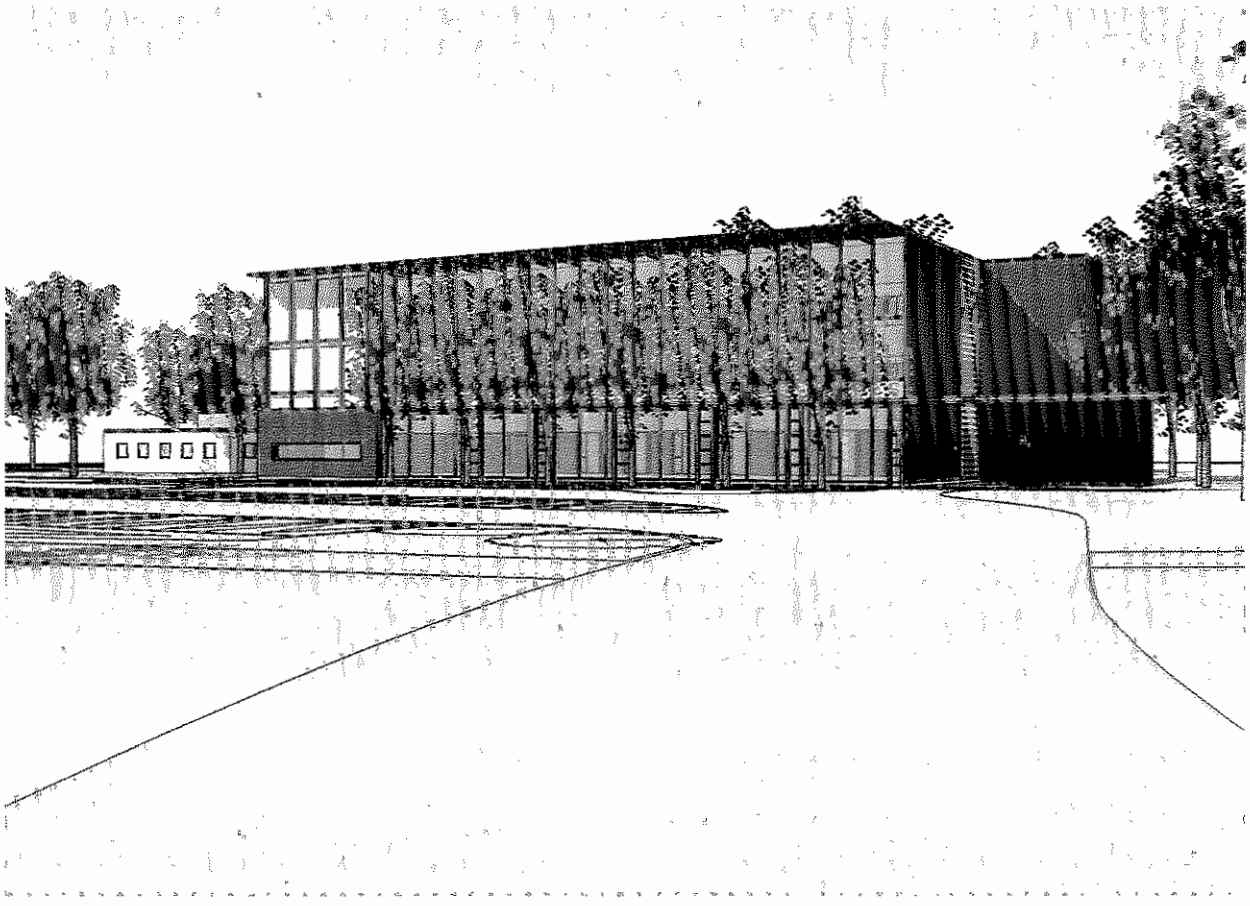
2008-809T
APPENDIX 6.6

Credit Valley Conservation Authority
Office Building Expansion



Project Manual
Volume 2 of 3
Specifications Divisions 15 & 16
Mechanical
Electrical

Project No. 7008
Issued for Tender

Date: February 12, 2009

Regional Municipality of Peel

THE CREDIT VALLEY CONSERVATION AUTHORITY EXPANSION

PROJECT MANUAL VOLUME 2 of 2

ISSUED FOR TENDER

Project No.
Date: February 12, 2009

Halsall Associates Ltd.
Structural Consultant

MV Shore Associates Ltd.
Mechanical/Electrical Consultant

Ron Koudys Landscape Architect Inc.
Landscape Consultant

SPECIFICATIONS

Rand Engineering Corp.
Site Services Consultant

Divisions 15, 16

Enermodal Engineering Ltd.
LEED Consultant

MECHANICAL SPECIFICATIONS

project

CREDIT VALLEY CONSERVATION

Mississauga

prepared by

M V Shore Associates (1993) Limited
Consulting Professional Engineers
#402-1200 Eglinton Avenue East
Toronto
Ontario
M3C 1H9

project number

2007-050

issued for

TENDER

date

FEBRUARY 10, 2009

ARTICLE NAME

Index

ARTICLE NAME PAGE

1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Comply with Division 1, General Requirements and documents referred to therein.

.2 Co-operate with the other trades as required for the satisfactory completion of the work.

.3 Conform to the standards, laws and regulations of the authorities having jurisdiction.

.4 The design of all systems and materials are to be in strict conformance with the current ASHRAE/IES 90.1 Standards.

.5 Follow instructions by the Manager for construction schedule, dust and noise control, security, access, fire safety, maintenance of services, delivery of equipment, etc.

1.2 MATERIALS AND CHANGES

.1 It is intended that materials or products specified by the name of the manufacturer or the brand or trade name or the catalogue reference, shall be the basis of the estimate and furnished under the contract unless changed by mutual agreement. Where there are two or more brands named, the choice of these shall be optional with the Contractor, subject to the Engineer's approval. See Instructions to Bidders.

.2 Should the Sub-Contractor propose to use any material or products other than those specified, he must so state in writing at the time of tendering, naming the proposed substitutions clearly and stating what difference, if any will be made in the amount of his estimate for each substitution, should it be accepted.

.3 Changes in the work from the drawings and specification shall not be made unless the Contractor has written authorization for the change, and no claim for an addition to or deduction from the Contract Sum shall be valid unless so ordered.

.4 All the materials required for the performance of the work shall be new and the best of their respective kinds, and of uniform pattern throughout the work.

1.3 CERTIFICATE AND FEES

.1 Give all necessary notices, obtain all necessary permits and pay all fees in order that the work hereinafter specified may be carried out, and furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of authorities having jurisdiction. Before final certificates are issued, make changes and alterations required by authorized inspector or an authority having jurisdiction.

1.4 DRAWINGS

.1 Consult Architectural, Structural and Electrical drawings for any necessary changes or additions to accommodate all conditions. The location of pipes, ducts and any equipment shall be altered without charge, before installation. Obtain approval by the Architect and/or Engineer before any alterations.

.2 As the work progresses, and before installing any equipment which may interfere with the interior treatment or use of the building, obtain drawings or instructions for the exact location of such equipment.

.3 The drawings indicate the general location and route to be followed by the pipes which are to be installed. All ducts, pipes, and equipment shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of the space through which they pass. Prepare interference drawings where required or requested.

.4 Co-ordinate with other trades so that piping, ductwork, etc., will not cause interferences with other work.

.5 In any place where a space for future equipment is indicated, leave space clear and install the piping and other work pertaining to this Contract in such a way that the necessary connections can be made to the future apparatus.

.6 The drawings and specifications are intended to include all work and material required for the full completion of the systems outlined. All materials, work of details required for the proper execution and completion of the work described or shown, shall be furnished and installed as a part of this Contract, without extra charge.

1.5 LIABILITY

.1 Assume full responsibility for layout of this work and for any damage resulting from improper locations of, or performance of this work.

.2 Supply, to other trades, any equipment to be built-in by them or measurements to allow necessary openings to be left.

.3 Protect all work from damage resulting from doing the work of this Division. Cover floors and other work with tarpaulins, if necessary. Repair all damage to floor surfaces or other parts of the building resulting from doing the work of this Division.

.4 Be responsible for the condition of all material and equipment supplied and provide all necessary protection and maintenance of the work of this Division until the building has been completed and accepted.

1.6 WORKMANSHIP

.1 Only first-class workmanship will be accepted, not only with regards to safety, efficiency, durability, etc., but also with regards to the neatness of detail. All pipework must be lined up parallel, or at right angles to the building walls. Equipment must be accurately set, plumb and level, and hanger rods must be all similarly in true vertical alignment. In general, the entire work throughout shall be first-class and workmanlike and present a neat and clean appearance on completion.

1.7 GUARANTEE

.1 Guarantee this work including all relocated, modified existing equipment and systems for a period of one (1) year (except where otherwise noted) from the date of substantial completion. Replace any parts of work done which become defective during the guarantee period and extend the guarantee on same for a period of one (1) year from the date of acceptance of the replacement parts of work. Provide all labour required for the carrying out of this guarantee.

.2 Where equipment is put into operation prior to completion of all phases of the work, the one (1) year period of guarantee covering such equipment shall commence on the date of the substantial completion, issued by the Architect. The putting into operation of any equipment prior to job completion shall only be with the expressed approval of the Owner and Engineer. No equipment shall be started up without first ascertaining that all systems and services associated with its operation are functioning and that responsibilities for equipment maintenance have been arranged.

.3 The guarantee period shall not be presumed to commence where any equipment is operated temporarily for the purpose of testing or checking out of systems.

1.8 RECORD DRAWINGS

.1 Obtain one (1) set of white prints, for mark-up, as the work progresses, and for final submission to the Manager, indicating "As-Built" conditions and information. Mark-up shall be done on a continuing basis and will be checked with each progress payment.

.2 The drawings shall indicate all access requirements, inverts, dimensional location and elevations of underground or in structure service, all clearance requirements, all locations of life safety devices and all hidden items requiring service.

.3 The drawings shall also include updates to equipment schedules, including make and model number.

1.9 SHOP DRAWINGS

.1 Submit a list of equipment for approval.

.2 When instructed by the Manager or Engineer, submit nine (9) copies of detail drawings of each piece of equipment, including pumps, chiller, boiler, tanks, fixtures, etc.

.3 Be responsible for fitting this equipment into the space allotted. No additional charges will be allowed for any additional pipe or other appurtenances later required by reason of any substitution of any equipment. Provide shop drawings showing layout within the space, details of piping, etc., for substituted equipment, where required by the Manager or Engineer. Shop drawings shall include operating weight of mechanical equipment, to be provided to the appropriate consultant upon request.

1.10 EXISTING CONDITIONS

.1 Examine the site and existing conditions affecting the work of this Division, prior to submission of bid and commencing of work. Report to the Manager any discrepancies or items which require clarification, that will affect the price, and/or work. Allow to replace or modify existing services as required to suit new installation. No extra will be allowed resulting from failure to make verifications and the necessary adjustment.

.2 Before commencing the work, examine the work of other trades and report, at once, any defect or interference affecting the work under this Division, or the guarantee of same.

.3 No extras will be allowed on account of a claim by this Contractor that he did not fully understand the extent of the work of this Division.

1.11 CLEAN-UP

.1 All exposed metal surfaces shall be free from grease, dirt, and other foreign material. Chrome-plated fittings, piping, and trimming shall be polished upon completion.

.2 Fixtures and equipment shall be properly protected from damage during the construction period.

.3 On completion of the work, all tools, surplus and waste materials, shall be removed and the work left in a clean and perfect manner. During work progress, remove all debris and excess materials as directed by the Job Superintendent.

1.12 OPERATION INSTRUCTIONS

.1 Compile and submit, to the Manager, at completion of the work, four (4) neatly bound booklets, containing operation and maintenance instructions for all equipment and systems. These shall include:-

.1 General arrangement of shop drawings.

.2 Complete explanation of operating principles and sequence.

.3 Complete parts lists with numbers.

.4 Recommended maintenance practices and precautions.

.5 Complete wiring and connection diagrams.

.6 A complete set of approved equipment drawings.

.7 Air and water balancing reports with performance curves for each pump and fan installed.

.8 Procedures and results of all tests performed with copies of Acceptance Certificates.

