURB & BIRDSCREEN
2.FREE AREA OF 3 SQFT 56IN INSIDE PENTHOUSE PERIMETER, 24IN HEIGHT

UNIT NO	**LV-6**	**LV-7**	**LV-8**
SERVICE	MUA-1	MUA-2	FCU-1
LOCATION	Washroom Mechanical Room	ChangeRoom Mechanical Room	Classroom
LOUVRE SIZE:			
WIDTH (mm)	254	406	610
(ins)	10	16	24
HEIGHT (mm)	254	406	457
(ins)	10	16	18
DEPTH (mm)	102	102	102
(ins)	4	4	4
CAPACITY (L/s)			118
(CFM)			250
FACE VEL.(m/s)			4.32
(F/M)			850
AIR P.D. (Pa)			25
(ins)			0.10
BORDER	B	B	B
FASTENING	A	A	A
FINISH	B	B	B
MANUFACTURER	EH Price	EH Price	EH Price
MODEL NO	ZE439	ZE439	ZE439
SEE NOTE(S)			

LEGEND:

BORDER
- A - NO FLANGE
- B - FLAT FLANGE
- C - ANGLE INSIDE
- D - ANGLE OUTSIDE

FASTENING
- A - BOLTED FLANGE
- B - BOLTED FRAME
- C - STRAP ANCHOR

FINISH
- A - MILL
- B - BAKED ENAMEL TO ARCHITECT'S CHOICE
- C - PRIME COAT

NOTES:

UNIT NO	**P -1**	**P -2**
SERVICE	DWH-1	DHW-2
LOCATION	Washroom Mech	Change Room Mech
PUMP TYPE	DWH Recirc	DWH Recirc
CAPACITY (L/s)	0.32	0.32
(USGPM)	5	5
LIQUID	water	water
LIQUID TEMP.(C)	60.0	60.0
(F)	140.0	140.0
DIFF.PRESS.(kPa)	24	24
(Ft)	8	8
PUMP (r/min)	1800	1800
PUMP MOTOR (HP)	1/12	1/12
VOLTS/PHASE/Hz	115/1/60	115/1/60
MANUFACTURER	Armstrong	Armstrong
MODEL NO	S25	S25
SERIES	1,2,3	1,2,3

SEE NOTE(S)
1. Bronze body
2. Non-ferrous impeller.
3. Suitable for portable water use

UNIT NO	**ET-1**	**ET-2**
SERVICE	DWH-1	DWH-2
LOCATION	Washroom Mech. Room	Washroom Mech. Room
WK.PRESS. (kPa)	1034	1034
(PSI)	150	150
CAPACITY (L)	24	24
(USGAL)	6	6
TANK DIMENSIONS:		
DIAMETER (mm)	305	305
(ins)	12	12
LENGTH (mm)	330	330
(ins)	13	13
ARRANGEMENT	Inline Vertical	Inline Vertical
MANUFACTURER	Amtrol	Amtrol
MODEL NO	ST-12-C	ST-12-C
SEE NOTE(S)	1	1

1. MUST COMPLY WITH LOW LEAD PLUMBING REQUIREMENTS

NOTE:
A. FOR TANK TAPPINGS SEE DRAWINGS AND SPECIFICATIONS
B. FOR DOMESTIC H.W. TANK SEE HEAT EXCHANGER SCHEDULE

Mechanical Specification
Alternate Price

Prepared for:

Dialog BC Architecture Engineering

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RDNO ATHLETIC PARK AMENITIES BUILDINGS

Michael Raiva P.Eng

Table of Contents

1 GENERAL

1.1 It is the intention of these specifications and drawings to provide for a complete and fully operating mechanical system as described herein, and in complete accord with applicable codes and ordinances. The work to be done shall include the provision of all labour, materials, tools and equipment as well as the application of a competent knowledge of construction, required for the installation, testing and commissioning of the complete mechanical system.

1.2 The drawings and specifications are a guide to establishing quality of equipment, materials, workmanship and performance. Drawings and specifications are complementary to one another. The term "provide" shall mean to supply and install.

1.3 References to “Consultant” in this document shall mean Williams Engineering Inc.

1.4 Any discrepancies between drawings and specifications leaving in doubt the true intent of work shall be brought to the attention of the Consultant immediately.

1.5 Before submitting his tender, the Contractor shall examine the site and all existing conditions affecting the work under this contract. He shall investigate and satisfy himself that he can supply and install this work without any additional charges after award of the Contract.

1.6 The mechanical system shall comply with the requirements of the local municipal building by-laws, the current edition of the British Columbia Building Code, British Columbia Plumbing Code, British Columbia Fire Code and all revisions and amendments thereto. The Contractor shall pay all fees, obtain all permits required, and obtain inspections and approvals from the inspection authority.

1.7 Furnish a written guarantee stating that all equipment supplied and all work executed under this contract will be free from defects of materials and workmanship for a period of one (1) year from the date of acceptance of the completed contract, and further that any defective materials that become evident during the guarantee period will be corrected at no additional cost to the Owner.

1.8 Employ only tradesmen having valid provincial trade certificates related to their work. All work shall be executed in a workmanlike manner and shall present a neat and finished appearance when completed. Workmanship shall be in accordance with recognized trade standards.

1.9 All materials used shall be new and the best of its respective kind. All equipment installed shall be in accordance with the manufacturer's printed installation directions.

1.10 The Contractor shall familiarize himself with the building plans and shall cooperate with the Owner so that the work will not conflict with operations. Any conflicts or defaults which arise during the construction period must be resolved immediately.

1.11 Without additional charge or expense, make any necessary changes or additions to accommodate the structural, electrical and architectural conditions that are required for the completion of the work.

1.12 Insurance coverage shall be provided by the Contractor unless otherwise indicated.

1.13 Leave systems operating with work areas clean and to the satisfaction of the Consultant.

1.14 All demolished materials and equipment are the property of the contractor and shall be removed from the site, unless otherwise directed by the Owner.

1.15 Patch and make good any materials and equipment.

2 DESCRIPTION OF WORK

2.1 Be responsible for all work identified or implied by the drawings and specifications, including but not limited to;

.1 Installation and commissioning of all systems, including the equipment provided by the Owner where noted.

.2 Balancing of the air and water systems. Make provisions for easy access for air and water balancer.

.3 Revision and testing of the heating, ventilation, plumbing and sprinkler systems in the area.

.4 Disposal of all unused material.

.5 Be responsible for the performance and commissioning of all equipment supplied and installed for the project (including all equipment supplied by the Owner where applicable).

3 STANDARD OF ACCEPTANCE

3.1 Means that item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

3.2 Where two or more manufacturers are listed, the manufacturer's name shown underlined or shown with a model name and/or number, was used in preparing the design. Tenders may be based on any one of those named, provided that they meet every aspect of the drawings and specifications.

3.3 Where other than the underlined manufacturer or named manufacturer is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.

3.4 Where two or more items of equipment and/or material, of the same type, are required, provide products of a single manufacturer.

3.5 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

4 ADDITION OF ACCEPTABLE MANUFACTURERS

4.1 Material/products considered to satisfy the specification, but of a manufacturer other than those named in the Specification may be submitted to the Consultant for consideration not later than five (5) working days prior to closing of tender

4.2 Addition of manufacturer's names to the specifications will be in writing by the Consultant.

5 EXISTING SERVICES

5.1 Confirm locations and routings of all existing services which might be affected by the work. Protect existing and repair any damage occasioned by the work. Accommodate work changes in location and routing as may be necessary.

6 CUTTING & PATCHING

6.1 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Make good all revisions to match the original condition.

6.2 Verify the location of existing service runs and structural reinforcement within existing roof, floors and walls prior to cutting. Cutting of structural building components shall only take place upon the receipt of specific written approval of the Structural Consultant. Repairs to existing services damaged as a result of cutting is included in this section of the work.

7 MISCELLANEOUS METAL

7.1 Be responsible for all miscellaneous steel work relative to the Specifications, including but not limited to support of equipment.

7.2 All steel work shall be prime coated, ready for paint finish.

8 ACCESSIBILITY

8.1 Install all work so as to be readily accessible for adjustment, inspection, operation and maintenance.

9 ACCESS DOORS

9.1 Install at all concealed dampers, traps, unions, valves, water hammer arrestors, special equipment, and trap primers.

9.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation and maintenance.

9.3 Do not locate access doors in feature wall or ceiling construction without the prior approval of the consultant. Locate in service areas wherever possible.

10 GUARDS AND COVERS

10.1 Provide removable protective guards on all exposed V-belt drives and shaft couplings in accordance with Worker's Compensation Board requirements.

10.2 Removable access covers shall be provided for all equipment installed under this project.

11 LUBRICATION OF EQUIPMENT

11.1 Lubricate all equipment prior to being operated, except sealed bearings, which shall be checked.

11.2 Use the lubricant recommended by the manufacturer for the service for which the equipment is specified.

12 ESCUTCHEONS

12.1 Provide escutcheons on all pipes passing through finished walls, floors and ceilings.

12.2 Escutcheons shall be chrome plated or stainless steel suitable for dimensions of piping and insulation.

13 PAINTING

13.1 Clean exposed bare metal surfaces supplied under Division 15 removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal. Paint all exposed ducts, equipment and supports with two finishing coats of paint; color to be as directed by the Owner.

13.2 Paint all pipe hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.

13.3 Repaint all marred factory finished equipment supplied under Division 15, to match the original factory finish.

14 PENETRATION OF FIRE SEPARATIONS

14.1 Seal all pipe and duct penetrations through fire separations with "3M Fire Barrier" system or equal U.L. Listed system.

15 TEMPORARY USE OF MECHANICAL SYSTEMS

15.1 Obtain written permission from the Consultant if it is desired to use the mechanical systems for temporary heat.

15.2 The following conditions must be confirmed prior to the use of the mechanical systems for temporary heating.

- .1 Any equipment start-ups shall comply with specified procedures.
- .2 All sanding must be complete, spray painting must be complete.
- .3 The contractor must pay for the gas/electricity.
- .4 All inspectors approvals must be received.
- .5 Lubricate all equipment operated.
- .6 Alarms/controls must be operational.

15.3 During the temporary heating period, comply with the following conditions:

- .1 Keep all rooms broom clean.
- .2 Maintain chemical treatment of piping systems.
- .3 Maintain the systems.
- .4 Operate the units utilizing 100% outside air if possible to avoid pulling building air into the return ducts and the units.

15.4 Before handing the systems over to the Owner, comply with the following conditions:

- .1 Bring plant to" as-new" conditions.
- .2 Replace all panel type air filters installed under this contract with new filters.
- .3 Re clean ductwork as necessary and provide a report from the approved duct cleaning agency certifying that the ductwork is clean.

16 SYSTEMS COMMISSIONING, VERIFICATION AND DEMONSTRATION

16.1 Be responsible for the performance and commissioning of all equipment provided under Division 15. Commissioning is the process of advancing the installation from the stage of static completion to full working order to specified requirements. It is the activation of the completed installation.