.9 Index inside front cover.

.2 Instruct building maintenance staff in the operation and maintenance of all equipment and controls. During first year, check to see that all equipment is properly maintained and make periodic heating control adjustments to obtain maximum operating economy.

1.13 EQUIPMENT EFFICIENCY

.1 The minimum equipment efficiency shall comply with current **ASHRAE 90.1 - 2004 Standard, Model National Energy Codes for Buildings (MNECB),** and requirements of all authorities having jurisdiction.

1.14 BUILDING COMMISSIONING

.1 Commissioning of the building mechanical and electrical equipment and systems are to be performed by a Building Commissioner appointed by the Owner. This Contractor is to cooperate fully and provide all the material and labour as required by the Building Commissioner to perform all the start-up, pre-functional and functional performance tests.

.2 Attend all the testing as requested by the Building Commissioner.

1.14 BUILDING COMMISSIONING - cont'd:

.3 Deficiency reports issued by the Building Commissioner shall have similar binding authority as reports issued by the Engineers to the Architect. Provide corrective measures to rectify the deficiencies so that acceptable performances could be achieved.

.4 The allocation of cost of deficiency resolution shall be determined by the Commissioning Team, on a case by case basis.

.5 Final completion of building mechanical and electrical systems shall be granted only with the acceptance by the Building Commissioner that all H.V.A.C. equipment, controls and systems function together properly and meet design intent.

.6 Refer to Section "Total Building Commissioning" as applicable and allow for all costs associated with this Section.

END OF SECTION

Index

1 GENERAL

.1 The General Mechanical Requirements, Section 15010, and this section, shall apply to all sections of the Mechanical Specifications.

2 MATERIALS AND METHODS

2.1 EXCAVATION AND BACKFILLING

.1 Except where otherwise noted, all excavation, removal of excess excavated material, bedding, backfilling, covering of bedding, shall be carried out by the trades concerned. Excavation for mechanical trades between foundation walls and property line of required depth shall be by Architectural division. All excavation within foundation walls shall be by the mechanical trades. Backfilling and compaction for mechanical services and equipment, inside and outside of foundation walls, to 304.8mm above buried items, shall be by the mechanical trades.

.2 For methods and materials to be used, adhere to the requirements of Section 0200 of Architectural specifications.

.3 For buried piping, where solid undisturbed soil exists beneath, this Divisions shall provide 152.4mm of crushed stone bedding on the firm sub-soil under the piping and extend the bedding up to the centre line of the pipe.

.4 Where a solid undisturbed sub-soil is not obtainable, lay buried piping on concrete pads supported by concrete beams extended down to undisturbed bearing.

.5 Where any excavating is necessary in close proximity to or below any footing level, backfill with 2000 psi (14000 kPa) concrete to the level of the top of the highest adjacent footing.

.6 Do all necessary pumping to maintain excavation for mechanical services, free of water.

2.2 EXPANSION JOINTS, GUIDES AND ANCHORS

.1 Make provision for pipe expansion and contraction by means of suitable anchors, offsets and expansion loops with required guides. Where pipe loops appear to be impractical, use expansion joints, selected system operating pressures and temperatures, as well as system test pressures, and suitable for the calculated pipe movement as per the following temperature ranges:

(a) For cold pipes - From minimum ambient to 100°F and 25% safety factor.

(b) For warm and hot pipes - From minimum ambient (0°F for Toronto) to maximum operating conditions and 25% safety factor.

Movement of piping shall also include building shrinkage and building lateral deflection where applicable.

Expansion joints shall be equal to **FLEXONICS** as follows:

Steel Pipes - Model 'H' with two-ply stainless steel bellows with stroud, limit, and guide rods. Screwed male ends for 2.5" (63.5mm) pipe and smaller and flanged ends for larger pipes. For pipe size 4" (100mm) and over, use Model SX.

Copper Pipes - Model 'HB' two-ply all bronze construction, with stroud.

Install expansion joints and piping guides - at least two (2) on each side of joint - in accordance with expansion joints manufacturer's recommendations and requirements, and submit such recommendations to Consulting Engineer for his review, comments and records before installation. Pipe alignment guides shall be equal to **FLEXONICS Series PGT** or approved alternate.

.2 Fabricate structural steel anchors required, secured to structure in such a manner that avoids transmitting pipe noise and excessive reactive forces and weights to the structure, piping and equipment. Mechanical Contractor shall provide all necessary steel required, and fabricate anchors, and shall submit prior to installation a drawing showing locating of expansion joints, guides and anchors, detail of proposed connections to structure and show magnitude of reactive forces and operating weights for review by Mechanical Consultant, and for comments and approval by Structural Engineers.

.3 All piping shall be installed free from building structure to allow for movement without noise under operating conditions.

.4 Provide the Engineer with an inspection report by the expansion joint manufacturer on the installation on the expansion joints and the guides.

2.3 SUPPORTS

.1 Supply and erect all special structure steel work required for the installation of tanks, pumps, motors and other apparatus. Set all apparatus at least 6" (152mm) above floor or to a height indicated on the drawings. Supply and install all anchor bolts and other fastenings. Concrete bases and concrete floating pads, where called for, shall be at least 4" (102mm) larger than the base of the apparatus. The supply and installation of cast-in-place concrete work and cast-in anchors for mechanical work of this project shall be as specified in the structural specification. Co-ordinate and furnish as required shop drawings for these house keeping pads.

.2 Support sanitary, storm or water service piping in backfilled areas on poured concrete wall supports extending down to a solid foundation or reinforced concrete beams. Supports shall be three (3) times pipe size in width but extending not less than 6" (152mm) on each side of the pipe. Supports shall be dowelled into the wall of the building.

2.4 FLOOR PLATES

.1 In general, all piping shall be concealed in walls and ceiling. Where exposed pipes pass through finished floors, ceiling, or walls, the floor plates shall be equal to **CRANE** #13-BC.

2.5 PIPE SLEEVES

.1 Be responsible for location of all required sleeves and openings for all services including piping and ductwork of this Division, and submit drawings showing required sleeving, recesses and formed holes in the concrete work to concrete reinforcer detailer at the appropriate time. Completely dimension all openings, recesses and sleeves and relate these to suitable grid lines and elevations datum.

.2 In all Mechanical Rooms, standard weight steel pipe sleeves shall extend at least 152mm above finished floor.

2.6 PIPE HANGERS

.1 Except as noted elsewhere in this Division, install pipe hangers equal to **GRINNELL** as follows:-

Type	Service	Grinnell #	Material
Clevis	Sprinkler & FSP	69	Carbon Steel (ULC listed) Galvanized (Dry sprinkler)
Clevis	non-insulated	260	Carbon Steel
Clevis	insulated pipe	300	Carbon Steel
Clevis	copper pipe	CT-269	Carbon Steel with Copper lining
Clevis	cast iron pipe	590	Carbon Steel
Riser Clamp	steel pipe	261	Carbon Steel
Riser Clamp	copper pipe	CT-121	Carbon Steel with Copper lining
Pipe Guide	all	255	Carbon Steel

Spacing to be not over 2.4m apart for pipes up to 51mm, 3.6m up to 76mm, and 4.6m for 102mm and over.

.2 All copper piping shall have flame retardant inert packing between the copper pipe and its hanger or support. Copper clad hangers will be accepted as an alternate.

.3 Support vertical drainage piping at every other floor. No interval between supports of horizontal drainage and water distributing piping shall be greater than 8' (2.4m), and for pipes 1/4" (6mm) and smaller, spacing of hangers shall be no greater than 6' (1.8m).

.4 Pipe hangers shall be supported by mild steel hanger rods affixed to the building structure with concrete inserts. Rods, nuts, and inserts shall be provided in accordance with hanger manufacturer's requirements, and selected for minimum load safety factor of 5.

.5 Horizontal hung drainage piping shall be supported at every hub or joint, but not more than allowed by Code and where such piping has successive fittings with no pipe exceeding 12" (305mm) between fittings, the pipe shall be supported every 36" (915mm) maximum.

2.7 CLEANOUTS

.1 Supply and install cleanouts at the ends of all straight runs of sewers, at the base of all risers, in all horizontal branches to main and auxiliary stacks, on straight horizontal runs 50' (15.2m) apart, and on exposed or accessible traps, and at all points of obstruction. Waste pipe connected to a sink shall have sufficient cleanouts to reach downstream each 20' (6.1m) maximum, of the waste pipe.

2.7 CLEANOUTS - cont'd:-

.2 The screw cap for the cleanouts shall be brass. The cleanouts shall be full size, 'Y' and 'T' branches shall be provided for cleanouts on drains and their branches, except where otherwise noted.

.3 Cleanouts in horizontal branches to main auxiliary stacks shall be **BARRETT** type to permit cleaning and rodding in both directions.

.4 Make cleanouts accessible, and wherever necessary, extend the branch connections to finished surface of floors or walls and finish with flush brass frames and cast brass plates of **SMITH** or equal manufacturer.

.5 Floor cleanouts shall be as follows:

In unfinished areas and outside areas **SMITH Series 4200 DUCO** epoxy coated cast body with integral clamp device, and removable positive seal cleanout plug and heavy duty scoriated safety finish adjustable cover secured with stainless steel screws.

In tiled areas **SMITH Series 4140** same as above with square nickel bronze cover and frame recessed for tile. Cover can be adjusted to suit floor lines when installing finished floor.

In terrazzo areas **SMITH Series 4180** same as above with square nickel bronze cover and frame recessed for terrazzo. Cover can be adjusted to suit floor lines when installing finished floor.

Carpeted areas **SMITH Series 4020Y** same as above with nickel bronze cover and frame.

Other finished areas **SMITH Series 4020** same as above with nickel bronze frame and cover.
For heavy traffic areas **SMITH Series 4100B** same as above with extra heavy nickel bronze cover and frame.

.6 Line cleanouts in cast iron pipes shall be **SMITH Series 4510** gasketted cover. In copper pipes, use **SMITH Series 4420** cast bronze tube and cleanout.

.7 In case of cast iron stacks, use **SMITH Series 4510** with epoxy coated body and gasketted screwed cover. Where cleanouts are concealed behind tiled walls or finishes, access shall be made by **SMITH 4530** round stainless steel plate and slotted flat head stainless steel screws.

.8 For urinal, use **SMITH SQ4-1819** cleanout with stainless steel bolt and wing nut complete with round polished stainless steel access cover secured with v.p. screws.

2.8 JOINTS

.1 Make joints in horizontal suspended cast iron hub and spigot pipe with PC-4 compound, or **BIBBY SEAL** gaskets.

.2 Make joints in cast iron hub and spigot pipe in other locations with packed oakum and molten lead using not less than 1 lb. (0.5 kg) of lead for each 1" (25mm) in diameter of pipe, or with mechanical seal gaskets.

.3 Make joints in plain end pipe or mechanical joint pipe with couplings approved for the service, and as per manufacturer's requirements.

.4 Solder joints in copper pipe with a blow torch, suing 95% tin and 5% antimony solder for water piping, and 50/50 solder for drains, wastes and vents.

.5 Make joints between dissimilar metal material pipes with dielectric isolating couplings or bushings.

.6 Ream threaded joints carefully and join with compound on the male thread only.

.7 Make joints in concrete pipe with rubber gaskets approved for the service.

.8 Joints in plain end tile shall be made with butyl gaskets and encased stainless steel bands and in bell and spigot tile as specified for concrete pipe.

.9 Joints in ABS or PVC plastic pipe shall be made with C.S.A. approved cement for the material being used, and as per piping manufacturer's recommendations.

.10 Joints in transite pipe shall be made with ring-tite coupling.

.11 Underground copper piping joints shall be Silfos soldered.

2.9 PIPES AND FITTINGS

.1 Above ground sanitary drains under 2" (50mm) in size shall be type D.W.V. hard tempered copper, with cast brass drainage fittings, and long sweep elbows.

.2 Above ground sanitary drains for 2" (50mm) and over in size, shall be medium weight plain end cast iron soil pipe, factory-coated in raw linseed oil, and with approved type mechanical joints.

.3 Below ground sanitary drainage pipe and fittings, within building shall be as above for suspended drains, approved for below ground application. Alternatively when on solid ground, use PVC DR35 pipe with solvent or gasketted joints, as recommended by manufacturer and approved by local Plumbing Inspector.

2.9 PIPES AND FITTINGS - cont'd:-

.4 Below ground storm drainage pipe and fittings, within building, shall be as above for suspended drains, approved for below ground application.

.5 Above ground storm drainage pipe shall be **JOHNS-MANVILLE, Type 1** transite asbestos cement soil pipe, with couplings and fittings as required by the pipe manufacturer.

.6 Below ground storm drains, outside the building, shall be concrete pipe of non-reinforced pipe (**A.S.T.M. C-14**) (S.S.) up to 18" (457mm) diameter and steel reinforced (**A.S.T.M. C-76**).

.7 Vent pipe and fittings shall be of galvanized wrought steel with galvanized malleable iron drainage fittings, or type D.W.V. hard tempered copper with sweat fittings or medium weight cast iron pipe.

.8 Below ground cold water piping up to the main shut-off valve inside the building, shall be ductile iron mechanical joint pattern, or PVC C-900-75, or Type 'K' copper.

.9 Unburied water piping from the main shut-off valve in the building, to the water meter assembly, and to the booster pump, if installed, shall be Type 'L' copper with wrought copper solder type fittings.

.10 Below ground cold, hot and recirculating domestic water piping shall be Type 'K' copper tubing with wrought copper solder type fittings.

.11 Above ground cold, hot and recirculating domestic water piping shall be Type 'L' copper tubing with wrought copper solder type fittings

.12 For in-suite domestic water distribution, polyethylene/aluminum/polyethylene and cross linked polyethylene-aluminum-polyethylene composite pipe may be used, if approved by local authority.

.1 Hot water piping to be cross-linked polyethylene (PEX) and aluminum composite tubing in PEX-AL-PEX arrangement. Tubing and fittings to be certified by Canadian Standards Association to CSA B137.5 and CSA B137.10 and made in full conformance to ASTM F 1281. Tubing to be colour coded orange and shall have the following minimum pressure ratings:-
1380 kPa at 23 deg. C, (200 psi @ 73◦F)
1034 kPa at 60 deg. C. (150 psi @ 160◦F)
862 kPa at 82 deg. C. (125 psi @ 180◦F)

.2 Cold water piping to be polyethylene (PE) and aluminium composite tubing in PE-AL-PE arrangement. Tubing and fittings to be certified by Canadian Standards Associates to CSA B137.5 and CSA B137.9 and made in full conformance to ASTM F1282 and shall be colour coded blue.

2.9 PIPES AND FITTINGS - cont'd:-

.3 Fittings for hot and cold water to be yellow brass insert crimp style and certified by Canadian Standards Association CSA B137.10. Inserts shall have double O ring seals.

.4 Ontario Building Code (OBC) Requirements:-

Pipe shall exhibit a flame spread rating of not more than 25 and a smoke developed classification not more than 50 when tested using the procedures of ULC/CAN4-S102.2M. Testing shall be conducted by a certified test laboratory and a listing shall be held which included all available sizes of tubing. Actual flame and smoke ratings shall be printed on pipe exterior for ease of inspection.

Pipe shall not be permitted for use in vertical shafts and shall not penetrate any fire rated separation including wall and floor.

.5 High Rise Slab Construction:-

Each residential suite shall contain a minimum of one (1) hot water and one (1) cold water 3/4" diameter copper header with 12mm (½") nominal sized branches suitable for crimp connection to the composite piping as described above. Piping from the headers shall supply all fixtures in the suite. Headers shall be certified to CSA B137.9 or B137.10.

Water piping shall be encased in corrugated PVC sleeve. IPEX Cor-Line or approved equal, in a nominal size larger than the tubing. PVC sleeve shall be certified by Canadian Standards Association to CSA C22.2 No. 227.1. To minimize potential rainwater entry into pipe sleeve, water piping and sleeve shall be installed in the ceiling of each suite with access boxes facing downward.

Each plumbing group (Bathroom, Powder Room, Kitchen & Laundry) shall be fed directly from the hot and cold water headers. No branching off to feed a second plumbing group is allowed.

.6 Water piping shall have a rate of expansion-contraction no greater than 0.000013 in./in./°F (0.23mm/10m/°C). Pipe fittings and headers to be supplied from same manufacturer, IPEX Inc. or approved equal.

.13 .1 All above ground fire protection piping, inside building shall be as follows:-

(i) Steel pipes for threaded fitting joints or joints by coupling used with cut-groove piping, shall have minimum wall thickness in accordance with **Schedule 30**, for sizes 8" (203mm) and larger, and **Schedule 40** for sizes less than 8" (203mm), for pressures up to 300 psi (2070 kPa), conforming to **A.S.T.M. A53-73, Table A2.**

2.9 PIPES AND FITTINGS - cont'd:-

.13 (ii) Welded and seamless steel pipe, joined by welding or approved couplings, shall have minimum wall thickness for pressure up to 300 psi (2070 kPa), as follows:-

Pipe Size	Minimum Wall Thickness
1.0" to 2.0" (25 to 50mm)	0.109
2.5" to 3.5" (63 to 89mm)	0.120
4.0" to 10.0" (100 to 250mm)	0.188

.2 Where buried, use ductile iron pipe for fire protection services.

.14 All unburied bilge and sump pump discharge lines shall be standard weight galvanized steel pipe with 150 lb. galvanized malleable iron fittings. Sewage lines shall be type 'L' copper or medium weight cast iron pipe. Victaulic galvanized couplings and fittings may be used with grooved pipe.

.15 Install all drain and soil piping with eccentric fittings of dimensions and in locations shown on the drawings. Horizontal piping 4" (100mm) and over shall be pitched on an even grade of not less than 1/8" (3mm) per 1' (300mm) run. Smaller piping shall have greater pitch. Turns shall be made with ling radium bends or 1/8 bend and fittings and 45° elbows.

.16 No bull-headed tees shall be used on water piping.

.17 All black steel pipe 2.5" (65mm) and larger, and all buried steel piping, shall have welded joints except at valves and connections to apparatus, where flanges must be installed. Use butt welding fittings specifically made by manufacturers for all elbows and tees for branches, except as noted. Branches, two or more piping sizes smaller than the mains, may be welded directly to the mains.

.18 All steel pipe, 2" (50mm) and smaller, except as noted in the foregoing clause may have screwed joints with long lengths connected by couplings. Where fittings are necessary, they shall be standard weight cast iron screwed fittings of approved make and ground joint brass lined unions shall be used where necessary and at all connections with apparatus. No field fabricated fittings will be permitted unless specifically noted otherwise.

.19 All heating and cooling pipe shall be new standard weight **Schedule 40** pipe, in accordance with **C.S.A. Specification B-62-1949**.

.20 Steam humidification piping shall be type 'L' copper with wrought copper sodder type fittings.

.21 .1 Gas piping shall be black steel pipe, welded with butt welding fittings, or screwed with malleable iron fittings. All piping shall be in accordance with **N.B.F.U.** and **Ontario Energy Resources Commission** requirements.

2.9 PIPES AND FITTINGS - cont'd:-

.2 Underground gas piping shall be **"Yellow Jacket" Schedule 40** polyethylene coated steel pipe as manufactured by **SHAW PIPEWORKS.** Pipe shall be of all welded construction. Pipe joints shall be protected with DENSO TAPE, as outlined in the manufacturer's specification guide. Cathodic protection consisting of magnesium anodes shall be installed as supplied by **CORROSION SERVICE CO. LTD.** Pipe shall be bedded on clean sand and backfilled to 12" (300mm) above the pipe, with sand. Minimum depth of bury to be 12" (300mm). No other pipe shall be installed in the same trench with the gas pipe.

.22 All pipes shall be straight, true and parallel, and supported at intervals specified or as indicated on the drawings. Run piping with proper slope to drain vent. Branch pipes shall have a greater slope.

.23 Water closet drain connections shall be made with copper closet ends and companion flange. For those drain connections at slabs on grade, provide impervious protective wrapping around the copper fittings through the slab to prevent contact between copper and steel.

.24 All exposed piping in suites shall be chrome plated.

.25 Condensate drain piping shall be type **D.W.V.** copper.

.26 Swimming pool piping shall be **Schedule 40** or **80** rigid PVC pipe and fittings with solvent weld joints to **C.S.A. B137.3**.

.27 Condenser water piping, all piping in equipment rooms, all accessible mains, vertical risers, with expansion and isolation design shall be joined by Victaulic couplings and fittings. Victaulic coupling shall be malleable iron with gaskets suitable for all operating pressure and temperature conditions up to 200°F (94°C), and complete installation shall be to manufacturer's recommendations.

.28 All copper water pipe for use in plumbing system shall conform to ASTM specification B-88 for tubing and B-42 for piping, by certification markings on the pipe by a certification body recognized by the **Standard Council of Canada**; either **C.S.A.** or **Warnock Hersey**.

.29 Sprinkler piping shall be new standard weight Schedule 40 pipe in accordance with **C.S.A.** specifications. All joints shall be welded or use victaulic grooved pipe couplings. Construction and installation in accordance with **N.F.P.A.** and piping manufacturer's recommendations.

.30 **Grooved Piping Method**

.1 Contractor may use grooved end piping concept in lieu of welded method on all heating, chilled water, condenser water, glycol and other building services provided they conform to the pressure and temperature

2.9 PIPES AND FITTINGS - cont'd:-

requirements of the manufacturer. All grooved products including couplings, fittings, valves and building service specialty items to be of one manufacturer.

.2 All grooved fittings to be manufactured from ductile iron conforming to **ASTM-536.**

.3 Couplings to be manufactured from ductile iron conforming to **ASTM-A-536** and be complete with a Grade E EPDM gasket operating temperature -34.4◦F to 110◦C. Couplings shall be **VICTAULIC** style 75, 71, and 750. In mechanical rooms use **VICTAULIC** style 07 zero-flex.

.4 Butterfly valves shall be **VICTAULIC** VIC-300, with Grade E EPDM disc coating. Valves shall provide bubble tight shut-off up to 2068 kPa.

64mm - 152mm shall be complete with lever handle and memory stop

Size 203mm and larger to be as above with gear operator.

.5 Check valves to be non-slam, spring loaded disc design permitting horizontal or vertical installation:-

64mm - 75mm	Victaulic Style 716
102mm - 203mm	Victaulic Style 715
254mm - 305mm	Victaulic Style 711

.6 Strainers shall be Victaulic Style 730. Suction diffusers where indicated shall be Victaulic Style 731 or Engineer reviewed alternate.

.7 For fire protection piping, mechanical joint fittings will be permitted. All grooved products to be of one manufacturer and be UL, ULC, and FM listed.

2.10 VALVES

.1 Supply and install valves on main branches and at all equipment tanks, pumps and elsewhere shown, or as required. All valves shall have minimum pressure ratings as required to suit job conditions.

.2 Valves, 3" (75mm) and smaller, shall be screwed pattern, all bronze or solder ends for copper lines, equal to **UNILUX** ball valves. Balancing ball valves shall be complete with indicator stop. supply and install two (2) valves for each heating unit or group of series pipe units.

.3 Butterfly valves, of sizes above 3" (75mm) shall be equal to **GRINNELL, U.I.** approved cast iron body, bronze disc, stainless steel shaft, EPDM (**NORDEL**) seat, full lung, wafer body for mounting between flanges. Valves to have bolt holes threaded so that valve can remain bolted to one pipe flange while the other flange is removed. Valves shall be complete with notched plate handle operator. Valves 5" (125mm) and over, shall be complete with gear operator.

2.10 VALVES - cont'd:-

.4 Check valves shall be equal to **GRINNELL #C.V. 817**, non-slam water disc.

.5 Install automatic air relief valves, equal to **MAID-O-MIST No. 7** or **27**, float type vents on mains at all high points of systems, complete with shut-off cock and drain line for system bleeding.

.6 Provide drip cocks equal to **UNILUX** ball valves, complete with hose end at all low points of system or provide drips as detailed.

.7 Pipe to and from equipment shall have necessary shut-off valves, full size of the line for isolating such equipment on system side of unions or flanges.