16.2 Acceptable Commissioning Contractors: BC Tech Engineering Services, R.A. Bruce Associates, Inland Technical Services, MDT Systems, Western Mechanical Services, KD Engineering.

16.3 In consultation with the General Contractor, ensure that sufficient time is allowed and fully identified on the construction schedule for the proper commissioning of all mechanical systems.

16.4 Commissioning is concluded when mechanical systems have been balanced and the installation is in full working order and acceptable for use. The work will include the following:

.1 Balancing of the air systems as specified.
.2 Balancing of the liquid systems as specified.
.3 Balancing of domestic hot water recirculation systems.
.4 Set up air diffusers, registers and grilles for optimum distribution/comfort.
.5 Plug all air pressure and flow measuring holes.
.6 Adjust vibration isolators and seismic restraints for optimum performance. Provide letter of certification.
.7 Verification of tight closure of outside air dampers.
.8 Verification and certification of operation of all fire dampers.
.9 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations.
.10 Verification of water tightness of all roof and exterior wall penetrations.
.11 Verification that all coil drain pans operate.
.12 Verification that equipment is not short cycling.
.13 Verification of fire extinguisher pressures.
.14 Verification of operation of all mechanical related fire alarm functions.
.15 Set up all automatic control valves/dampers and automatic temperature control devices.
.16 Testing and debugging of the Building Automation System.
.17 Set up and test all alarm and protective devices.
.18 Obtain and review trend logs for all control points. Submit trend logs to Consultant with detailed comments after verification of proper operation of all control sequences.
.19 Verification and certification of sewage and septic system installations.

16.5 At the conclusion of commissioning, demonstrate the operation of the systems to the Consultant and then to the Owner's Operating Staff.

16.6 At the completion of the commissioning, testing, balancing and demonstration submit the following to the Consultant:

.1 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specification and drawings.
.2 Completed copies of all commissioning check lists plus copies of start-up reports from specialty contractors and vendors.
.3 Signed off Williams Engineering Inc. field reports.
.4 "AS-BUILT" record drawings, as specified.
.5 B.C. Boiler Inspection Dept. approval of boiler, pressure vessels and pressure piping installations.
.6 B.C. Gas Inspection Dept. approval of boiler on gas firing.
.7 Fire Commissioner's approval of oil fuel installations.
.8 A list of all alarm and protective devices tested, with the final operating settings.

16.7 The verification process shall include instructional seminars to demonstrate all systems and to explain the operation of each. The instruction shall include the following:

.1 Ease of access provided throughout for servicing coils, filters, motors, drives, fusible link fire dampers, control dampers and damper operators.
.2 Operation of all equipment and systems under each mode of operation and failure, including:
    .1 Building Automation System control features.
    .2 Boilers and associated fuel systems.
    .3 Air conditioners and refrigeration systems.

.4 Pumps, fans, heaters, unit heaters and coils.
.5 Sprinkler fire protection systems.
.6 Sewage and septic installations.
.7 Tanks - domestic hot water and expansion.

.3 After demonstration obtain the Owner's signature certifying that the demonstration has been performed and completed to their satisfaction.

17 SUBSTANTIAL PERFORMANCE REQUIREMENTS

17.1 Before the Consultant is requested to make an inspection for Substantial Performance of the work:

.1 Commission all systems and prove out all components, interlocks and safety devices.
.2 Submit a letter certifying that all work (including calibration of instruments and balancing of systems) is complete, operational, clean and all required submissions have been completed.

17.2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:

.1 All life safety items are completed and fully functional.
.2 All reported deficiencies have been corrected.
.3 Testing and balancing completed.
.4 Operating and Maintenance Manuals completed.
.5 "As Built" Record Drawing ready for review.
.6 System Commissioning has been completed and has been verified by Consultant.
.7 All demonstrations to the Owner have been completed.

18 OPERATING & MAINTENANCE MANUALS

18.1 Prepare instruction manuals which include equipment manufacturers' operating and maintenance bulletins, a report on the balancing of the air and water systems and a report on chlorination of water mains. The manuals shall be prepared by the Commissioning Contractor.

18.2 The manufacturers' bulletins shall include:

.1 General description of the equipment and their operation.
.2 Normal maintenance and minor trouble-shooting of each major item.
.3 Wiring diagrams.
.4 Control diagrams.
.5 Spare parts list.
.6 Local source of supply.

18.3 Submit three copies in suitably labeled hard cover binders, to the Consultant at least ten days prior to the Substantial Performance inspection date.

18.4 Provide a CD-ROM based copy of the Operating & Maintenance Manuals described above.

.1 The CD-Rom shall consist of all data in the manuals, arranged in a “pdf” format file, with an interactive menu system of bookmarks to match the manual format.
.2 Include the latest version of Adobe Acrobat Reader.
.3 Include “pdf” format copies of the as-built project drawings (contact the consultant for files).

.4 Submit the CD-ROM to the consultant for review and comment. Incorporate any suggested revisions.

19 SYSTEMS BALANCING

19.1 Adjust duct and terminal balance dampers, adjustable air turning devices and adjust or change drive sheaves to balance supply, return and exhaust air systems to provide the design air quantities (within +/-10%) at each outlet and inlet and to maintain the design relationship between the supply and exhaust air system quantities. Refer to the drawings for air quantities.

19.2 Acceptable Balancing Contractors: BC Tech Engineering Services, R.A. Bruce Associates, Inland Technical Services, MDT Systems, Western Mechanical Services, KD Engineering.

19.3 Adjust all air terminals to obtain the optimum air distribution pattern.

19.4 Adjust all air flow and pressure sensing devices.

19.5 Adjust the new water systems to design flow conditions.

19.6 Adjust the domestic hot water recirculation system flow rates.

19.7 Include 3 copies of a balance report for inclusion into the manuals.

20 SHOP DRAWINGS

20.1 The Contractor shall provide 6 copies of shop drawings of all equipment for the Consultant's review. Submit clear and descriptive control sequences prior to installation.

21 AS-INSTALLED RECORD DRAWINGS

21.1 Maintain one set of record drawings at the site. Clearly mark in red any changes or deviations from the original design intent. Record all changes to the work as the installation progresses.

21.2 At the completion of the work, certify the drawing as being accurate, mark the drawing as "AS-BUILT", and send to the Consultant upon Substantial Performance of this Contract.

21.3 Include in the tender price an allowance of $850.00 to transfer changes to the original documents. Coordinate changes to the original documents with the Consultant.

22 IDENTIFICATION

22.1 Each piping system shall be colour coded for identification and labeled with the system identification code letters, including temperature and pressure, if applicable, and directional flow arrows.

.1 Identify all new piping to existing building identification standards.

.2 Identify piping adjacent to valves and where valves are in series at no more than 2m [6'-6"] intervals. Identify piping at least once in each room and at 15m [50ft.] maximum spacing in open areas. Exception: gas piping to be identified at 2m [6'-6"] intervals in ceiling plenums.

.3 Identify piping both sides where piping passes through walls, partitions and floors. Identify piping at point of entry and leaving each pipe chase and/or confined space. Identify piping accessible at each access opening.

.4 Identification labels may be stenciled. Identification arrows labels and letters may be vinyl cloth (Brady B500) or vinyl film (Brady B946), with adhesive compatible with the surface temperature.

.5 Identification colour bands for primary and secondary colours to indicate the type and degree of hazard shall be applied to overlap a minimum of 50mm [2"]. Bands shall be Brady B550 vinyl cloth tape or Brady B946 vinyl tape, with adhesive compatible with the surface temperature.

22.2 Each piece of equipment shall be identified with its equipment schedule identification, e.g. supply fan SF-1, cooling coil CC-1, pump P-1.

.1 Provide laminated plastic plates with black face and white centre of minimum size 90mm x 40mm x 2.5mm [3-1/2" x 1-1/2" x 3/32"] engraved with 12mm [1/2"] high lettering. Use 25mm [1"] high lettering for major equipment.

.2 Apply nameplates securely in conspicuous places, on cool surfaces.

22.3 Secure 6mm [1/4"] self adhesive coloured dots, (Brady Quik Dots or Avery Data Dots), to the ceiling, to identify the location of access to equipment concealed above the ceiling

23 SPARE PARTS

23.1 Provide spare parts for the Owner as follows:

.1 one set of v-belts for each new piece of equipment.

.2 one set of filter media for each filter or filter bank installed.

.3 One box (12 cartridges) for each water filter installed.

24 VIBRATION ISOLATION

24.1 Provide vibration isolation on all motor driven equipment with motors of ½ HP and greater power output (as indicated on the motor nameplate) and on piping and ductwork, as specified herein. For equipment less than ½ HP, provide neoprene grommets at the support points.

24.2 Provide 20mm [3/4"] thick continuous perimeter closed cell foam gasket to isolate base of package type equipment, AHU's, exhaust fans, etc. from floors, roofs and roof curbs. Select width for nominal 3 psig loading under weight of equipment and allow for 25% compression, 5mm [3/16"]. Increase width of curb using steel shim if necessary to accommodate gasket. For light equipment such as exhaust fans, deflection should be a minimum of 0.05". Use hold down bolts selected for seismic loads. Isolate bolts from base of unit using neoprene hemi-grommets. Avoid compressing gasket (eg. use Hilti HVA adhesive set bolts, or equal, with steel washers and lock nuts, adjusted finger tight to the hemi-grommets). Size bolt and hemi-grommet for minimum lateral clearance. Standard of Acceptance: American National Rubber-EPDM-SBR blend SCE 41 type self-extinguishing neoprene, Mason Industries Type HG Hemi-Grommets

25 SEISMIC RESTRAINTS

25.1 Provide cable restraints on all isolated equipment and seismic restraint on all other equipment, piping and ductwork, all in general accordance with SMACNA Guidelines

25.2 Include in the Tender the services of a BC Professional engineer, regularly employed in the design of restraint systems to review and sign-off on all seismic supports and restraints. Submit "sealed and signed" Letters of Assurance from the Seismic Engineer.

25.3 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

25.4 All resiliently mounted equipment, including piping and ductwork, shall be provided with seismic restraining devices (snubbers).

25.5 Air terminals installed in grid ceilings on flexible duct shall have at least two galvanized steel seismic restraint wires attached to the building structure or to ceiling hanger wires. Attach security bridles at opposite corners of each air terminal and in such a manner that the air terminal cannot fall.

25.6 Air terminals installed in grid ceilings on rigid duct shall have at least two screws securing the air terminal to the duct.

25.7 Air terminals installed in grid ceilings not attached to ducts shall have at least two screws securing the air terminal to the ceiling support or at least two galvanized steel seismic restraint wires attached to the building structure or to ceiling hanger wires.

25.8 Provide galvanized steel seismic restraint wires for radiant ceiling panels attached to either building structure or to ceiling hanger wires.

25.9 Roof top unit systems shall have roof curb/support bolting restraint systems designed by a BC Professional engineer, regularly employed in the design of restraint systems. Submit "sealed" shop drawings for review by the Consultant.

25.10 Slack Cable Systems

.1 Slack cable restraints as supplied by Vibra-Sonic Control.