.8 Outside hose bibbs or wall hydrants shall be non-freeze type, equal to **EMCO #10260** lockshield type, complete with **WATTS #NF-8** hose connection vacuum breaker.

.9 Provide shut-off valves to isolate each item of equipment, plumbing fixtures, pipe riser or pipe branch.

.10 Inside hose bibbs shall be 3/4" (20mm) size, equal to **EMCO #10250**, lockshield in garage, and **#10240** wheel handle elsewhere and complete with **WATTS #NF-8** hose connection vacuum breaker.

.11 Gas valves shall be **C.G.A.** approved plug cocks, with lever handle. Provide valve at each outlet or connection to unit.

.12 Triple duty valves shall be equal to **ARMSTRONG FLO-TREX.** Provide at each heating or cooling pump.

.13 Pressure reducing valves shall be equal to **WATTS #PV20M**. Valves shall be complete with check valves.

.14 All valves for the fire protection system shall be U.L. approved.

.15 All valves shall be placed to permit easy operation and access.

.16 Install automatic mixing valves and suite control valves, as specified.

.17 Provide a shut-off valve for each supply riser and circuit balancing shut-off valve for each return riser for the following:-
a) Heating & cooling
b) Domestic cold, hot & recirculation.

.18 Supply and install lockshield valve on each expansion tank line.

.19 Shut-off valves shall be gate, ball or butterfly, except where throttling effect is required as in bypasses or end of line service, where balancing type globe or ball valve with indicator stop lever shall be provided.

.20 Where soldered joints are required, provide soldered valves or copper to iron adaptors before valves.

.21 Circuit balancing valves shall be:-

Up to 20mm	-	**ARMSTRONG** Model **CBV-MS**
50mm and smaller	-	**ARMSTRONG** Models **CBV-S** or **CBV-T**
Larger size	-	**ARMSTRONG** Models **CBV-G** or **CBV-A**

2.11 ACCESS DOORS

.1 Supply access doors and panel of adequate size, not less than 12" x 12" (300 x 300mm), and shall be located to provide access to concealed equipment, dampers, valves, controls, etc. Wherever possible, valves shall be grouped and larger access doors provided. Where access doors are required in a fire-rated structure, such doors shall be listed to conform to the required rating of the structure. Access doors for cleanouts on horizontal drains shall be not less than 16" x 16" (400mm x 400mm).

.2 Installation of access doors, supplied by this Division, shall be as specified in the Architectural Specifications of this project.

2.12 FLASHING

.1 All vent pipes extending through the roof shall be flashed with 10 oz. per sq.ft. (3 Kg per square meter) copper or 5 lbs. per sq.ft. (24 kg per square meter) lead flashing about 20" (500mm) square and dressed over hub and caulked in place. Provide vent extension above roof, height as required, or minimum 12" (300mm) high.

.2 Other piping or ducts passing through roof shall be provided with curb by other Division with flashing into roof by other Division. This Sub-Contractor shall provide a galvanized sheet metal counterflashing soldered or clamped to the pipe or duct and caulked to provide a weatherproof installation.

2.13 TESTING AND START-UP

.1 After all piping has been installed, but before pipe covering has been applied or concealed piping has been covered up, test the tightness of all joints and the soundness of all pipes.

.2 Notify the inspectors or authorities having jurisdiction, the Owner, and the Engineer, of all tests, and conduct same to their satisfaction, in the presence of their representatives. Provide all labour and equipment for tests and conduct same.

Repeat tests until system is shown to be leak-tight and in proper working condition.

.3 Perform all tests in shifts to allow other trades to proceed in accordance with the building progress.

.4 For piping, other than drains, vents and gas piping, apply 150 psi (1035 kPa) water pressure for eight (8) hours. Repair leaks and re-test.

.5 All drains shall be tested for tightness and grade as required by the **Provincial Plumbing Code**.

.6 All gas piping shall be tested in accordance with the requirements of the inspection authority. Costs of all tests as required by said authority shall be borne by this Sub-Contractor. All joints shall be tested with a soap and water solution during this test to check for leaks. Repair leaks and re-test.

.7 Perform tests as required to provide specified and satisfactory operation of all equipment. After installations are complete, adjust all dampers, balancing valves, pressure regulators, controls, etc., to establish system's operation as prescribed.

.8 Before putting systems in operation, perform the following functions:

.1 Thoroughly flush heating, water and drainage system.

.2 Clean filters, screens, strainers, and dirt pockets.

.3 Supply and install lubricants required for bearings, couplings, linkage, valves, etc. After completion of installation of all electrical motors, pumps, etc., these shall be completely re-lubricated and all bearings re-packed. This work shall be done by the installation Sub-Contractor prior to putting the equipment into operation and shall be in accordance with the manufacturer's requirements.

.4 Manufacturer's representatives shall check equipment installation to ensure that all connections, alignment and other details affecting the equipment performance are in accordance with the manufacturer's requirements.

.5 Instruct Owner's supervisory management personnel in system's operation and see that arrangements have been made for regular maintenance of equipment and services where required. Provide written instructions for the use of all system's operations.

.9 After completion of the above tests, a certified copy of the test results to be provided to the Owner.

2.14 CUTTING AND PATCHING

.1 Be responsible for all necessary cutting and patching for the installation of this work and all such work shall be done by skilled tradesmen, to the full approval of the Architect. No reinforcing steel shall be cut by the Sub-contractor without the Architect and Structural Engineer's approvals.

.2 Employ skilled trades employed on the project to repair walls, pavements, finishes, walks, etc., where these have been damaged by this work. This work will be co-ordinated by the General Contractor.

.3 Cost of cutting and patching caused by failure of mechanical trades to provide timely information to architectural and structural trades is to be paid for by the trade concerned.

2.15 CLEAN-UP

.1 All exposed metal surfaces shall be free from grease, dirt and other foreign material. Chrome-plated fittings, piping, and trimmings shall be polished upon completion.

.2 Fixtures shall be properly protected from damage during the construction period.

.3 On completion of the work, all tools, surplus, and waste materials shall be removed and the work left in a clean and perfect manner. During work progress, remove all debris, and excess materials as directed by the Job Superintendent.

2.16 PAINTING

.1 All final painting will be done by the painting Sub-contractor except as noted. Painting shall be as specified by the Architectural Division.

.2 All factory-made pieces of equipment, supports, accessories, etc., except pipe, fittings, valves and hangers, shall be supplied with a prime coat finish, such as baked enamel or chrome-plating. Primer shall be touched up where necessary with approved primer.

2.17 ELECTRICAL MOTORS, STARTERS AND WIRING

.1 All apparatus supplied shall be complete with electric motors, starting equipment, remote control equipment, speed controls, and thermostats, where required.

.2 All electrical wiring, including suite fan coil units, power and control wiring, will be by the Electrical Division, except for the following:

.1 Factory pre-wired panels and equipment as specified under this Division.

.2 Low voltage wiring for thermostatic controls as specified under the applicable sections of these specifications.

2.17 ELECTRICAL MOTORS, STARTERS AND WIRING - cont'd:-

.3 Low voltage wiring for thermostatic controls and required interlocks for split and packaged A/C units and all control and interlock wiring for duplex air-compressor, smoke exhaust, C.O. Detector, chillers, controls, etc., which shall be by the Mechanical Division.

.3 All starting equipment, motors, electric interlocks with fire alarm, electrical load shedding interlocks, sprinkler alarm switches, etc., supplied by this Division, will be installed and wired by the Electrical Division.

.4 Supply electrical Division with wiring diagrams, motors and equipment specifications, for all equipment prior to installation of wiring.

.5 Assume full responsibility for the proper installation and operation of motors, controls, and equipment supplied under this Contract.

.6 All wiring shall be installed as specified under Wiring Method in the Electrical Specifications.

.7 All wiring shall be in accordance with the regulations of the H.E.P.C. and their local inspection authorities. Provide fused or circuit break equipment as required.

.8 Motor ratings shall be as indicated on the drawings. Motors up to and including ½ HP (0.38 kw) shall have 120 volt, single-phase, 60 cycle characteristics, and motors 3/4 HP (0.57 kw) and over shall have 208 volt, three-phase, 60 cycle or 416 to 575 volt, three-phase, 60 cycle characteristics, as noted.

.9 Starter and remote control equipment shall be manufactured by **C.G.E.** or equal. Starters shall be provided with suitable overload protection on all phases.

.10 Manual starters for motors, up to and including ½ HP (0.38 kw), shall be equal to **C.G.E. #CR-1061.**

.11 Manual starters for motors over ½ HP (0.38 kw) shall be equal to **C.G.E. #CR-1062.**

.12 Magnetic starters, except as noted elsewhere, shall be of combination fusible type, equal to C.G.E. #CR-208, provided with push buttons, H.O.A. selector switches, etc., as noted on the schedules, and with control transformers, where required.

.13 Magnetic starter for two-speed, single winding, variable torque cooling tower motor, when called for shall be equal to **C.G.E. #CR-209**, complete with time delay relay, and provided with requirements as for single speed magnetic starter in Item 12 above. Comply to recommendations of equipment manufacturer, as to motor requirements.

.14 Starters and/or control equipment, located remote from motor location, shall be provided with pilot light.

.15 Manual starter and remote control equipment, located in finished areas, shall be recess mounted and provided with stainless steel coverplates. Remote pushbutton stations shall be miniature type.

.16 Verify, with the Electrical Division, all electrical characteristics, before ordering equipment.

2.18 TAGS AND DIRECTORY

.1 Supply and attach to all main and branch valves, but excluding rad valves, coloured tag with typed information, showing valve number, service and function of valve, as well as apartments served. Tagging shall be by means of a coloured insert in a sealed plastic case of approved neat design, subject to Architect's approval, of differing colour for each service. Tags are to be securely attached by chain to valves and are to be provided as the work progresses.

.2 The colour of the valve tag inserts shall be as follows:-

Domestic water (hot & cold)	- Light blue
Heating water	- Orange
Fire lines	- Red
Compressed air	- Light green
Chilled water & heat pump piping	- White
Gas	- Yellow

.3 Furnish, for each boiler room, two (2) duplicate valve charts in glazed frames and hung where directed. Chart shall show number, location, service and function of each valve, as well as apartments served.

.4 All starters, including remote control switch, shall be provided with nameplates. This nameplate shall be engraved with name of equipment controlled.

.5 All equipment shall be provided with a nameplate. This nameplate shall be engraved indicating equipment function and system served.

2.19 PIPE IDENTIFICATION

.1 All piping is to have **STENCIL** labels affixed, after pipe covering and painting has been completed, identifying pipe service and direction of flow, spaced at maximum 6.0m (20 ft.)..

2.20 INSTRUCTIONS

.1 Compile and submit to the Owner, at completion of the work, two (2) neatly bound booklets, containing operation and maintenance instructions for all equipment and systems. These shall include:-

.1 General arrangement of shop drawings
.2 Complete explanation of operating principles and sequence
.3 Complete parts list with numbers.
.4 Recommended maintenance practices and precautions
.5 Complete wiring and connection diagrams
.6 A complete set of approved equipment drawings
.7 Air and water balancing reports with performance curves for each pump and fan installed
.8 Procedures and results of all tests performed with copies of Acceptance Certificates
.9 Index inside front cover.

.2 Instruct building superintendent in operation and maintenance of all equipment and controls. during first year, check to see that all equipment is properly maintained and make periodic heating control adjustments to obtain maximum operating economy.

2.21 EQUIPMENT OPERATING INSTRUCTIONS

.1 All hot water heating equipment must be suitable for operation at temperatures up to 240°F (115°C).

.2 All equipment supplied shall have minimum pressure ratings as shown or as required.

.3 Any equipment model numbers used in this specification, or on the drawings, are only indicative of the general requirements, and such designation of equipment is not to be interpreted as overriding the equipment operating requirements, should the two conflict.

.4 All equipment and installation of same to be in accordance with **A.S.H.R.A.E. Standards** for applicable applications, including noise.

2.22 SWITCHES LOCKGUARD

.1 Supply and install lockguards for garage switches (i.e.) unit heaters, sump pumps, fans and timers.