.2 Restraint systems as detailed in SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems" as reviewed by the "Office of the State Architect, Structural Safety Section" for California. If lesser restraint than recommended by SMACNA is proposed to meet local NBCC seismic requirements, provide shop drawings of details certified by a B.C. registered structural consultant.

26 DUCTWORK AND ACCESSORIES

26.1 Galvanized steel, lock forming quality. All ductwork to be constructed, braced, connected and jointed according to ASHRAE and SMACNA.

26.2 Provide stainless steel ductwork where noted on the drawings.

26.3 Snaplock seams and crimp joints are not acceptable.

26.4 All duct joints, indoor and outdoor, shall be completely sealed with an approved sealant. Sealants shall meet acceptable smoke and flame spread ratings.

26.5 Provide gauge of metal and bracing as required for 500 Pa [2" w.c.] static pressure or greater.

26.6 Install duct necks before grilles, registers and diffusers and cushion heads after diffuser take-offs. Provide maximum of 24" of flexible connection. Do not use flex to change directions.

26.7 Where flexible ductwork is used, provide factory fabricated insulated flex.

.1 Flexible vinyl coated steel helix bonded to inner duct liner. Fibrous glass thermal insulation.

.2 Outer jacket of metalized fire-resistant vapour barrier.

.3 Suitable for up to 500 Pa [2" w.g.] positive static pressure and/or 250 Pa [1" w.g.] negative static pressure.

.4 UL or ULC labeled, Class 1, duct connector.

.5 Connect to ductwork using two wraps of duct tape and stainless steel worm drive clamps or Panduit adjustable diameter clamps or Thermaflex duct strap.

26.8 Provide backdraft dampers where indicated on the drawings.

.1 Minimum Requirements:

.1 1.4 mm thick [16 ga] galvanized steel or aluminum channel frame.

.2 1.2 mm thick [15 ga] aluminum blades, complete with stiffening ribs/bends.

.3 Full blade length shafts; brass, ball or nylon bearings.

.4 Felt or neoprene anti-chatter blade strips.

.5 Blade connecting linkage with eyelet and pin bearings.

.6 Maximum blade length of 760 mm [30"], use multiples for larger dimensions.

.7 Manufacturer's label.

.8 Where a balanced backdraft damper (BBD) is indicated the damper shall incorporate an adjustable counterbalance weight and lever.

.9 Maximum pressure drop across damper at 4.06 m/s [800 FPM] shall be 45 Pa [0.18" w.g.]

.10 Standard of Acceptance: Airolite 625, Penn CBD-6.

26.9 Provide heavy duty opposed blade balance dampers with locking quadrant on each run out to a grille or diffuser and where indicated on the drawings.

.1 Identify the airflow direction and blade rotation and open and closed position.

.2 Provide sheet metal bridge to raise quadrant type operators above the insulation thickness. Provide open end bearings where bridges are used.

.3 The damper operating lever shall be arranged parallel with the damper blade.

26.10 Wire Mesh Screens

.1 Provide wire mesh screens in all air intake openings where noted on the drawings.

.2 Screens shall be constructed from aluminum wire 1.3 mm diameter [16 ga].

.3 Screen mesh shall be 12.7 mm [1/2"].

26.11 Provide fire stop flaps where indicated on the drawings. Fire stop flaps shall be single damper flap with spring catch, U.L.C. tested and labeled. Construct of minimum 1.35 mm [16 ga] thick sheet steel with 1.6 mm [1/16"] thick [asbestos] on unexposed side and corrosion-resistant pins and hinges. Arranged so as not to reduce duct free area. Provide thermal blanket as required. Standard of Acceptance: Ruskin CFSF.

26.12 Provide fire dampers where indicated on the drawings.

.1 Fire dampers shall be U.L.C. or Warnock Hersey tested and labeled. Fire dampers shall be curtain type, fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type in horizontal position with vertical air flow. Curtain fire dampers shall have blades retained in a recess so free area of connecting ductwork is not reduced. Standard of Acceptance: Ruskin, Nailor Hart, Controlled Air.

.2 Install in accordance with the SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems - Fourth Edition 1992.

.3 Size so that the free area of the duct is maintained through the assembly.

.4 Install in galvanized steel sleeve, retained in place with retaining angles on all four sides at each face of wall.

.5 Connect ductwork to damper sleeves using break-away duct joints on all faces.

.6 Fire dampers must be installed within wall thickness of fire separation.

.7 Use ULC approved fire stop sealant to caulk all joints between the fire damper sleeve angles and the sleeve and between the fire damper sleeve angles and the fire separation.

26.13 Duct and Plenum Access

.1 Provide access doors and panels as follows:

.1 Doors: where shown on the drawings.

.2 Panels:

.1 Every 12 m [40 ft] on all ductwork.

.2 At the base of each duct riser.

.3 Both sides of equipment blocking the duct, (e.g. air flow measuring stations, coils)

.4 At or to one side of other equipment in duct, (eg. Backdraft dampers, balancing dampers serving multiple inlets/outlets,

.5 Panels need not be provided where access is available through a door or a register mounted on the side of the duct.

.2 Products:

.1 Doors - construct in accordance with SMACNA Duct Standards Fig. 6-12 except for latch type. 40mm [1-1/2"] thick insulation.

.2 Panels - Nailor Hart, Ventlok, 25 mm [1"] thick insulation.

.3 Gaskets - neoprene or foam rubber.

.3 Hardware:

.1 Panels up to 400mm x 300mm [16"x12"] - 2 sash locks.

.2 Panels - 380mm x 500mm [15"x20"] - 4 sash locks.

.3 Doors - piano hinge and Ventlok 310 latches c/w front and inside handles and front door pull.

.4 Installation:

.1 Seal frames airtight.

.2 Install so as to not interfere with airflow.

.3 Install to provide easiest possible access for servicing and cleaning.

.4 Do not use sheet metal screws for attaching access panels to ductwork.

.5 Round ducts 330mm [13”] and larger shall include a short collar for the installation of access panels.

.6 Small rectangular ducts shall be transitioned for the installation of access panels.

26.14 Provide thermal breaks at all roof and wall penetrations.

26.15 Provide flexible canvas duct connections on all fan equipment.

26.16 Before handing the systems over to the Owner, comply with the following conditions:

.1 As a condition of acceptance all new and /or existing air ductwork systems shall be clean. The Contractor shall confirm system cleanliness in writing and shall assume responsibility for misinformation and correction of damage. Before starting fan systems, all supply outlets shall have clean cheesecloth attached to them.

.2 Final systems cleaning shall be performed by an approved Cleaning Agency.

.3 The cleaning shall be to the satisfaction of the Consultant and Owner.

.4 Provide a report from the approved duct cleaning agency certifying that the ductwork is clean.

.5 Provide new filters for all air handlers after cleaning has been completed.

27 PIPING INSTALLATION

27.1 Ream pipe ends. Clean scale and dirt, inside and outside before and after assembly.

27.2 During construction, protect all openings in piping and equipment, by capping or plugging to prevent entry of dirt.

27.3 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

27.4 Slope supply piping up (1:480) in direction of flow and drain from low points. Slope return piping down (1:480) in the direction of flow.

27.5 Use eccentric reducers at pipe size change installed to provide positive drainage.

27.6 Provide clearance for access for maintenance of equipment, valves and fittings.

27.7 Install unions or flanges in connections to all equipment and specially components.

27.8 Arrange piping connections to allow ease of access and for removal of equipment.

27.9 Align and independently support piping connections adjacent to equipment to prevent piping stresses being transferred.

27.10 Install valves with stems upright or horizontal unless approved otherwise.

27.11 Install valves to isolate each piece of equipment, and as indicated.

27.12 Construct piping to allow for expansion and contraction.

27.13 Tests and Cleaning

.1 Hydrostatically test all pipes for at least 8 hours prior to insulating.

.2 Repair all leaks as required for zero loss.

.3 Chemically clean and flush all new hydronic and steam piping prior to reconnection to equipment.

.4 Thoroughly flush all new domestic water piping.

27.14 Provide chemical treatment to match existing as required to refill system.

27.15 Provide chemical treatment and test kit for the hot water heating system.

.1 The Chemical Treatment Agency shall provide supervision of installations, set-up and adjustment and shall submit a written report on system operations.

.2 The Chemical Treatment Agency shall instruct the maintenance personnel before Substantial Performance. Written instructions of the treatment, dosages, control charts and test procedures shall be included in the maintenance manuals.

28 THERMOMETERS AND GAUGES

28.1 Select thermometers and gauges so that their operating range falls in the middle half of the scale range.

28.2 Thermometers shall be pipe mounted stem type in copper, brass or bronze well installed so as not to restrict flow. Thermometers shall be non-mercury actuated adjustable angle type, 225 mm [9"] scale length, white background with black lettering, with both Celsius and Fahrenheit scales.

28.3 Pressure gauges shall be 115mm [4 1/2"] diameter, phosphor bronze bourdon tube type with white background and black lettering. Provide needle valve ahead of each gauge. Provide kPa and PSIG scales. Use extensions where gauges are installed through insulation.

29 INSULATION - DUCTWORK

29.1 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Standards Manual" as a reference standard if sufficient detail/information is not specified herein.

29.2 External

.1 Flexible glass fibre insulation with integral vapour barrier.

.2 Thermal Conductivity at 24°C. - 0.042 W/m/°C.

.3 Acceptable Manufacturers: Certainteed STP Ductwrap #75, Fiberglas AF300 (type II) RFFRK, Knauf FSK Ductwrap, Manson Alley-Wrap FSK.

29.3 Acoustic Duct Liner

.1 Internal flexible glass fibre acoustical insulation with sealer coating on one face.

.2 Thermal Conductivity at 24°C. - 0.040 W/m/°C.

.3 Acceptable Manufacturers: Certainteed Ultralite #150, Knauf Duct Liner M, Manson Akousti-liner.

29.4 Insulation Accessories

.1 All insulation accessories (adhesives, tape, coatings, etc.) shall be approved for the specific application.

29.5 Duct Insulation Schedule:

.1 Provide 25mm [1"] thermal insulation for outside air ducts.

.2 Provide 25mm [1"] thermal insulation for exhaust ducts for 2.5m [8'] from roof or wall penetration.

.3 Provide 25mm [1"] thermal insulation for all interior supply ducts.

.4 Provide acoustic duct liner where noted on drawings (25mm [1”] minimum, 50mm [2”] where noted).

.5 Adhere insulation with insulation adhesive applied in 150mm [6”] wide strips at 300mm [12”] on centre and secure with twine at 300mm [12”] on centre.

.6 Provide 50mm [2”] insulation with waterproof jacket on all cooling and heating supply ducts located outdoors.

30 INSULATION - PIPING

30.1 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Standards Manual" as a reference standard if sufficient detail/information is not specified herein.

30.2 Preformed pipe covering with integral vapour barrier.

.1 Thermal Conductivity at 24°C. - 0.033 W/m/°C.

.2 Acceptable Manufacturers: Certainteed 500 ASJ/SSL, Fiberglas 850 ASJ/SSL or equal.

30.3 Flexible Foamed Elastomeric (refrigerant piping only):

.1 Thermal Conductivity at 24^{o}C - 0.040 W/m/ ^{o}C.