.2 Lockguard shall be supplied and installed by the contractor supplying respective unit switch.

.3 Supply and install lockable covers for all thermostats installed in Public Areas.

2.23 FIRE STOPPING AND SMOKE SEAL

.1 When mechanical system elements, including conduits, piping and ductwork etc., penetrate through fire rated separations, seal all openings to form tight barriers to retard the passage of flame and smoke.

.2 The Fire Stop System shall conform to all applicable standards, including **CAN4-S115-M85** and current **U.L.C.**

.3 Provide U.L.C. rated insulated sleeves for insulated pipe and duct penetrating fire separation.

.4 Provide shop drawings and certificate on the sealing material and application method.

2.24 GARBAGE CHUTE

.1 Supply and install a garbage chute as shown and dimensioned on the drawings. The garbage chute shall be as, or equal to **YORK CHUTES OF CANADA LTD**. Chute shall be aluminized steel of 18 gauge up to 12 storeys, and 16 gauge for 12 storeys and over, complete with hopper doors, sprinkler head provision, flushing rim and access doors and accessories, and shall be lock-seamed, slip joined and complete with one (1) expansion joint per storey. Crimped joints are not acceptable.

.2 Garbage disposal chute shall be complete with garbage hopper door at each floor. Provide 4' (1.3m) gauge aluminized steel sleeve through masonry wall of chute shaft at hopper door location. The installation of the complete hopper door assembly must be such as to permit removal and re-installation of the complete assembly without disturbing either the sleeve or masonry.

.3 The garbage hopper door assembly shall be 15" x 18" (381 x 457mm size, 1/8" (3mm) steel plate, chrome plated, bottom hinged, hand operated, noiseless, self-closing, and self-latching, complete with trim and baffle flap. Hopper door frame shall be fabricated of 16 gauge aluminized steel and the baffle flap shall be of the same material as the chute.

.4 The lowest section of the chute shall be suitable for discharge into a garbage compactor and shall be complete with a close-off spring loaded fire door, held in the open position by a fusible link, arranged to close automatically in the event of a fire.

.5 Garbage chute shall extend not less than 3' (1m) above the roof. Terminate, as required by local authority and Codes.

.6 Chute shall include all necessary metal work for the installation of chute wash-down heads and sprinkler heads. Sprinkler heads, at floors indicated on the drawings, shall be installed in boxes, recessed on the inner side of the chute. The arrangement shall be complete with access panel in box and shaft wall to facilitate sprinkler head replacement, all as shown on the detail drawings. Co-ordinate this work with the **Plumbing** and **Sprinkler Sections**.

END OF SECTION

ARTICLE NAME PAGE

1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to all applicable provisions of the Mechanical General Requirements, Section 15050.

.2 .1 All equipment shall be adequately isolated to maintain acceptable noise (NC) levels in the occupied areas of the building, to ASHRAE requirements.

.2 All vibration isolation, duct silencers, acoustic plenums and floating floors shall be supplied by a single manufacturer, who will take single responsibility for the complete project.

.3 conform and co-ordinate this Section with project's Sound Consultant's requirements, which shall govern.

1.2 SCOPE OF WORK

.1 It is the responsibility of the Mechanical and Sheet Metal Contractors to supply to the Vibration and Noise Control Manufacturer, a copy of approved drawings of equipment to be isolated. These drawings are to show belt centres, operating weights and motor positions.

.2 The Sound and Vibration Control Manufacturer shall submit, for approval, drawings of the isolation and noise control components, being supplied.

.3 Precautions shall be taken to ensure that no noticeable noise or vibration is transmitted from the fans or units to the building structure. All units, bearings, motors, brackets, guards, etc., shall be designed for especially quiet operation.

.4 Supply and install acoustic lining in ducts where shown on the drawings and where called for in Section 15850 of these specifications.

.5 Acoustic lining to be as specified in Section 15850.

.6 The Contractor shall supply all necessary structural steel where cooling towers, boilers, and refrigeration machines which are not sufficiently rigid for isolator point loading.

.7 Supply and install all silencers as shown on drawings, schedules and as required by these specifications.

.8 Reinforced floating concrete floors, supporting 8" (200mm) thick concrete wall blocks, for Generator Room, Chiller Room, and where shown on the drawings shall be provided. Refer to floating room details in Section 15990 of these specifications.

.9 Adhere to project noise consultant's requirements, to be obtained from Architect, which shall govern, and apply to this and all other applicable mechanical sub-sections of these specifications.

2 PRODUCTS

2.1 GENERAL REQUIREMENTS

.1 **BURGESS-VIBRO-ACOUSTICS LTD.**, has been used as a base for this specification.

2.2 VIBRATION ISOLATION TYPES

.1 Bases:-

.1 'T'-shaped concrete inertia pump bases shall be used only where shown on the drawings and shall be the sizes shown.

.2 Type 'S' - integral steel fan and motor bases, complete with adjustable motor slide rails welded in place and having minimum vertical sections of 3", 4", 6", 10", and 12" (75, 100, 150, 200, 250 and 300mm) for motor horsepowers up to and including 3 hp, 7-1/2 hp, 20 hp, 40 hp, 75 hp and 100 hp, respectively.

.3 Type 'SS' - slung steel base of structural members with gusset plates welded to ends.

.4 Type 'C' - concrete inertia base forms shall have full depth perimeter formed frames with flanges pointed in the centre of the base. for spring mounted units, the load shall be carried by gusseted brackets forming an integral part of the channel frame. Base shall be complete with reinforcing rods. Slide rails and concrete by others.

.2 Isolators:-

.1 All springs shall be completely stable, colour coded and selected to operate at no greater than two-thirds solid load.

.2 All spring isolators shall be complete with levelling devices, 1/4" (6mm) thick, ribbed neoprene sound pads and zinc plated hardware. For applications subject to outdoor or high humidity conditions, the housings shall have a two-coat system or rust resisting paint and the springs shall have two coats of neoprene unless otherwise specified.

.3 Type CM - closed spring mounts with top and bottom housing separated with neoprene rubber stabilizers.

2.2 VIBRATION ISOLATION TYPES - cont'd:-

.2 Isolators - cont'd:-

.4 Type FS - open spring mounts having extra stable iso-stiff springs with a minimum horizontal stiffness to vertical stiffness (Kx/Ky) of 1.0.

.5 Type CSR - open controlled mounts with heavy rigid steel base frame, built-in limit stops and removable spacer plates. Springs shall be iso-stiff with a minimum horizontal to vertical stiffness (Kx/Ky) of 1.0.

.6 Type MD - elastomer rubber mount with threaded insert and hold down bolt holes.

.7 Type R - waffle pads shall be 30 durometer natural rubber (2000 psi (13,800 kPa) tensile), a minimum of 1" (25mm) thick and selected for an optimum loading of 60 psi (414 kPa). when pads are built into spring isolators or hangers 50 durometer (3000 psi (20,700 kPa) tensile) pads are acceptable with an optimum loading of 90 psi (620 kPa).

.8 Type N - waffle pads shall be 50 durometer neoprene 1800 psi (12,420 kPa) tensile, minimum of 1/2" (13mm) thick and selected for an operating load of 90 psi (620 kPa).

.9 Type RSR - rubber-steel-rubber pads shall consist of two (2) layers of 1/2" (13mm) thick type R pad, as specified above, bonded to 1/4" (6mm) steel plate. All holes to be sleeved and complete with an isolation washer.

.10 Type NSN - neoprene-steel-neoprene pads shall consist of two (2) layers of 1/2" (13mm) thick type N pad, as specified above, bonded to 1/4" (6mm) steel plate. all holes to be sleeved and complete with isolated washer.

.11 Type KIP - kinetic precompressed moulded fibreglass pads shall be coated with a flexible moisture impervious elastomeric membrane. Glass fibres, produced by the multiple flame attenuation process, shall have a diameter not exceeding .00018" (.00457mm).

Pads shall be capable of sustaining 300% overload without damage, permanent set, collapse or permanent loss in natural frequency. Static deflection shall not exceed 15% of the undeflected height of the pad.

.3 Spring Hangers

.1 Type SH - shall have fabricated steel housing with one (1) coat of anti-rust paint, and be complete with a colour coded stable spring, retaining cups and acoustic washer.

.2 Type SHR - shall be as for Type 'SH' above, but shall have 1" (25mm) elastomeric element in lieu of acoustic washer.

.3 Select springs to operate at not greater than 2/3 solid defection.

.4 Floating Floor

.1 Floating slab isolators shall be 2" (50mm) thick Kinetic KIP type, pre-compressed moulded glass fibre pads, coated with a flexible moisture impervious membrane. Glass fibres, produced by the multiple flame attenuation process, shall have a diameter not exceeding .00018" (.00457mm). Pads shall accept a 300% overload without damage, and shall be selected to give a constant deflection and a natural frequency of 10 cps over the whole floating floor section.

2.3 SILENCERS

.1 All silencers shall be completely prefabricated to connecting duct size (Transitions are not acceptable) and shall be packed with shot free acoustic media having long resilient inorganic glass fibres bonded with temp-setting resin, compressed to 3 lbs/cu.ft. (45.83 kg per cubic meter) shall be protected from air erosion by 22 gauge perforated galvanized metal.

.2 Silencers shall have streamlined inlets and tapered diffuser outlet and shall be selected not to exceed the specified values of maximum allowable pressure drop and minimum allowable duct-to reverberation room insertion loss.

.3 All silencers with internal air velocities above 4500 FPM (22.8 m/s) shall have the acoustic media wrapped in fiberglass cloth to minimize erosion.

.4 Rectangular

.1 Type 'RRS' shall be constructed in accordance with the following classes.

.1 Silencers over 48" (1220mm) in any cross sectional dimension shall be constructed in single modules not exceeding 48" (1220mm) and a length not exceeding 7' (2135mm).

.2 Class I - the outer casing shall be a minimum of 22 gauge galvanized steel with air tight mastic filled seams and 2" (50mm) slip connections each end.

.3 Class II - the outer casing shall be a minimum of 16 gauge hot rolled steel with continuous welded seams and steel angle flanges and one (1) prime coat of rust resistant paint.

.4 Crosstalk - Type 'CTS' - shall be of the size and arrangement as shown on the drawings. Casings shall be a minimum of 22 gauge galvanized steel and 22 gauge galvanized perforated steel.

2.4 ACOUSTIC LINING

.1 Unless otherwise called for, acoustic lining shall be 1" (25mm) thick **FIBERGLAS** coated duct insulation, board type, with neoprene coating, 4.5 lbs./cubic foot (72 kg/cubic meter) density.

3 EXECUTION

3.1 GENERAL REQUIREMENTS

.1 Care must be taken to ensure that no ducts or pipework transmit vibration to the walls and floors through which they pass. A minimum clearance of 1" (25mm) shall be allowed around the entire perimeter of the penetration. The clearance to be packed with rockwool and sealed on both sides with non-hardening caulking and gypsum-board.

.2 Unless otherwise specified, isolation materials shall be installed on 4" (100mm) concrete sub-bases, which extend at least over the full base and isolator area of the isolated equipment.

.3 All steel bases and inertia bases shall clear the sub-bases by at least 1" (25mm) and 2" (50mm) respectively - all bases shall be blocked and shimmed level, so that all ductwork and piping connections can be made to a rigid system, at the operating level, before isolator adjustment is made.

3.2 DUCTWORK AND AIR HANDLING SYSTEM

.1 .1 Supply and return ducts, for 15' (4.6m) from fans and heating and cooling units, shall be insulated with duct liner, applied to the inside of the duct, with a minimum 50% coverage of **BENJAMIN FOSTER'S #81-99**. Increase duct size to compensate for duct liner.

.2 Use mechanical fastening of **GRAHAM** welded pins, **TUFF-WELD** nylon hangers or stick-klips, on maximum 16" (406mm) centres at top sections (where width exceeds 12" (304mm)), on sides (when height exceeds 24" (608mm)).

.3 Before installation of the linear, caulk edges of butted insulation with heavy coat of **BENJAMIN FOSTER'S #30-36 Sealfas.**

.2 Provide fireproof flexible connections as specified at all duct connections to fan units and to reheat boxes.