.2 Acceptable Products: AP Armaflex, Rubatex R-180-FS.

30.4 Insulation Accessories

.1 All insulation accessories (adhesives, tape, coatings, etc.) shall be approved for the specific application.

.2 Install flexible foamed elastomeric or flexible closed cell preformed piping insulation. Secure longitudinal and butt joints with adhesive. Insulate all fittings and components. To obtain the specified thickness, apply in layers with staggered joints.

30.5 Insulation Termination Points

.1 Terminate insulation 75 mm [3"] back from all uninsulated fittings to provide working clearance and terminate insulation at 90^{o} and finish with reinforced scrim cloth and vapour barrier mastic system. Cover onto pipe and over the insulation vapour barrier. On concealed hot services terminate insulation 75mm [3"] back from all uninsulated fittings, cut off at 90^{o} and apply reinforced scrim cloth and breather mastic system.

.2 Cut back insulation at 45^{o} and finish with a silicone caulking sealant around the base of thermometer wells, pressure gauges, flow switches and pressure and control sensors.

30.6 Pipe Insulation Schedule:

.1 Insulate plumbing vents for 2.5m [8'] from roof penetration. Do not use flexible duct wrap insulation.

.2 Insulate rainwater leaders for the entire length including roof drain bodies. Do not use flexible duct wrap insulation.

.3 Insulate all valves and pipe mounted equipment.

.4 Provide 25mm [1"] insulation for all heating pipes 50mm [2"] and smaller. 40mm [1.5"] for all heating pipes greater than 50mm [2"].

.5 Provide 40mm [1.5"] insulation for all steam and condensate pipes 50mm [2"] and smaller, 50mm [2"] for all steam and condensate greater than 50mm [2"].

.6 Provide 25mm [1"] insulation for all domestic hot water and hot water recirculation pipes 50mm [2"] and smaller. 40mm [1.5"] for all domestic hot water hot water and recirculation pipes greater than 50mm [2"].

.7 Provide 25mm [1"] insulation for all domestic cold water pipes.

.8 P-traps, waste arms and water supplies at all handicap accessible lavatories and sinks shall be insulated with a manufactured insulation kit or 12mm [½"] of fiberglass insulation and finished with a polyvinyl chloride jacket in a neat and workmanlike manner. Acceptable Manufactured Products: Truebro 'Handi Lav-Guard', Brocar Products Inc. 'Trap Wrap', Sexauer 'Handi Lav-Guard'

31 INSULATION - EQUIPMENT

31.1 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Standards Manual" as a reference standard if sufficient detail/information is not specified herein.

31.2 Flexible glass fibre insulation with integral vapour barrier.

.1 Thermal Conductivity at 24°C. - 0.042 W/m/°C.

.2 Acceptable Manufacturers: Certainteed STP Ductwrap #75, Fiberglas AF300 (type II) RFFRK, Knauf FSK Ductwrap, Manson Alley-Wrap FSK.

31.3 Rigid glass fibre insulation with integral vapour barrier.

.1 Thermal Conductivity at 24°C. - 0.042 W/m/°C.

.2 Acceptable Manufacturers: Certainteed STP Ductwrap #75, Fiberglas AF300 (type II) RFFRK, Knauf FSK Ductwrap, Manson Alley-Wrap FSK.

31.4 Insulation Accessories

.1 All insulation accessories (adhesives, tape, coatings, etc.) shall be approved for the specific application.

31.5 Equipment Insulation Schedule:

.1 Provide 40mm [1.5"] foil faced glass fibre insulation on top of each radiant panel to fully cover panel and interconnecting piping.

32 DOMESTIC WATER SYSTEMS - PIPING, VALVES AND FITTINGS

32.1 Piping and Fittings

.1 Hot and cold water and hot water recirculation piping: Type L copper with wrot copper fittings and 95/5 Sn/Sb, Silvabrite 100 or other lead free solder joints.

32.2 Gate Valves

.1 Solder or screwed end joints 50mm [2"] and smaller: Crane 1320 or 428, Jenkins 300P or 810, Lunkenheimer 2133 or 2127, Red & White 281A or 280, Neuman-Hattersley A41SE or A40AT / 33X, Kitz 41 or 40.

.2 Flanged ends 65mm [2½"] and larger: Crane 465-1/2, Jenkins 404, Lunkenheimer 1430C, Red & White 421A, Neuman-Hattersley 504, Kitz 72.

32.3 Ball Va**L**ves

.1 Ball: (in lieu of gate valves or as specified)

.2 50mm [2"] and smaller, brass two piece body, blow-out proof stem, PTFE seats, brass chrome plate ball, lever handle operator, 1035 kPa [150 PSIG] rating.

.3 Acceptable Products:

.1 Solder joint type: Red & White / Toyo 5049A, Apollo, Crane, Jenkins, Kitz, Lunkenheimer 746FS or 747FS, Neuman-Hattersley, Nibco, Watts, Worcester.

.2 Threaded joint type: Red & White / Toyo 5044A, Apollo-70 Series, Crane 93-TF, Grinnell 3700 full port, Jenkins-1101-T, Kitz 58, Lunkenheimer 746F or 747F, Neuman-Hattersley 1969AT, Nibco T-580-BR, Watts B-6000, Worcester 4211-RT.

32.4 Balance: (for domestic hot water recirculation)

.1 30mm [1¼"] and smaller, globe lockshield, for maximum system temperature, bronze body and trim, Teflon; polytetrafluoroethylene (PTFE), disc, female by male union connection, 690 kPa [100 psig] rating. Acceptable Products: Dahl 13012 or 13013 with memory stop, Dunham Bush 840A, Red & White / Toyo 250LS or 251LS, Grinnell GBV-T threaded.

.2 40mm [1½"] and larger, plug type, wrench adjustable stop, for maximum system temperature, semi-steel body, resilient plug seals, EPT or RS 55, max. 120°C [250°F] operating temperature, 860kPa [125 psig], threaded end connections for up to 50 mm [2"], flanged end connections on 65mm [2½"] and larger. Acceptable Products: DeZurik 435 with 487 adjustable stop, Homestead Ballcentric, Neuman-Hattersley 170M or 171M, Grinnell GBV-T or GBV

32.5 Vacuum relief: (for hot water tanks installations)

.1 Up to 12 mm [½"], 860 kPa [125 psig] rating. Acceptable Products: 12 mm [½"] Watts 36A, Cash Acme.

.2 19 mm [¾"] and larger, 860 kPa [125 psig] rating. Acceptable Products: 18 mm [3/4"] Watts 36A, Cash Acme.

32.6 Pressure Reducing Valves:

.1 6 mm [¼"] to 9 mm [3/8"] ,860 kPa [125 psig] rating. Acceptable Products: Watts 215, Cash Acme, Singer.

.2 12 mm [½"] to 50 mm [2"], 860 kPa [125 psig] rating. Acceptable Products: Watts 223, Braukman, Conbraco, Cash Acme, Singer.

.3 65 mm [2½"] and larger, 860 kPa [125 psig] rating. Acceptable Products: BCA 317 PR, Clayton 90 or 90B, Singer 106PR.

32.7 Pressure reducing valve with integral low flow bypass:

.1 40 mm [1½"] and larger, 860 kPa [125 psig] rating. Acceptable Products: Watts PV-10-06M, Clayton, Singer.

32.8 Water Meter:

.1 The water meter shall be supplied by the Contractor and shall be to Municipal Standards.

.2 Hermetically sealed direct reading centre sweep register, one piece cast bronze main case, nutating disc measuring chamber with flow control adjustment, magnetically driven, rated for 1035 kPa [150 psig] service, reading in cubic metres and flanged ends conforming to AWWA C700.

.1 Acceptable Products: Neptune Trident 8, Rockwell, Hersey

.3 Self generating remote meter reader to suit municipal requirements.

.4 Size meter for a maximum of 35 kPa [5 psig] pressure drop at design flow rates.

32.9 Pressure Reducing Valves Installation:

.1 Pressure reducing valve stations, as a minimum shall consist of the following:

.1 A high flow or main pressure reducing valve; which shall be one pipe size smaller than the incoming or outflowing building service, and shall be provided with a strainer, a reducer and a shut off valve on the inlet side and a reducer and a shut off valve on the outlet side.

.2 A low flow pressure reducing valve; which shall be 25 mm [1"] in size, and shall be provided with a strainer and a shut off valve on the inlet side and a shut off valve on the outlet side.

.3 A bypass around both pressure reducing valves with a normally closed globe valve; which shall be of the same pipe size as the incoming or outflowing building service, and a pressure gauge on each side of the globe valve.

.4 Where a pressure reducing valve with integral low flow bypass is used the piping, fittings and accessories shall be arranged as described above.

.2 Set main pressure reducing valve at 415 kPa [60 psi] outlet pressure.

.3 Set small flow pressure reducing valve at 35 kPa [5 psi] higher outlet pressure than main pressure reducing valve.

33 DRAIN, WASTE AND VENT SYSTEMS - PIPING AND FITTINGS

33.1 Piping and fittings - above grade

.1 Waste and vent piping 50mm [2"] and smaller: DWV copper with cast brass fittings and solder joints.

.2 Waste and vent piping 65mm [2.5"] and larger: Cast iron soil pipe and fittings with mechanical joint couplings.

33.2 Piping and fittings - below grade

.1 Acrylonitrile-Butadiene-Styrene (ABS) Drain Waste and Vent Pipe Fittings conforming to CSA CAN 3-B181.1.

.2 Polyvinyl Chloride (PVC) Drain Waste and Vent Pipe and Pipe Fittings conforming to CSA B181.2.

33.3 Install cleanouts as shown on the drawings and as required by the B.C. Plumbing Code.

34 REFRIGERATION SYSTEMS

34.1 Do refrigeration system work in accordance with latest version of B.C. Power Engineers and Pressure Vessels Safety Act and Regulations ("Refrigeration Code"), CSA B52 and ANSI B31.5.

34.2 Ensure that a permit is obtained before anyone commences to install or alter any refrigeration system.

34.3 Every person who installs or makes alterations or repairs to a refrigeration system shall be the holder of a valid and subsisting refrigeration contractor’s license and all persons repairing equipment with ODS/CFC's shall have completed an Environment Canada approved training program.

34.4 Refrigerant Tubing

.1 Provide processed tubing for refrigeration installation, deoxidized, dehydrated and sealed.

.2 Hard copper tube, type L, to ASTM B88M.

.3 Annealed copper tube to ASTM B280, with minimum wall thickness as per CSA B52.

34.5 Fittings

.1 Service: design pressure 2070 kPa [300 psig] and temperature 121^{o}C [250^{o}F]

.2 Brazed: wrought copper to ANSI B16.22 or cast bronze to MIL-F-1183E.

.3 Flare: Bronze or brass, for refrigeration, to ANSI B16.26.

.4 Long radius type for elbows and return bends.

34.6 Joints

.1 Brazing materials shall be SIL-FOS-15 phosphor-copper-silver alloy for copper piping jointed by copper fittings and silver solder for brass fittings.

.2 Flexible connections: 3/8" nominal or less shall be made using coiled soft copper tubing. For larger sizes, use seamless flexible bronze hose with bronze wire braid covering. Use factory sealed neoprene jacket unit where freezing may occur.

34.7 Shut-Off Valves:

.1 Line size; selected for low pressure drop.

34.8 Solenoid Valves:

.1 With field replaceable coil, serviceable without removing valve from line.

.2 Coil voltage to suit field requirements.

.3 Provide upstream of thermostatic expansion valves.

.4 Acceptable Products: Alco 240 RA series.

34.9 Expansion Valves:

.1 Thermostatic type with external equalizer, adjustable superheat setting, capacity and bulb charge to suit operating conditions.

34.10 Water Regulating Valves:

.1 Pressure activated two-way straight-through type.

.2 For three-way regulators, install balancing valve in by-pass, adjusted to maintain constant system flow rate irrespective of valve position.

34.11 Charging and Purging Valves

.1 Valves to be the same size as line size into which they are connected or ½" whichever is the larger.

.2 Valve complete with a removable seal cap chained to the valve body.

.3 Acceptable Products: Henry Standard type, Mueller Linemaster Special.

34.12 Sight Glass

.1 Provide sight glass in liquid line following filter drier.

.2 Sight glass shall be combination moisture-liquid indicator and with a protective removable cap.

.3 Sight glass to be fitted in-line.

.4 Acceptable Products: Henry Dri-Vue, Mueller Vuemaster, Sporlan See All.

34.13 Access Fittings

.1 Provide Schraeder access fittings in each suction connection from an evaporator, located adjacent to the superheat sensing element of the expansion valve.

.2 Fittings to be used for checking the superheat of the suction gas.

.1 Access fitting shall be soldered into a tee and shall be complete with a quick-seal cap.

34.14 Filter Drier

.1 Provide a filter drier in the liquid line from the condenser. Shut-off valves shall be installed on each side of drier and sight glass.

.2 Filter drier shall be selected to have a pressure drop of not more than 13 kPa [2 psig] when passing 150% of the system flow rate.

.3 Removable core with flare connections.

.4 Acceptable Products: Alco Extra-Klean, Catch-All, Henry Dri-Cor, Mueller Drymaster II, Sporlan.

34.15 Flexible Connections

.1 Braided tin-bronze convoluted flexible connections.

.2 Design pressure 2070 kPa [300 psig].

.3 Acceptable Products: Anaconda

34.16 Install the following accessories:

.1 Ball check isolating valves at receiver sight glass.

.2 Charging valve for high and low side filter drier, solenoid valve and thermostatic expansion valve.

34.17 Refrigerant Tests

.1 Each refrigerant system shall be tested as follows before operation with dry nitrogen gas to a pressure not less than 1.5 times the system working pressure. During the test, each joint shall be tested for leaks with a solution of soap and water. Compressors with refrigerant holding charge shall remain isolated from system.

.2 The system shall then be evacuated to not less than 33.25 Pa (250 microns) absolute and left for 24 hours, during which time the pressure shall not have increased more than 33.25 Pa (250 microns). The system shall then be pressurized to 14 kPa [2 psig] with refrigerant to be used and shall be evacuated to 66.5 Pa [500 microns] absolute and then shall be immediately fully charged with the refrigerant to be used in the system and each joint checked with an electronic testing device. Tests shall be performed before insulation is applied.

.3 All damaged or defective components shall be replaced with new (not reconditioned) components.

34.18 Start-Up and Adjustment

.1 Provide necessary instruments, gauges and testing equipment required. Adjust controls, to obtain design requirements and manufacturer's ratings.

.2 Test and record cooling apparatus entering and leaving air temperatures, dry bulb and wet bulb.

.3 Test and record voltage and running amperes and compare to motor nameplate data, and starter heater rating against design requirements.

.4 Ensure that refrigerant temperatures are accurate to within $0.5^{o}C$ [$0.9^{o}F$] of design requirements.

.5 In cooperation with controls contractor's representative, set and adjust automatic control system to achieve required sequence of operations.

.6 Bring equipment into operation, trial run and make up any loss of oil and refrigerant.

.7 Test reports to be submitted for review and inclusion in Maintenance Manuals.

35 NATURAL GAS SYSTEM - PIPING, VALVES AND FITTINGS -

35.1 Do all piping system work in accordance with CAN1-B149.1 and B.C. Code Amendments.

35.2 Submit to the Provincial Gas Inspection Department, drawings, applicable sections of specifications and detailed drawings as required to obtain approval for the gas installation before the work commences.

35.3 Pipe: Schedule 40 to ASTM A53-84a Grade B.

35.4 Pipe Fittings: Screwed, flanged or welded:

.1 Malleable iron screwed fittings (banded pattern): Class 150 to ANSI B16.3-1977.

.2 Steel pipe flanges and flanged fittings: to ANSI B16.5-1981.

.3 Steel butt-welding fittings: to ANSI B16.9a-1981.

.4 Unions, malleable iron, brass to iron ground joint type: to ANSI B16.3-1977.

35.5 Gas Valves

.1 NPS 50mm [2"] and under, screwed.

.2 NPS 75mm [3"] and over, flanged.

.3 Suitable for the temperature to which exposed.

.4 Registered and bearing Province of British Columbia, Gas Inspection Department approval.

.5 Acceptable Manufacturers: Emco, Homestead, Mueller, Newman Milliken, Wallaceburg

35.6 Roof Supports

.1 Support piping on roof with an engineered prefabricated Pipe Hanger System designed for installation without roof penetrations, flashing or damage to the roofing material. The system shall consist of bases and made of high-density polypropylene plastics with UV Protection. System shall be custom designed to fit piping and conduit to be installed and the actual conditions of service.

.2 Install using Pro Pipe Support system and Clamps. Follow manufacturer's instructions to adhere supports to roof.

.3 Field fabricated wood supports will not be accepted.

35.7 Piping Installation

.1 Install piping in accordance with applicable code.

.2 Use dielectric type fittings where buried service enters and connects to building piping.

.3 Slope piping down in direction of flow to low points.

.4 Install valve on the main gas service entering the building. Valve to have locking lugs.

.5 Prime, paint and label piping.

35.8 Testing

.1 Test system in accordance with applicable code.

.2 Notify the Consultant and the Inspection Authority having jurisdiction, 48 hours in advance of intended test date.

.3 Examine piping for leaks. Remake all leaking connections and joints.

35.9 Purging

.1 Purge after pressure test in accordance with applicable code.

36 ROOF DRAINS AND FLOOR DRAINS

36.1 Acceptable manufacturers of spun copper or aluminum roof drains: Menzies Metal Products

36.2 Acceptable manufacturers of full body floor and roof drains: Watts, Zurn, Mifab, Smith

36.3 Trap Seal Primers:

.1 Provide pressure actuated type priming device for all floor drains. Locate at locations that are readily accessible by the building maintenance staff. Provide isolation valve. (alternative: consider DDC controlled solenoid valves as they are more dependable)

.2 Acceptable Products: Precision Plumbing Products Model P-1, Mifab 500

36.4 Floor Drain FD-1:

.1 Floor drain shall include trap primer connection and trap primer device.

.2 Acceptable Products:Zurn, Ancon, Enpoco

37 PLUMBING FIXTURES AND TRIM

37.1 Acceptable Manufacturers

.1 Acceptable manufacturers of plumbing fixtures: American Standard, Crane, Kohler, Toto.

.2 Acceptable manufacturers of plumbing faucets and trim (except hands-free): Symmons, Cambridge Brass, Teck, Chicago, Crane, Zurn.

.3 Acceptable manufacturers of hands-free plumbing faucets and flush valves: Sloan.

.4 Acceptable manufacturers of stainless steel sinks: Aristaline, Kindred, Elkay, Steel Queen, AMI, Metcraft.

.5 Acceptable manufacturers of water closet seats: Olsonite, Moldex, Bemis, Centoco

.6 Acceptable manufacturers of fixture carriers: Smith, Zurn, Watts, Enpoco.

.7 Acceptable manufacturers of flush valves (except hands-free): Zurn, Teck, Chicago, Crane, Sloan.

.8 Acceptable manufacturers of floor mounted janitor sinks: Fiat, Stern-Williams.

.9 Acceptable manufacturers of drinking fountains: Haws, Elkay, Western, Sunroc, Aquarius, Halsey Taylor

.10 Acceptable manufacturers of mixing valves: Powers, Symmons, Leonard, Lawler

.11 Acceptable manufacturers of emergency eye washes and safety showers: Western, Haws, Guardian, Bradley, Encon

37.2 Handicap Fixtures

.1 Water Closets

.1 Install all wall hung water closets designated for handicap use at an elevation above the finished floor level of 460mm [18"] to the rim of the fixture.

.2 Install offset on handicap watercloset flush valve connection to eliminate any interference with grab bar mounting.

.3 Install the flush valve such that the handle is facing the transfer or non-grab bar side of the water closet.

.2 Lavatories and Sinks

.1 Offset P-traps shall be installed with the run of the P-trap parallel to and close to wall.

.2 Supplies on handicap lavatories shall be offset to accommodate the offset P-trap.

.3 P-traps, waste arms and water supplies at all handicap accessible lavatories and sinks shall be insulated with a manufactured insulation kit or 12mm [½"] of fiberglass insulation and finished with a polyvinyl chloride jacket in a neat and workmanlike manner.

.4 Acceptable Manufactured Products: Truebro 'Handi Lav-Guard', Brocar Products Inc. 'Trap Wrap', Sexauer 'Handi Lav-Guard'

37.3 Water Closet 'WC-1':

.1 **American Standard Afwall Millennium Flowise Elongated #3351.101.020 HET Toilet**, white vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, Wall Hung, siphon jet flush action, operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, condensate channel, 305 mm x 254 mm (12" x 10") water surface area, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, back outlet, 38 mm (1-1/2") dia. Top spud. **Centoco #500STSCC.001 toilet seat**, heavy duty, for elongated bowl open front, white solid plastic, less cover, reinforced stainless steel check hinges, metal flat washers stainless steel posts and nuts. **Sloan #111-1.28 SMO, Exposed Flushometer** for Top Spud toilet, 4.8 L (1.28 US Gal) factory set flow, fixed volume piston with filtered O-ring bypass, infrared sensor, courtesy flush over-ride button, vandal resistant stop cap on back-check angle stop (screwdriver operated), flush tube for 292 mm (11-1/2") rough-in, vacuum breaker, four 'C' batteries (included) serviceable without shutting off water with 'Low Battery' flashing LED. **Watts #ISCA-101-M11, single horizontal, Adjustable Toilet Carrier**, mounted on concrete floor, all epoxy coated cast iron fitting, adjustable ABS slide nipple with integral test cap and neoprene bowl gasket, wasted plated hardware, chrome cap nuts, tiling frame, 102 mm (4") no hub waste, 51 mm (2") no hub vent. 305 mm (12") finished metal stud wall to back of pipe space.