.3 After systems have been air balanced, submit a report, including sound curves to substantiate that all equipment has been isolated in accordance with the manufacturer's instructions and that acceptable noise levels exist in the occupied areas.

3.3 SPRING HANGERS

.1 All piping over 2" (50mm) diameter, in mechanical room, connected to spring isolated equipment, shall be supported with minimum 1" (25mm) static deflection vibration mounts or hangers, equal to Type SHR, to isolator manufacturer's recommendations.

.2 The first point of support shall have a static deflection of twice the deflection of the isolated equipment, but not more than 2" (50mm)

.3 Any piping supported from the mechanical penthouse floor shall be isolated on type CM or SL mounts with the deflection being equal to that of the isolated equipment.

.4 Ensure that there is no physical contact between the pipes and sleeves or pipes and structure.

.5 Pipe holes shall be sleeved at least 2" (50mm) greater diameter. After installation of the pipe, the periphery shall be packed with rock-wood and sealed with non-hardening caulking and gypsum board on both sides of the wall, and on top floor for vertical slab penetration for water-proofing.

3.4 APPLICATION

.1 All base-mounted pumps shall be mounted on concrete inertia basis, which in turn are mounted on 25mm thick 'NSN' pads and type 'FS' spring mounts, selected for at least 98% isolation efficiency, for locations on suspended slab floors. The height of the inertia bases shall be as determined by the vibration equipment supplier but not less than 6" (150mm).

.2 All in-line pumps, suspended from the ceiling, shall have 'SHR' type spring hangers for three hanger points on either side of the pumps, to provide 98% isolation efficiency minimum.

.3 All in-line pumps for floor-mounted locations on suspended slab floors, shall be supported on NSN pad and 'CM' type mounts, to provide 98% isolation efficiency minimum.

.4 All in-line pumps for location on grades resting on the slab, shall be supported with 25mm thick 'NSN' pads, or suspended from the ceiling with Type 'SHR' hangers.

.5 Supply and install on each base-mounted and vertical pump, of 5Hp and up, chiller, cooling tower and any other equipment subject to vibration, twin-sphere flexible connector, to suit system pressure, equal to **MASON** Model **'MFTNC'**, EPDM, reinforced with multi-layer nylon tire cord and metal ring.

.6 Boilers and water heaters shall be mounted directly on 'NSN' pads.

3.4 APPLICATION - cont'd:-

.7 Chillers for locations on suspended slab floors shall be mounted directly on 3" (75mm) deflection type 'CSR' spring mounts and 1" (25mm) thick NSN pad.

.8 Chillers for locations on grade shall be mounted directly on 1" (25mm) deflection type CSR spring mount and 1" (25mm) thick 'NSN' pads on concrete housekeeping pads.

.9 Cooling towers shall be mounted directly on structural steel beams as shown on drawings, which in turn are carried on 2" (50mm) deflection type 'CSR' spring mounts and 1" (25mm) thick NSN pads.

.10 Air compressors shall be mounted directly on 2" (50mm) deflection type 'CH' spring mounts on concrete housekeeping pads.

.11 Floor-mounted air handling and air conditioning units for location on suspended slab floors, shall be mounted on type 'FS' spring mounts to provide 98% isolation efficiency minimum. If unit is internally isolated for 98% efficiency then mount unit on 1" (25mm) thick NSN pads.

.12 Floor-mounted air conditioning and air handling units on grade locations, shall be mounted on 1" (25mm) NSN pads.

.13 Suspended air conditioning units and heating/ventilating units shall be supported with type 'SHR' spring hangers, to provide 98% efficiency minimum.

.14 Centrifugal fans, on suspended slab floors, shall be mounted on type 'FS' spring mounts, to provide 98% isolation efficiency minimum.

.15 Roof-top air cooled condensing units shall be set on 2" (50mm) static deflection spring isolators, Type 'CSR' to provide minimum 98% isolation efficiency.

.16 Diesel generator on suspended slab floor shall be set on nominal 2" (50mm) deflection type 'CSR' spring mounts, on concrete pad of minimum 6" (150mm) height.

3.5 FLOATING FLOOR

.1 The Mechanical Contractor shall supply the vibration and noise control manufacturer with drawings showing the location of equipment mounted on the floating floor area for preparation of shop drawings.

.2 Floors shall be poured in sections not exceeding 50' (15m), or as directed by the Structural Engineer.

.3 No ducts or piping shall pass through the floating floor.

.4 Installation:

.1 The design and supply of the following items shall be by the sound and vibration control manufacturer; KIP pads, plywood, low density fibreglass junction plates, polyethylene and perimeter board.

.2 Assembled panels shall be butted together and fastened with plyclips at 12" (305mm) centres and covered with a single layer of 4 mil. polyethylene sheeting overlapped 6" (150mm) and taped by the Contractor.

.3 Isolate side walls with 1" (25mm) thick rigid fibreglass #AF-570 to within 1/2" (13mm) of the finished floating slab level. This gap to be sealed with polysulphide non-hardening synthetic caulking compound, by others.

.4 The Mechanical Contractor shall supply the isolation materials. The General Contractor will be responsible for supplying and installing concrete, reinforcing and caulking compound.

.5 The Sound and Vibration Control Products Manufacturer is responsible for supervision of the floating floor installation and should be contracted prior to commencement of the work.

END OF SECTION

ARTICLE NAME PAGE

.6 All vapour barrier, duct tape and other accessories shall have flame spread and smoke developed rating in accordance with **Ontario Building Code**.

2.2 ACOUSTIC DUCT LINING

.1 Supply and return ducts for 5m from air handling units, including make-up air unit, air conditioning unit, heating unit, exhaust fan, etc., shall be lined with 1" (25mm) rigid duct liner, equal to **FIBERGLAS CANADA** type AF, with neoprene coating, 72kg/m³ density fiberglass. Duct liner and all accessories shall be ULC approved for flame spread and smoke developed rating in compliance with **Ontario Building Code**.

.2 Use adhesive and sealant for liner as manufactured by **BENJAMIN FOSTER** to prevent edge erosion.

.3 Use mechanical fastenings of welded pins and clips at maximum 400mm centres on top and two sides of duct.

.4 Provide acoustic lining elsewhere as shown on drawings.

.5 Duct sizes shown on drawings are net sizes, increase size to allow for duct lining.

2.3 PIPE COVERING - GENERAL

.1 Pipe insulation shall be preformed fibreglass insulation equal to **FIBERGLAS CANADA INC.**, 5lb/cuft (80kg/cubic meter) density insulation with all service jacket, of thickness and finish as specified in this Section.

.2 Cut, mitre, and tape all joints in accordance with the manufacturer's recommendations, for a neat and professional finish. All joints and seams shall be completely vaopur sealed by compatible types.

.3 Insulate all fittings including valves, flanges, etc., with preformed fitting or mitred segments of pipe insulation of same thickness. Coat each fitting with two 1/8" (3.2mm) coats of approved vapour barrier mastic reinforced with glass fibre and extend over onto adjacent pipe insulation for a complete seal.

.4 When exposed to outdoor air, pipe insulation shall be cladd with aluminium alloy pipe jacket of overlapping design for a weather proofed installation. Embossed jacket shall be 0.4mm thick with longitudinal slip joints and 50mm end laps with protective liner on interior and secured by aluminum alloy butt straps with mechanical fasteners.

.5 Insulated heat exchanger shall be cladd with aluminium alloy jacket.

.6 Insulate piping within Mechanical Room and where exposed to view, shall be cladd with PVC jacket of 0.38mm minimum thickness and fastened in accordance with manufacturer's standard.

.7 Insulated valves, strainers, water meter, and other fittings shall be cladd with pre-moulded PVC jacket.

.8 Insulated domestic hot water tank shall be cladd with PVC jacket.

.9 PVC jacket shall have flame spread and smoke developed rating in accordance with **Ontario Building Code**.

2.4 PLUMBING PIPING

.1 Provide ½" (13mm) preformed fibreglass insulation for:

- Domestic cold water piping
- Sanitary traps in unheated areas
- Heating and air conditioning system make-up water piping
- Cast iron rain water leaders, piping and fittings
- Condensate drains.

.2 Provide 25mm preformed fibreglass insulation for:

- Domestic hot water and recirculation piping up to 50mm diameter

.3 Provide 40mm preformed fibreglass insulation for:

Domestic hot water and recirculation piping 65mm and up.
All electrically traced piping in unheated areas, including fire line, wet sprinkler lines, domestic hot and cold water lines, storm lines from the building core, sanitary line, sewage and sump pump discharge lines, and where shown on the drawings.

.4 Insulate the water meter with type **#AF545** insulated of 1" (25mm) thickness equal to **FIBERGLAS CANADA LTD.** Insulation shall be cut and mitred to fit.

.5 Where piping is exposed to outside air, piping shall be insulated with 50mm preformed firbreglass insulation and weather proofed as per Clause 2.3.5.

.6 Place 3" (75mm) glass fibre batts under all bath tubs.

.7 Individual suite hot and cold copper water branches in furred spaces shall be wrapped with ½" (13mm) thick insulation with vapour barrier.

.8 Insulate piping p-trap for handicapped sink and basin with foam plastic insulation equal to **ARMAFLEX**. Protect insulation with pre-moulded PVC jacket.

.9 All materials shall have flame spread and smoke developed ratings in accordance with **Ontario Building Code.**

2.5 HEATING PIPING

.1 Cover all hot water heating piping and boiler headers with 1-1/2" (40mm) preformed glass fibre insulation.

Pipe diameter (mm)	up 50	65 and up
Insulation thickness	1" (25)	1-1/2" (40)

.2 Where the piping is exposed to the outside air and unheated space, cover the piping with 2" (50mm) preformed glass fibre insulation and weatherproof as per Clause 2.3.5.

.3 All materials shall have flame spread and smoke developed ratings in accordance with **Ontario Building Code.**

2.6 TANKS AND HEAT EXCHANGER

.1 Insulate the domestic hot water tanks, heat exchangers and convertors with rigid fibreglass equal to **FIBERGLAS CANADA LTD. #AF545** of 90mm (3-1/2") thickness. Cover the insulation as per Clause 2.3.4 and 2.3.7.

2.7 CHILLED WATER PIPING & FAN COIL SYSTEM WATER PIPING

.1 Cover all chilled water piping and fan coil system distribution piping with preformed insulation of following thickness:-

.1 Up to 100mm 25mm
.2 125mm and up 40mm

.2 Where the piping is exposed to the outside air and unheated space, cover the piping with 2" (50mm) preformed glass fibre insulation and weather proof as per Clause 2.3.5.

.3 Piping hangers, anchors, etc., shall be insulated by applying insulation upward along the hanger rod or along the anchor member to a point not less than four (4) times the insulation thickness from the adjacent pipe finish and seal off. Insulation thickness shall be one-half pipe insulation thickness.

.4 All material used shall have flame spread and smoke developed rating in accordance with **Ontario Building Code**.

2.8 CHILLER INSULATION

.1 Packaged water chiller shall be factory insulated, or

.2 Insulate the surface of the evaporator, suction elbow, evaporator cover and connections, and any other areas that are subject to low temperature (below 45°F. (8°C.)) with 3/4" (19mm) closed cell formed PVC sheets, complete with moisture barrier. Flame spread not to exceed 25 and smoke developed not to exceed 50.

.3 Special precautions should be taken in application of insulation to water box covers, so that they may be removed without damage to thermal insulation and moisture barrier.

.4 Auxiliary water piping shall be covered as specified for cold water piping.

2.9 REFRIGERANT PIPING

.1 Hot gas and liquid piping, including liquid receiver, shall be covered with 3/4" (18mm) insulation and suction lines shall be covered with 1-1/2" (37mm) thick insulation, equal to **JOHNS MANVILLE MICRO-LOC** fibreglass with flame bar jacket. Valves and fittings shall be covered with built-up insulation to match adjacent pipe insulation. Outdoor piping insulation shall be double insulated and weatherproofed as required.

2.10 CONDENSATE DRAIN PIPING

.1 All condensate piping shall be covered as specified for cold water piping in this Section.