37.4 Water Closet 'WC-2':

.1 **American Standard Afwall Millennium Flowise Elongated #3351.101.020 HET Toilet**, white vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, Wall Hung, siphon jet flush action, operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, condensate channel, 305 mm x 254 mm (12" x 10") water surface area, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, back outlet, 38 mm (1-1/2") dia. Top spud. Mount fixture 16"(406mm) above finished floor to rim of toilet (or as required by local code).**Centoco #500STSCC.001 toilet seat**, heavy duty, for elongated bowl open front, white solid plastic, less cover, reinforced stainless steel check hinges, metal flat washers stainless steel posts and nuts. **Sloan Royal Optima #111 ES-S-CP, Exposed Flushometer** for Top Spud toilet, chrome plated, 6 L (1.6 US Gal) factory set flow, quiet action 'PERMEX' diaphragm type with dual filter by-pass, infrared sensor located on a 125 mm x 125 mm (4-15/16" x 4-15/16") stainless steel plate, courtesy flush over-ride button, V.P. Smooth design stop cap on back-check angle stop (screwdriver operated), flush tube for 292 mm (11-1/2") rough-in, high pressure vacuum breaker, sensor located above the toilet, 5 VA Power Required per unit. **Provide 4" (102 mm) square electrical box for mounting sensor plate. Sloan #EL-154, box mount hard wired transformer**, 120 VA / 24 VA 50 A. **Franke Commercial Midland #CM16104**, back rest, satin finish type 304 18 GA. (1.2mm) stainless steel bar 32 mm (1-1/4") diameter, antique white solid core plastic laminate panel. **Watts #ISCA-101-M11, single horizontal, Adjustable Toilet Carrier**, mounted on concrete floor, all epoxy coated cast iron fitting, adjustable ABS slide nipple with integral test cap and neoprene bowl gasket, wasted plated hardware, chrome cap nuts, tiling frame, 102 mm (4") no hub waste, 51 mm (2") no hub vent. 305 mm (12") finished metal stud wall to back of pipe space.

37.5 Urinal ‘UR-1’:

.1 **American Standard Decorum Flowise #6042.005.020 Urinal**, white vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, 1.9 L (0.5 US Gal) per flush, Wall Hung, washdown action, 19 mm (3/4") dia. Top spud, integral P-trap, outlet connection 51 mm (2"), wall hanger. Mount fixture between 19-1/4" and 20-1/8" (488mm and 512mm) above finish floor to front rim of urinal (or as required by code).**Sloan** Optima **Plus #8186-0.5-CP, Exposed Flushometer** for Top Spud urinal, chrome plated, 1.9 L (0.5 US Gal) factory set flow, quiet action 'PERMEX' diaphragm type with linear filtered by-pass and Vortex Cleansing Action, infrared sensor with multiple-focused lobular sensing fields for high and low target sensing, courtesy flush over-ride button, vandal resistant stop cap on back-check angle stop (screwdriver operated), flush tube for 292 mm (11-1/2") rough-in, vacuum breaker, patented 'Isolated Operator' for superior performance under a heavy duty metal stylish cover with plastic optical face, four 'AA' batteries (included) serviceable without shuting off water with 'Low Battery' flashing LED. **Watts #CA-321, Urinal Carrier**, mounted on concrete floor, epoxy coated with heavy gauge steel uprights with welded feet supports and with top and bottom universal steel hanger plates with plated hardware, heavy gauge epoxy coated steel offset uprights. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space. **Watts #WU-CO Urinal Wall Access Cleanout**, two piece expandable plug with 102mm (4") diameter stainless steel access cover and secured with vandal proof stainless steel screw

37.6 Lavatory ‘LAV-1’:

.1 **American Standard Mezzo #9960.403 Basin,** 546 mm x 559 mm x 210 mm (21-1/2" x 22" x 8-1/4") deep, fireclay, semi-counter, rear overflow, faucet ledge, space saving design, mounting kit. Provide basin rim sealant. **Sloan Optima #ETF-600-LT-VPB-SL-BDT-LF Electronic Faucet**, chrome plated, 4" (102mm) centerset, cast brass, 1.9 LPM (0.5 GPM) aerator spray outlet, infrared sensor with screw adjustable range, undercounter filtered solenoid valve with serviceable strainer filter, module control assembly with splashproof junction box and mounting kit, 24VAC 50/60Hz, vandal proof box, 12" (305mm) sq. Recessed metal box with 13"(330mm) sq. V.P. S.S face, located in wall under basin. Flexible copper supply, Below Deck lead free Thermostatic Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlet and outlet FNPT connection, integral checks, offer temperature range between 95 C (203 F) and 46 C (114.8 F). Set valve temperature at 46 C (114.8 F). **Provide tee, adaptors and flex. copper tubing to suit installation.** 15 VA power required per unit. **Sloan #EL-154, box mount hard wired transformer**, 120 VA / 24 VA 50 A. **McGuire #155WCC Offset Open Grid Drain,** chrome plated cast brass one piece top, 17 GA. (1.5mm) mm tubular 32 mm (1-1/4") tailpiece. **McGuire #8872C P-Trap,** heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. **McGuire PROWRAP #PW2000WC Sanitary Covering vandal-resistant,** flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.

37.7 Lavatory ‘LAV-2’:

.1 **American Standard Cadet #0236.004 Basin,** 622 mm x 508 mm x (24-1/2" x 20" x 8") deep, vitreous china, for carrier with "U" bracket, rear overflow, faucet ledge, generous shelf area. **Sloan Optima #ETF-600-LT Electronic Faucet**, chrome plated, 4" (102mm) centerset, cast brass, 1.9 LPM (0.5 GPM) aerator spray outlet, infrared sensor with screw adjustable range, undercounter filtered solenoid valve with serviceable strainer filter, module control assembly with splashproof junction box and mounting kit, 24VAC 50/60Hz, vandal proof box. **Provide tee, adaptors and flex. copper tubing to suit installation.** 15 VA power required per unit. **Sloan #EL-154, box mount hard wired transformer**, 120 VA / 24 VA 50 A. **Lawler #TMM-1070, Point Of Use Mechanical Water Mixing Valve**, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop (automatic shuts down flow of water when temperature reaches 48 deg.C (118 deg.F) with automatic reset, shut-off with automatic reset when temperature exceeds 120F (48.8C), integral checks, offer temperature range from full cold through 46 °C (114.8 °F). **Provide tee, adaptors and flex. copper tubing to suit installation. McGuire #155AC Open Grid Drain,** chrome plated cast brass one piece top, 17 GA. (1.5mm) tubular 32 mm (1-1/4") tailpiece. **McGuire #LFH170BV, Faucet Supplies**, chrome plated polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handle, escutcheons and flexible copper riser. **McGuire #8872C P-Trap,** heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. **Watts #CA-421, Fixture Carrier**, steel hanger plate, heavy gauge epoxy coated steel uprights with welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

37.8 Mop Sink ‘MS-1’:

.1 **American Standard #7692.000 service / Mop sink**, 457 mm (18") x 559 mm (22") x 515 mm (20-1/4") deep, Wall Hung, faucet on wall, enamelled cast iron construction porcelain finish, 229 mm (9") high plain backsplash, stainless steel rim guard, wall hanger. **Chicago Faucets #897-369VP-XK wall mounted Two Handle Manual Faucet**, chrome plated, 8" (203mm) centerset, solid brass exposed body, ceramic 1/4 turn cartridges, unrestricted hose end outlet, 200 mm (7-7/8") from wall to outlet reach, integral atmospheric vacuum breaker, metal red and blue index buttons 60 mm (2-3/8") long lever handles with vandal resistant screw. Wall brace support. **American Standard #7798.030 Pedestal P-Trap with adjustable foot,** cast iron with metallic open grid strainer, 76 mm (3") outlet, flange and nipple by other and F.N.P.T. Connection.

37.9 Mop Sink ‘MS-2’:

.1 **Stern Williams #EB-54 square service / Mop sink**, 610 mm (24") x 610 mm (24") x 152 mm (6") deep, Floor Mounted, terrazzo composed of pearl gray marble chips and Portland cement ground smooth, sealed to resist stain, cast brass drain with stainless steel strainer, 3"(75mm) outlet. **Chicago Faucets #897-369VP-XK wall mounted Two Handle Manual Faucet**, chrome plated, 8" (203mm) centerset, solid brass exposed body, ceramic 1/4 turn cartridges, unrestricted hose end outlet, 200 mm (7-7/8") from wall to outlet reach, integral atmospheric vacuum breaker, metal red and blue index buttons 60 mm (2-3/8") long lever handles with vandal resistant screw. Wall brace support. **Stern Williams T-35 Hose and Wall Hook** hose 36" (914mm) long with 3/4" (19mm) chrome coupling, stainless steel wall bracket. **Stern Williams T-40 Mop Hanger** stainless steel #4 finish, 24" (610mm) long with 3 rubber spring loaded clips. **Stern Williams BP Back Splash Panel** 20 gauge type 304 stainless steel. **Provide P-Trap,** same material as the connecting pipe drain.

37.10 Sink 'SK-1':

.1 **Franke Commercial #LBD6808-1/1 Double Bowl Countertop Mount Sink**, 1 hole, 522 mm (20-9/16") x 995 mm (39-3/16") x 203 mm (8") deep, counter mounted, backledge, 18-10 type 302 20 GA. (0.9mm) stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece. **Chicago Faucets #430-ABCP Single Lever Faucet**, chrome plated, center hole only, lead free cast brass body, 5.7 LPM (1.5 GPM) aerator outlet, long cast spout 229 mm (9") projection reach, lever handle, adjustable volume control, adjustable hot limit stop. **McGuire #LFH170BV, Faucet Supplies**, chrome plated polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handle, escutcheons and flexible copper riser. **Provide P-Trap,** adjustable all metal construction, 38 mm (1-1/2") size, and escutcheon.

37.11 Sink 'SK-2':

.1 **Franke Commercial #LBS6808-1/1 Single bowl Countertop Mount Sink**, 1 hole, 521 mm (20-1/2") x 508 mm (20") x 203 mm (8") deep, counter mounted, backledge, 18-10 type 302 20 GA. (0.9mm) stainless steel, self-rimming, satin finish rim and bowls, mounting kit provided, fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece. **Chicago Faucets #430-ABCP Single Lever Faucet**, chrome plated, center hole only, lead free cast brass body, 5.7 LPM (1.5 GPM) aerator outlet, long cast spout 229 mm (9") projection reach, lever handle, adjustable volume control, adjustable hot limit stop. **McGuire #LFH170BV, Faucet Supplies**, chrome plated polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handle, escutcheons and flexible copper riser. **Provide P-Trap,** adjustable all metal construction, 38 mm (1-1/2") size, and escutcheon.

37.12 Shower Valve and HandShower 'SH-1':

.1 **American Standard Ceramix #T000.500/R120SS, pressure balancing mixing valve, brass body, washerless ceramic drip-free disc valve cartridge, integral hot limit stop, screwdriver stops with separate checks.** brass wall escutcheon, metal lever handle. Comply to local codes for Shower Control location and Trim Kit requirements. **American Standard #1662.551 3 function spray hand shower,** 9.5 LPM (2.5 GPM) maximum flow rate, spray pattern adjust from gentle rain to hard rain to massage, easy clean rubber nozzles, integral checks. **American Standard #1660.400 HandShower Vacuum Breaker,** between supply outlet and personal shower hose. **Watts #FD-100-C-A Floor Drain,** epoxy coated cast iron, anchor flange, 5" (127mm) adjustable round nickel bronze strainer, reversible clamping collar with primary & secondary weepholes. **Provide P-Trap,** same material as the connecting pipe drain.

37.13 Drinking Fountain 'DF-1':

.1 **Elkay Model VRC8WS** Unit shall include electric water cooler with bottle filling station. VRC8WS shall deliver 8 GPH of 50°F drinking water at 90°F ambient and 80°F inlet water. Units shall be stainless steel construction and include vandal-resistant pushbutton activation. Cooler shall include vandal-resistant bubbler. Bottle filling unit shall include an auto 20-second shut-off timer. Shall include Green Ticker™ displaying count of plastic bottles saved from waste. Bottle filler shall provide 1.1-1.5 gpm flow rate with laminar flow to minimize splashing. Shall include integrated silver ion anti-microbial protection in key areas. Unit shall meet ADA guidelines. Unit shall be lead-free design which is certified to NSF/ANSI 61 and 372 and meets Federal and Provincial low-lead requirements. Unit shall be certified to UL399 and CAN/CSA 22.2 No. 120.

37.14 Drinking Fountain Bubbler'DF-2':

.1 **Chicago Faucets No. 748-665ABCP**, Deck Mounted Single Hole Drinking Fountain, Chrome Plated solid brass construction. 1-3/4" Metal Vandal Proof MVP Metering Push handle(s) with Blue or Red Button. 1/2" NPSM Supply Inlet and Coupling Nut for 3/8" or 1/2" Flexible Riser. Anti-Rotational Pins for Optional Field Installation. Vandal Resistant Recessed Manual Volume Control. All metal projector head. ECAST® construction with less than 0.25% lead content by weighted average.

37.15 Hosebib 'HB-1':

.1 **ZURN Z1300** Encased Ecolotrol "anti-siphon" automatic draining wall hydrant for flush installation. Complete with non-freeze type integral backflow preventer, bronze casing, all bronze interior parts, non-turning operating rod with free-floating compression closure valve, replaceable bronze seat and seat washer, and combination 3/4 [19] female or 1 [25] male straight IP inlet. Nickel bronze box and hinged cover with operating key lock and "WATER" cast on cover.

38 DOMESTIC WATER HEATER (DWH-1/2)

38.1 Natural gas water heater(s) shall be A. O. Smith Cyclone HE model # BTX-80, with 90% thermal efficiency, a storage capacity of 50 gallons, an input rating of 76,000 BTUs per hour, a recovery rating of 83 gallons per hour at 100ºF rise and a maximum hydrostatic working pressure of 150 psi. Water heater(s) shall be of power vent design, using 2", 3" or 4" PVC pipe for horizontal and/or vertical vent runs. Water heater(s) shall have: 1: Glasslined steel tank construction and a spiral-shaped heat exchanger placed entirely inside the tank, which shall be glasslined on the flue gas side to protect against acidic condensate. 2: An Intelli-Vent™ gas control system with silicon nitride hot surface ignitor. 3: A 3-year limited warranty against tank leaks.

39 FIRE EXTINGUISHERS (FE)

39.1 Acceptable Manufacturers

.1 National Fire Equipment, General, Ansul, Chubb, Nystrom, Pyrene, Larsen

39.2 Fire Extinguisher and Cabinet 'FE-1':

.1 Extinguisher: Multipurpose stored pressure rechargeable fire extinguisher, rating for 4-A, 60-B, C and capacity of 4.5 kilograms [10 pounds], mounted in a fully recessed steel cabinet with prime coat finish and full glass panel, and of dimensions to suit the specified extinguisher.

.2 Acceptable Products: National Fire Equipment ABC-10F in NFE C-950 cabinet

39.3 Fire Extinguisher 'FE-2':

.1 Extinguisher: Multipurpose stored pressure rechargeable fire extinguisher, squeeze grip positive on/off operation, heavy duty glossy enamel finish steel cylinder, pull pin safety lock, forged valve, rating for 4-A, 60-B, C and capacity of 4.5 kilograms [10 pounds] with wall bracket.

.2 Acceptable Products: National Fire Equipment ABC-10F

40 DUCT CONTROLS GENERAL

40.1 Acceptable Manufacturers

.1 Delta, Siemens, Inland Comfort, Care Systems

40.2 Control system shall be an electronic system. The system architecture shall utilize intelligent distributed control modules, located at each piece of equipment, which will communicate on a peer to peer LAN trunk.

40.3 The system shall provide direct digital control, energy management and building automation for the heating, ventilating and air conditioning systems based upon heating and cooling demands as per the sequence of operations described herein.

40.4 The installation shall be performed by Contractors specializing in this type of control system installation and setup.

40.5 The Contractor shall be responsible for the following items:

.1 All conduit and wiring for the low voltage control system.

.2 Supply of control valves and external control dampers and operators to the Mechanical Contractor.

.3 All programming, commissioning and tuning of the complete control system.

.4 Shop drawings, as-built diagrams and operating manuals.

.5 Demonstration and instruction for the Owner.

40.6 Space Temperature Sensor

.1 Sensors shall be thermistor type.

40.7 Pump Status Indication

.1 Water flow switch shall have stainless steel paddles.

40.8 Air Handling Unit Status Indication

.1 Adjustable setpoint current sensing relay.

40.9 Control Dampers

.1 Low leakage outside air damper c/w side seals and edge seals.

40.10 Damper Actuators

.1 Gear drive direct coupled with spring return electronic actuators sized for a minimum of 15% excess torque for the damper area controlled.

41 CONTROLS SEQUENCE OF OPERATION

41.1 Washroom Building Control

.1 General:

.1 The Washroom system consists of the following major components:

.1 Make Up Air Unit MUA-1.

.2 Exhaust Fans EF-1, EF-2

.3 Temperature Sensors (averaging mode)

.4 Outdoor air damper

.5 Condensing unit CU-1

.2 Operation:

.1 Unoccupied Mode:

.1 During unoccupied mode:

.1 The Make Up Air (MUA-1) unit shall normally be off.

.2 The Control Damper CD-1 shall be closed.

.3 Exhaust fans EF-1 and EF-2 shall be off.

.4 When the washroom areas require heating during unoccupied mode (as sensed by the averaging sensors):

.1 Control Damper CD-1 shall open.
.2 MUA-1 shall start
.3 Exhaust Fans EF-1 and EF-2 shall start
.4 The system shall operate until space temperatures are achieved (as sensed by the averaging temperature sensors) and for a minimum of 15 minutes.

.2 Occupied Mode:

.1 MUA-1 shall operate in occupied/unoccupied mode according to a user defined schedule.
.2 When MUA-1 is operating in occupied mode the outdoor air dampers, fans and the refrigeration compressors shall operate in sequence to maintain the supply air temperature at setpoint.
.3 The space temperature setpoint shall be 14°C (58°F) in winter and 24°C (75°F) in summer.
.4 The refrigeration compressor shall be locked out from operating when the outdoor air temperature is below 10°C [50°F].
.5 The refrigeration compressor control sequences shall contain minimum on and minimum off times as recommended by the manufacturer.

.3 Fail safe Mode:

.1 In the event of a power failure, all systems shall revert to off position and restart when power is restored if required.
.2 System shall stop if SAT set point is not maintained. Revert to failsafe position.
.3 DDC provides alarm if failure or high/low space temperature alarm

41.2 Change Room Building Control

.1 General:

.1 The Change Room system consists of the following major components:

.1 Make Up Air Unit MUA-2.
.2 Exhaust Fan EF-3
.3 Temperature Sensors (averaging mode)
.4 Outdoor air damper CD-4
.5 Condensing unit CU-2

.2 Operation:

.1 Unoccupied Mode:

.1 During unoccupied mode:
.2 The Make Up Air (MUA-2) unit shall normally be off.
.3 The Control Damper CD-4 shall be closed.
.4 Exhaust fans EF-3 shall be off.
.5 When the washroom areas require heating during unoccupied mode (as sensed by the averaging sensors):
.6 Control Damper CD-4 shall open.
.7 MUA-2 shall start
.8 Exhaust Fans EF-3 shall start
.9 The system shall operate until space temperatures are achieved (as sensed by the averaging temperature sensors) and for a minimum of 15 minutes.

.2 Occupied Mode:

.1 MUA-2 shall operate in occupied/unoccupied mode according to a user defined schedule.

.2 When MUA-2 is operating in occupied mode the outdoor air dampers, fans and the refrigeration compressors shall operate in sequence to maintain the supply air temperature at setpoint.

.3 The space temperature setpoint shall be 14°C (58°F) in winter and 24°C (75°F) in summer.

.4 The refrigeration compressor shall be locked out from operating when the outdoor air temperature is below 10°C [50°F].

.5 The refrigeration compressor control sequences shall contain minimum on and minimum off times as recommended by the manufacturer.

.3 Fail safe Mode:

.1 In the event of a power failure, all systems shall revert to off position and restart when power is restored if required.

.2 System shall stop if SAT set point is not maintained. Revert to failsafe position.

.3 DDC provides alarm if failure or high/low space temperature alarm

41.3 Classroom Control

.1 General:

.1 The Classroom system consists of the following major components:

.1 Fan Coil Unit FCU-1.

.2 Exhaust Fan EF-4

.3 Condensing Unit CU-3

.4 Temperature Sensor

.5 Occupancy Sensor c/w push button over-ride.

.6 Modulating outdoor air/return air damper

.2 Operation:

.1 Unoccupied Mode:

.1 During unoccupied mode the Fan Coil unit shall normally be off.

.2 When the classroom requires heating during unoccupied mode FCU-1 shall start and operate until space temperatures are achieved and for a minimum of 15 minutes. The outside air dampers shall remain closed and EF-4 off at all times during unoccupied mode.

.3 If a space sensor push button over-ride is activated, FCU-1 shall start and operate in occupied mode. Pushing and holding the over-ride button for more than 3 seconds shall return the classroom to unoccupied mode.

.2 Occupied Mode:

.1 FCU-1 shall operate in occupied/unoccupied mode according to a user defined schedule.

.2 When FCU-1 is operating in occupied mode the mixed air dampers, fan and the refrigeration compressors shall operate in sequence to maintain the supply air temperature at setpoint.

.3 The space temperature setpoint shall be 14°C (58°F) in winter and 24°C (75°F) in summer.

.4 The refrigeration compressor shall be locked out from operating when the outdoor air temperature is below 10°C [50°F].

.5 The refrigeration compressor control sequences shall contain minimum on and minimum off times as recommended by the manufacturer.

.3 Fail safe Mode:

.1 In the event of a power failure, all systems shall revert to off position and restart when power is restored if required.