2.11 CONDENSING WATER PIPING

.1 For cooling tower intended for year round operation (4-pipe fan coil system), insulate the condensing water supply and return piping when exposed to outdoor air with 2" (50mm) preformed fibreglass insulation and weather proofed as per Clause 2.3.5.

2.12 HEAT PUMP PIPING

.1 When exposed to outdoor air or unheated space, insulate the heat pump piping with 2" (50mm) preformed fibreglass insulation and weather proofed as per Clause 2.3.5.

2.13 EMERGENCY GENERATOR

.1 Cover entire generator exhaust piping system including muffler and exhaust pipe with high temperature pre-formed mineral wool pipe insulation, 100mm thick, suitable for up to 650°C (1200°F) operating temperature.

.2 Insulation shall be **ROXUL TECHTON 1200** or approved equal.

3 EXECUTION

3.1 INSTALLATION

.1 Adhere to installation standards of **FIBERGLAS CANADA LTD.**, and to applicable insulation manufacturer approved for use on project.

.2 Apply insulation over clean and dry surfaces, and butt all sections firmly together.

.3 Provide for removable section at items and equipments requiring service and do not cover nameplates.

.4 Piping and ductwork insulation shall be continuous through hangers, wall, partitions, roofs and curbs, and such openings shall be increased to accommodate the required insulation thickness.

.5 For all air plenum and duct dimension exceeding 400mm (16"), entire plenum and the insulation at the bottom of duct shall be secured with mechanical fastenings of welded pin and clip, at maximum 300mm (12") spacing.

.6 Ductwork sizes indicated on drawings are net dimensions inside the duct liner.

.7 Use mechanical fastening of **GRAHAM** welded pins, **TUFF-WELD** nylon hangers or stick-klips, on maximum 300mm (12") centres at bottom section where duct width exceeds 400mm (16"), on sides when height exceeds 400mm (16").

.8 For acoustic lining, mechanical fastenings shall be used on top section of duct when width exceeds 400mm (16") and on sides when height exceeds 400mm (16").

.9 Before installation of the liner, caulk edges of butted insulation with heavy coat of **BENJAMIN FOSTER'S #30-36 SEALFAS.**

3.2 PROTECTION

.1 Protect the work of other trades, and of the work of this Section.

.2 Make good any damage and leave work in perfect condition, ready, where required, for final painting.

END OF SECTION

ARTICLE NAME PAGE

1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to all applicable provisions of the **Mechanical General Requirements**, Section 15010.

.2 Systems shall be in accordance with the latest standards, the **Insurance Advisory Organization Code**, **NFPA-13**, **NFPA-14** and the **Ontario Building Code**, and must be acceptable to the (local) Fire Department.

1.2 SCOPE OF WORK

.1 Furnish and install, complete with all related items, fire protection system including automatic sprinkler designed by a certified professional engineer.

.2 Fabrication and installation shall be by experienced competent workmen, regularly engaged in the work.

.3 Work shall include, but shall not necessarily be limited to the following:-

.1 Sprinkler system for entire building including basement and elsewhere where shown and where required.

.2 Fire pump and automatic transfer switch system.

.3 Hydraulic calculation and design for sprinkler piping to I.A.O. and Fire Department's approval.

.4 Certification of the entire sprinkler system and fire pump.

1.3 GUARANTEE

.1 The entire installation shall be guaranteed for a period of one (1) year from the building acceptance date.

2 PRODUCT

2.1 MINIMUM REQUIREMENTS

.1 Piping in areas having ceilings shall be concealed. Piping in storage rooms and service areas may be exposed but kept at a minimum distance from ceiling. All piping shall be free of rust, clean and have a minimum of one (1) shop coat. All system components shall be U.L.C. listed and labelled.

.2 Sprinkler heads in unfinished areas with exposed piping shall be brass pendant or upright types. Heads in areas with finished ceilings shall be chrome plated pendant recessed type with chrome plated cup, located (unless functionally impossible) as shown on Architectural reflected ceiling plan. Install additional heads as required. Final types of heads, in finished areas shall be subject to Architect and Owner's approval. Submit sample of each type of head for these areas to Architect and Owner for approval before installation. The following head types shall be used as a guide for finished areas:-

Where required by local authorities and when heads are located in the vicinity of heat producing equipment, heads shall be rated for high temperature.

Install protection wire guard for heads as required.

.3 Complete system shall be designed using hydraulic calculations in conformance with **NFPA-13** and to respective areas hazard classifications.

.4 Provide siamese Fire Department connection with drain located to face a public street, as specified for stand-pipe system in Section 15430.4 of these specifications.

.5 Designs requiring cutting of structural members for passage of sprinkler pipes or hangers shall be avoided. When design, due to economy, appearance and similar aspects, denotes the necessity of cutting, it shall be held to absolute minimum, and done only with the Architect's written approval.

.6 Wet and dry pipe valves shall be equal to **RELIABLE.**

.7 Pressurization air compressor shall be air cooled, belt-driven, equal to **WEBSTER**, complete with pressure switch and H.O.A. magnetic starter. Compressor and motor shall be mounted on one (1) steel bedplate.

2.2 STANDPIPE & HOSE CABINETS SYSTEM

.1 Standpipe system and components shall be U.L.C. rated for pressures as required to suit job conditions, but not less than 250 psi (1725 kPa).

2.2 STANDPIPE & HOSE CABINETS SYSTEM - CONT'D

.2 Provide, where shown on drawings, **NATIONAL FIRE EQUIPMENT** siamese connections, **Model 229** polished brass finish, 2-1/2" x 2-1/2" x 4" (65mm x 65mm x 102mm) or 6" (153mm), as required, all bronze, double clapper with plugs and chains and local Fire Department thread. Provide nameplate (standpipe or sprinkler) with raised letters (or as noted on drawings).

.3 Fire hose cabinets shall be recessed and non-recessed type, as called for on drawings, prime-painted steel cabinets equal to **NATIONAL FIRE EQUIPMENT**, 3/16" (5mm) plate glass door, and space for fire extinguisher. Frame for recessed cabinets to be separate from cabinet.

.4 Each cabinet shall contain 100' (30m), or lengths shown, of 1-1/2" (38mm) hose with water stop to requirements of local authorities, with **Underwriters'** label, **Underwriters'** 1-1/2" (38mm) angle hose valve with integral hydrolater (drain vent), 2-1/2" (65mm) angle hose valve with cap and chain, as shown on the drawings, and as required. Valves shall be equipped with approved type pressure reducing device, acceptable to local and all other authorities having jurisdiction to reduce pressure to 90 psi (620 kPa) maximum at flow condition. The hose shall be equipped with a shut-off type adjustable spray to straight stream nozzle. In addition, supply and place in the cabinet, a portable **Underwriters'** approved fire extinguisher to local Fire Authority approval. Final finish of extinguisher, valves and cabinet frame and trim shall be to Architect's requirements and approval.

.5 Supply and install, on substantial wall brackets, individual **Underwriters'** approved CO_2 and dry type extinguishers, in boiler room, garbage rooms, fan rooms, mechanical equipment rooms, electrical rooms, parking area, elevator machine room and underground garage. Extinguishers to be suitably rated for the service. Where shown, and where required, supply and install prime-painted steel fire extinguisher cabinet with door, trim, latch, and glass panel, recessed or wall-mounted, and contain listed required multi-purpose approved type, fire extinguisher, complete with pressure gauge. Final finish shall be as above for hose cabinets.

3 EXECUTION

3.1 SPRINKLER SYSTEM

.1 Install system of automatic sprinklers and piping, connected to the main cold water service. Each zone line shall be complete and with an alarm switch and supervised valves to be installed under this Section, and wired under the Electrical Division.

.2 Sprinkler systems for all areas shall be wet pipe, except unheated areas such as garages, which shall be dry type pipe system.

.3 Dry pipe equipment shall be supplied and installed by this Section, and wired by the Electrical Division.

.4 Drum drips shall be installed at all low points of the system. All drum drips in unheated areas shall be electrically traced and wired under the Electrical Division.

.5 Dry pipe valves shall be provided where shown on drawings. For pressurizing of the dry pipe sprinkler system, supply and install, on 6" (150mm) high concrete foundations, an air compressor, as shown. Provide Schedule 40 galvanized steel air piping from air compressor to dry pipe valve enclosure of each dry pipe system to include shut-off valve at each dry pipe system connection.

.6 When shown on the drawings, install non-freeze sprinkler systems, complete with pressure switch, accelerator, drop loops, valves and fill points, all to NFPA Standards, or approved dry sprinkler heads where applicable.

.7 Include for all required ULC supervised valves and P.R.V.'s, and test and drain lines piped to drain, and all required items and accessories for a complete approved system, including excess pressure sprinkler pump tied into sprinkler alarm valves, complete with suction and discharge pressure gauges. Pressure relief and isolating valves, installed and wired for automatic operation.

.8 Apply for approval by the Building Department and all other governing authorities, including I.A.O. of submitted layout drawings, schematics, hydraulic calculations and products, shop drawing data and details. After obtaining final approval, submit the above information to Architect, Engineer, and Owners for review and comments, before installation. Include in hydraulic design for flow and pressure tests of street water service, and inform engineer, at early stages of system design, if any modifications to the flow and/or head of fire pumps shown on drawings is required.

3.2 STANDPIPE & HOSE CABINETS SYSTEM

.1 Fire protection systems, including supply of required number and type of extinguishers in proper locations, shall be to the approval of the local Fire Department having jurisdiction. Responsibility for complete compliance with department regulations shall rest with this Section.

.2 Supply and install, a complete system for fire protection as shown on the drawings, including connection to water service, standpipes, fire hose cabinets, valves, accessories, and siamese connections.

.3 The siamese connection shall be mounted a minimum of 12" (300mm) above grade and a maximum of 3' (900mm) above grade, and shall be installed to allow for clearance for 15" (380mmm) Fire Department hose spanner.

.4 Install, between check valve and outside siamese, automatic ball drip and install drip pipe to nearest floor drain.

.5 Supply and install, at high point of each standpipe riser, a 4-1/2" (114mm) dial pressure gauge, range 0 to 90 psi (690 kPa), complete with isolating valve, electrically supervised shut-off valve at base of every standpipe riser. (O.S. & Y. gate valve, complete with monitor switch equal to **GRINNELL, Model #F640** supplied and installed by this Division and wired by the Electrical Division.)

.6 Prior to commencement of work, present to Engineers, final plans and shop drawings, approved by the local Fire Department and all authorities having jurisdiction.

3.3 TEMPORARY FIRE PROTECTION

.1 Have the standpipe fire protection system installed and operating for temporary fire protection at all times during construction of the building and in phase with the construction as required by local authority, and in compliance to governing Building Code requirements.

3.4 DRAWINGS

.1 Architect shall furnish fabricator drawings of the ceiling layouts showing locations of all items (i.e. lighting fixtures, ceiling air diffusers, etc.), and have the fabricator correlate the sprinkler system to the ceiling plan.

.2 The Sub-contractor shall co-ordinate the riser locations as well as furnish whatever information the fabricator may require in accordance to the chosen method and obtain approval from the Project Manager.

3.4 DRAWINGS cont'd

.3 Shop drawings consisting of the following shall be furnished to the Project Manager:

.1 Layout drawings of complete overhead sprinkler system indicating relationship of all other overhead items, including ceiling air diffusers. Location of risers, piping, etc., shall be as inconspicuous as possible, provide a pleasing overhead appearance and still fulfil all functional requirements.

.2 Plot plan, indicating location of all underground connections, control valves, piping and all related items, and any other items or data deemed necessary by the (local) Fire Rating Bureau.

.3 Complete details and sections as required to clearly define and clarify the design indicted by the aforementioned layout and plot plan.

.4 All shop drawings, prior to being sent to the Project Manager, must bear the (local) Fire Rating Bureau's stamp of acceptance.

.4 Furnish and install, next to the incoming sprinkler main, a printed sheet, protected by glass or transparent plastic cover, giving brief instructions regarding control emergency procedure and other data as deemed necessary and approved by the (local) Fire Rating Bureau.

.5 Upon completion of the work, accurately mark a drawing (furnished by the Project Manager) showing location of all underground fire prevention system piping, valves, meters, etc., as finally installed.