.2 DDC provides alarm if failure or high/low space temperature alarm

42 EQUIPMENT SCHEDULES

UNIT NO	**MUA-1**	**MUA-2**
SERVICE	Washroom	Change Room
HEATING:		
CAPACITY (kW)	82.07	164.14
(BTUh)	280000.00	560000.00
EDB. (C)	-20.00	-20.00
(F)	-4.00	-4.00
TYPE:	Indirect Fired	Indirect Fired
SUPPLY FAN:		
AIR FLOW (L/s)	1415.70	2831.40
(CFM)	3000.00	6000.00
S.P. (Pa)	186.83	186.83
(ins)	0.75	0.75
FAN DRAW (BHP)	2.00	5.00
GAS FURNACE:		
INPUT (kW)	102.59	0.21
(MBH)	350.00	700.00
FAN MOTOR (HP)	3.00	5.00
VOLTS/PHASE/Hz	575/3/60	575/3/60
MANUFACTURER	Engineered Air	Engineered Air
MODEL NO	DJS40/C/V	DJS100/V/C
SEE NOTE(S)	1,2,3	1,2,3

NOTES:
1. GAS PRESSURE REGULATOR
2. SUPPLIER TO CONFIRM UNIT WILL FIT WITHIN AVAILABLE MECHANICAL SPACE
3. INDOOR UNIT

NOTATION	A	B	C
MANUFACTURER	E.H.PRICE	E.H.PRICE	E.H.PRICE
TYPE	Heavy Duty	Heavy Duty	Round Plaque
MODEL NO	96	90	RPD
BORDER	-	-	-
BLADE ORIENT.	L	L	
CORE STYLE	-	-	-
VANES	-	-	-
NO OF SLOTS	-	-	-
NOM. SIZE	Refer to dwgs	Refer to dwgs	250mm
VOLUME DAMPER	D	D	-
MOUNTING FRAME	-	-	-
FASTENING	A	A	-
FINISH	As per Arch.	As per Arch.	As per Arch.
SEE NOTE(S)	1	1	2

1. Duct mounted grille. Provide boot as required.
2. Inlet size to suit mechanical drawings

FOR LEGEND REFER TO SCHEDULE No MS141

UNIT NO	**CU -1**	**CU -2**	**CU -3**
SERVICE	MUA-1	MUA-2	FC-1
LOCATION	OUTSIDE	OUTSIDE	OUTSIDE
CAPACITY (kW)	24.74	51.85	10.49
(BTUh)	84400	176900	35800
REFRIGERANT	R-410a	R-410a	R-410a
CONDENSER FAN:			
AIR FLOW (L/s)	1416	2831	
(CFM)	3000	6000	
FAN MOTOR (HP)			
AMBIENT AIR:			
MAX TEMP.(C)	38	38	-18
(F)	100	100	
VOLTS/PHASE/Hz	575/60/3	575/60/3	208/60/1
MANUFACTURER	ENGINEERED AIR	ENGINEERED AIR	TITAN
MODEL NO	CUE83/O	CUE163	CCHG-36-DFN13
SEE NOTE(S)	1	1	1,2

1. CONDENSING UNIT TO BE MATCHED TO MAKE
2. UNIT SHALL BE HORIZONTAL DISCHARGE.

UNIT NO	**CD - 1**	**CD - 2**	**CD - 3**	**CD - 4**
SERVICE	MUA-1	FCU-1	FCU-1	MUA-2
AIR STREAM	O/A	O/A	R/A	O/A
FLOW (L/s)	1416	118	448	2831
(CFM)	3000	250	950	6000
SIZE:				
W X H (mm)	1050X950	500x500	600x450	1200x1200
VELOCITY (m/s)				
(F/M)				
NORMAL POSITION	CLOSED	CLOSED	OPEN	CLOSED
TYPE	2P	2P	2P	2P

DAMPER TYPE:
2P - 2 POSITION
MOD - MODULATING
NORMAL POSITION IS "BENCH" POSITION

UNIT NO	**EF-1**	**EF-2**	**EF-3**	**EF-4**
SERVICE	Washroom - Lower	Washroom - Upper	Change Room	Classroom
LOCATION	Washroom - Lower	Female WC 206	Mech Room 311	Classroom 309
FAN TYPE				
AIR FLOW (L/s)	590	543	2,831	118
(CFM)	1,250	1,150	6,000	250
FAN S.P. (Pa)	125	125	125	125
(ins)	0.5	0.5	0.5	0.5
FAN DRAW				
FAN (RPM)	1725	1382	734	1245
DRIVE TYPE	DIRECT	BELT	DIRECT	DIRECT
FAN MOTOR (HP)	0.25	0.5	1.5	0.5
VOLTS/Hz/PHASE	115/60/1	115/60/1	115/60/1	115/60/1
MANUFACTURER	GREENHECK	GREENHECK	GREENHECK	GREENHECK
MODEL NO	BDF-80-5	SQ-100-A	BSQ-240-15	SQ-80-4
SEE NOTE(S)	1	1	1	1

NOTES:
1 - Provide backdraft damper at outlet of fan.

UNIT NO	**FCU -1**
SERVICE	Classroom
LOCATION	Classroom 309
HEATING:	
TOTAL (kW)	8.29
(BTUh)	28278
COOLING:	
TOTAL (kW)	13.14
(BTUh)	44830
SENS. (kW)	9.15
(BTUh)	31220
EDB. (C)	26.7
(F)	80.0
EWB. (C)	19.4
(F)	67.0
LDB. (C)	13.5
(F)	56.3
LWB. (C)	12.8
(F)	55.0
COIL REFRIG. (C)	7.2
(F)	45.0
REFRIGERANT	R-410A
SUPPLY FAN:	
FLOW (L/s)	566
(CFM)	1200
EXT.S.P.(Pa)	125
(ins)	0.50
FAN RPM	
FAN MOTOR (HP)	0.75
VOLTS/PHASE/Hz	575/60/3
MANUFACTURER	Trane
MODEL NO	BCHC036H1
NOTES	SEE BELOW

SEE NOTE(S)
1. Stainless Steel drain pan. Confirm orientation on site
2. c/w 2" pleated MERV 8/ Mixing Box
3. c/w opposed blade dampers.
4. horizontal configuration
5. Motor, drive & control box on Same Side as Coil & Drainpan Connection

UNIT NO	**LV-1**	**LV-2**	**LV-3**	**LV-4**	**LV-5**
SERVICE	MUA-1	MUA-2	EF-1	EF-2	EF-3
LOCATION	Washroom Mechanical Room	ChangeRoom Mechanical Room	Storage Room	Female Washroom	ChangeRoom Mechanical Room
LOUVRE SIZE:					
WIDTH (mm)	1067	1219	457	610	
(ins)	42	48	18	24	
HEIGHT (mm)	660	1270	356	457	610
(ins)	26	50	14	18	24
DEPTH (mm)	102	102	102	102	
(ins)	4	4	4	4	
CAPACITY (L/s)	1416	3539	1416	512	
(CFM)	3000	7500	3000	1085	
FACE VEL.(m/s)	4.32	4.32	4.32	4.32	
(F/M)	850	850	850	850	
AIR P.D. (Pa)	25	25	25	25	
(ins)	0.10	0.10	0.10	0.10	
BORDER	B	B	B	B	
FASTENING	A	A	A	A	
FINISH	B	B	B	B	
MANUFACTURER	EH Price	EH Price	EH Price	EH Price	EH Price
MODEL NO	ZE439	ZE439	ZE439	ZE439	BCJE443
SEE NOTE(S)					1,2

LEGEND:

BORDER
- A - NO FLANGE
- B - FLAT FLANGE
- C - ANGLE INSIDE
- D - ANGLE OUTSIDE

FASTENING
- A - BOLTED FLANGE
- B - BOLTED FRAME
- C - STRAP ANCHOR

FINISH
- A - MILL
- B - BAKED ENAMEL TO ARCHITECT'S CHOICE
- C - PRIME COAT

NOTES:
1. C/W ROOF CURB & BIRDSCREEN
2.FREE AREA OF 3 SQFT 56IN INSIDE PENTHOUSE PERIMETER, 24IN HEIGHT

UNIT NO	**LV-6**	**LV-7**	**LV-8**
SERVICE	MUA-1	MUA-2	FCU-1
LOCATION	Washroom Mechanical Room	ChangeRoom Mechanical Room	Classroom
LOUVRE SIZE:			
WIDTH (mm)	254	406	610
(ins)	10	16	24
HEIGHT (mm)	254	406	457
(ins)	10	16	18
DEPTH (mm)	102	102	102
(ins)	4	4	4
CAPACITY (L/s)			118
(CFM)			250
FACE VEL.(m/s)			4.32
(F/M)			850
AIR P.D. (Pa)			25
(ins)			0.10
BORDER	B	B	B
FASTENING	A	A	A
FINISH	B	B	B
MANUFACTURER	EH Price	EH Price	EH Price
MODEL NO	ZE439	ZE439	ZE439
SEE NOTE(S)			

LEGEND:

BORDER
- A - NO FLANGE
- B - FLAT FLANGE
- C - ANGLE INSIDE
- D - ANGLE OUTSIDE

FASTENING
- A - BOLTED FLANGE
- B - BOLTED FRAME
- C - STRAP ANCHOR

FINISH
- A - MILL
- B - BAKED ENAMEL TO ARCHITECT'S CHOICE
- C - PRIME COAT

NOTES:

UNIT NO	**P -1**	**P -2**
SERVICE	DWH-1	DHW-2
LOCATION	Washroom Mech	Change Room Mech
PUMP TYPE	DWH Recirc	DWH Recirc
CAPACITY (L/s)	0.32	0.32
(USGPM)	5	5
LIQUID	water	water
LIQUID TEMP.(C)	60.0	60.0
(F)	140.0	140.0
DIFF.PRESS.(kPa)	24	24
(Ft)	8	8
PUMP (r/min)	1800	1800
PUMP MOTOR (HP)	1/12	1/12
VOLTS/PHASE/Hz	115/1/60	115/1/60
MANUFACTURER	Armstrong	Armstrong
MODEL NO	S25	S25
SERIES	1,2,3	1,2,3

SEE NOTE(S)
1. Bronze body
2. Non-ferrous impeller.
3. Suitable for portable water use

UNIT NO	**ET-1**	**ET-2**
SERVICE	DWH-1	DWH-2
LOCATION	Washroom Mech. Room	Washroom Mech. Room
WK.PRESS. (kPa)	1034	1034
(PSI)	150	150
CAPACITY (L)	24	24
(USGAL)	6	6
TANK DIMENSIONS:		
DIAMETER (mm)	305	305
(ins)	12	12
LENGTH (mm)	330	330
(ins)	13	13
ARRANGEMENT	Inline Vertical	Inline Vertical
MANUFACTURER	Amtrol	Amtrol
MODEL NO	ST-12-C	ST-12-C
SEE NOTE(S)	1	1

1. MUST COMPLY WITH LOW LEAD PLUMBING REQUIREMENTS

NOTE:
A. FOR TANK TAPPINGS SEE DRAWINGS AND SPECIFICATIONS
B. FOR DOMESTIC H.W. TANK SEE HEAT EXCHANGER SCHEDULE