3.5 INSTALLATION

.1 Where exposed piping passes through finished work, chrome plated or other finish acceptable to the Project Manager, split wall plates or escutcheons shall be installed to fit snugly around piping. Where finish is not a problem, suitable plates shall be provided at each hole to assure effectiveness of construction as a fire stop.

.2 All openings for piping should be anticipated and indicated on the approved and accepted shop drawings. Any additional cutting of openings must have the written approval of the Project Manager.

.3 The system shall have one (1) sprinkler cabinet suitably located, complete with twelve (12) sprinkler heads, to include each type of head used in the system, in the amount as desired by the Owner. Also, one (1) sprinkler wrench for emergency use shall be furnished.

3.6 TESTS

.1 Prior to connecting to the overhead sprinkler piping, the underground main should be flushed in the presence of a representative of the (local) Fire Rating Bureau and meet with his written epproval.

.2 After completion of the installation, the entire system shall be tested for acceptance by the (local) Fire Rating Bureau.

3.7 APPROVAL AND ACCEPTANCE

.1 The (local) Fire Rating bureau, after satisfying itself that the installation is satisfactory in all respects, will issue a letter of final acceptance. The letter shall be addressed to the sprinkler company responsible for the installation, prepared in triplicate and given to the Project Manager for distribution.

.2 After completion of all installations, tests, etc., and prior to the building opening date, the sprinkler contractor shall instruct the building personnel in the operation of the sprinkler system. Special care shall be taken to make sure the building manager or tenant will:-

.1 Immediately recognize whether the main valve is in an open or closed position.

.2 Know how to drain the system.

.3 Know how to test the alarm valve.

END OF SECTION

ARTICLE NAME PAGE

1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to all applicable provisions of the **Mechanical General Requirements**, Section 15010.

.2 All underground services to be supplied and installed in accordance with current requirements of local municipal authorities, Ontario Provincial Standard drawings, various applicable **CSA** and **ASTM** Standards, and specifications where applicable.

1.2 SCOPE OF WORK

.1 Supply all labour equipment and materials required for the complete installation and testing of the underground drainage and water main systems as shown on the drawings and/or herein specified. The work shall be left complete and in satisfactory operation. In general, the major divisions of the work are:

.1 Complete underground sanitary and storm drains.

.2 Installation of all drain fixtures in slabs, walls, pits, or trenches on grade. These drain fixtures are to be supplied under Section 15430, **Plumbing and Drainage**.

.3 Weeping tiles.

.4 Forming, placing and finishing for concrete work as required for:

.1 Sump pits

.2 Interior catch basins

.5 Frames and cover plates for:

.1 Interior catch basins

.2 Sand pits

.3 Sump pits

.6 Complete water main system, from 2m beyond building wall.

.7 All earth work including trenching, bedding, and back-filling pertaining to this scope of work shall be responsible by Division 15. Refer to Architectural Section 02200 for details.

1.3 SITE SERVICES

.1 Co-ordinate connections to sewers and water mains with Services Contractor.

.2 Actual location and inverts of connections will be subject to field conditions.

2 PRODUCTS

2.1 MATERIALS

.1 Sanitary and storm sewer pipes and fitting shall be PVC DR-35 and shall be manufactured in accordance with **CSA B182.2** and various applicable **ASTM** Standards.

.2 P.V.C. pipe joints shall meet requirements of **CSA-B182.2** and **A.S.T.M. F477**. In general, 100mm pipes shall be welded joint and pipes 150mm and over shall be gasketed joint.

.3 Weeping tile to be helically corrugated and preformed plastic pipe 4" diameter, with corrugation 35mm to 48mm pitch and 8mm diameter perforations on inside crest of corrugations. Corner fittings and elbows by same manufacturer. Use **MIRADRAIN** pipe at vertical wall at 20 feet intervals or as shown on drawings. Filter fabric to be **TERRAFIX 270R**.

.4 Manholes shall be poured-in-place, or built-up precast units, **A.S.T.M. 478** and in accordance with Works Department standards.

.5 Catch basins shall be poured-in-place, or built-up precast units, and in accordance with Works Department standards.

.6 Poured concrete shall have a minimum compressive strength of 20,700 kPa at 28 days.

.7 Manhole frames and covers shall be cast iron and tight fitting.

.8 Manhole ladder rungs shall be cast-in-place.

.9 Precast modules used to adjust manhole and catch basin tops shall be **MODULOC** having a minimum compressive strength of 27,600 kPa.

.10 Concrete, all plain and reinforced, shall conform to **C.S.A. Standard #A23-1967**, and shall meet the minimum strength specified on the drawings.

.11 Mortar for brickwork and parging shall be a one cement to three sand volume mix.

.12 Reinforcing steel shall conform to **A.S.T.M. A-16 Standard**.

.13 Sump and sand pits shall be as detailed on drawings and be complete with all required hardware.

.14 Water main piping materials shall be as follows:-

Up to 3" (75mm)	-	Type 'K' copper
4" (100mm) and over	-	**PVC 900** (C.S.A. approved) with cemented joints, pipe to be wire traced.

2.1 MATERIALS - cont'd:-

.15 Valves shall be iron body, bronze mounted double disc gate valves with mechanical joints, conforming to **A.W.W.A. C-500**equivalent to **JENKINS Fig. 398-A**, or other municipally approved type with service box or valve chamber, as noted.

.16 Fire hydrants shall be in accordance with **A.W.W.A. C502** and requirement of local authority. Provide gate valve on each lateral.

.17 Valve boxes shall be sliding type, **MEULLER A759**, or equal.

.18 Flexible couplings used on pipes entering or leaving rigid structures (meter chamber, building walls) shall be **ROBAR** or equal.

.19 Bedding for manhole, catch basins, sewers, water piping, etc., shall be 19mm clear crushed stone or granular "A" material. The quality, sizing and graduations of the materials shall conform with **OPSS1010** and the Municipal specifications. Filter and backfill for weeping tiles shall be 19mm clear crush stone.

.20 Backfill used for backfilling trenches shall be of approved material and free from rubbish and debris, boulders or rock or concrete fragments, roots, stumps, or timber.

.21 Testing and inspection - all materials proposed for use on this project shall be subject to testing and inspection by the Owner or his agent, and those materials which are rejected, shall be immediately removed from the site by this Division.

3 EXECUTION

3.1 CONSTRUCTION

.1 All work shall be done in accordance with the **Municipal Standard** and/or **Ontario Standard and Regulations** and the recommendations by equipment manufacturers.

.2 **Trench Excavation** - all pipes shall be constructed in open trenches excavated to the dimensions, elevations, and grades shown on the drawings. All trenching work shall be subject to the **Trench Excavators Protection Act, 1960** and any amendments thereto.

.3 All water main trenches shall be excavated to provide a minimum of 1.8 metres of cover from top of pipe to finished grade.

.4 **Pipe Bedding** - shall be in accordance with **Works Department Standards** and pipe manufacturers' recommendations. Where pipes pass through backfill at other trenches, manholes, catch basins and building walls, install concrete cradle to extend from the underside of the pipe to the bottom of the original excavation.

.5 Under all plastic piping, provide minimum of 4" (100mm) of 3/4" (19mm) clear crushed stones or granular "A" material up to 150mm above pipe. Material to be compacted in 150mm layers to a minimum of 85% proctor density.

.6 The bottom of the trench shall be carefully trimmed by hand to provide a uniform and continuous support for the pipe on solid undisturbed ground at every point between the joints of the pipe.

.7 Where pipes pass through backfill at other trenches or near structure, the pipe must be supported on compacted granular backfill extending from the underside of the pipe to the bottom of the original excavation.

.8 Laying Water Pipes - pipes shall be laid with bell ends facing in the direction of laying. Mechanical joints shall be carefully made according to the manufacturer's recommendations.

.10 All sewer pipes shall be laid to the lines and grades shown on the drawings.

.11 **Backfilling Trenches** - all trenches shall be backfilled with selected excavation material to a height of 2' (600mm) above the top of the pipe, in 6" (150mm) layers, thoroughly compacted with approved mechanical equipment.

.12 The remainder of the trench shall be backfilled with excavated material in layers not exceeding 1' (300mm) in thickness. Each layer shall be compacted with approved mechanical equipment to a minimum of 95% Standard Proctor Density.

.13 All trenches and excavations within 5' (1.5m) of the outside wall of manholes, catch basins and other structures, shall be backfilled with granular material, compacted in 1" (300mm) layers to a minimum of 95% standard proctor density..

3.1 CONSTRUCTION - cont'd:-

.14 **Installing Valves** - valves shall be installed in the locations shown on the drawings. Care shall be taken to see that the stuffing glands of the valves are properly packed and that the valves will operate freely before they are installed and backfilled.

Boxes shall be carefully set over the valve heads with the shaft truly vertical and well braced to the sides of the trench.

.15 **Setting Hydrants** - hydrants shall be installed to the detail shown on the drawings, with the ground line flange set 3" (75mm) above final design grade.

.16 **Thrust Blocks** - trust blocks consisting of not less than 1/3 cubic yard of 2000 psi concrete, shall be provided and placed at all tees, crosses and bends, or as instructed by the Engineer.

3.2 WEEPING TILE

.1 The supply and installation of sub-drainage piping, chimney drains and filter aggregates and/or filter fabric is to be as specified in the Architectural Specifications, and as directed by Soil Consultant's recommendations and to his approval. Provide connections for weeping tiles to drains or pits as required.

.2 Prepare bed using 150mm of compacted 20mm clear gravel.

.3 Wrap the clear gravel with an approved filter membrane, **TERRAFIX 270R** or equivalent.

.4 Lay and join pipe to manufacturer's instructions to the layout shown on drawings.

.5 Connect pipe to storm sump pit with appropriate adapters.

.6 Provide fiction fit end plugs at open ends of pipe runs.

.7 Encase pipe completely with filter fabric and cover with filter gravel as follows: 150mm at sides. 150mm over top.

.8 Carry out installation as a continuous operation so that pipe is not left exposed for more than two (2) days.

.9 Above filter gravel fill trench to top of adjoining grade with 3/4" clear crushed stone.

.10 Obtain Mechanical and Soil Consultants approval of drainage pipe installation prior to completing backfill work.

3.3 DRAINS AND CLEANOUTS

.1 Make drain connections to all fixture footings and drain footings on slab or grade and to all cast iron footings at base of stacks and leaders and supply and install all buried underfloor and site drains, extending to outside buildings and connecting to sewers at property line.

.2 Provide cleanouts as specified and as required by **Plumbing Code** for all underground drains.

3.4 COMPLETION

.1 After work of all trades is completed, all drain lines shall be flushed and cleaned out to remove any material left from construction.

3.5 RECORD DRAWINGS

.1 Provide record drawings as specified in **Sub-Section 15010.1.8** of these specifications.

END OF SECTION

ARTICLE NAME PAGE

1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to all applicable provisions of the **Mechanical General Requirements, Section 15050.**

1.2 SCOPE OF WORK

.1 Supply all labour, equipment and materials required for the complete installation and testing of a plumbing and drainage system in new buildings, as shown on the drawings, and/or herein specified.

The work shall be left complete and in satisfactory operating condition. In general, the major divisions of the work are:

.1 Complete domestic cold and hot water piping systems with water connections to all fixtures requiring such connections, and to pressure booster systems, where shown.

.2 Complete unburied drainage system, including both sanitary and storm drainage, with stacks terminating with cast iron base footings. Connect to underground drain pipes.

.3 Lawn hose hydrant systems.

.4 Pipe covering as outlined in the **Pipe Covering Section, 15250** of these specifications.

.5 Equipment and piping vibration isolation, as outlined in the **Sound Control Section 15240** of these specifications.

.6 The following work shall be as described under separate **Underground Drains and Water Mains Section 15410:**

.1 Underground storm and sanitary tile and concrete drains.

.2 Concrete catchbasins and manholes.

.3 Concrete sump pits, sand pits, and oil interceptors.

.4 Concrete trench drain and covers.

.5 Underground Water mains and fire hydrants.

1.3 MANUFACTURERS' REPRESENTATION

.1 All manufacturers of the following equipment shall maintain local sales and service representation, which shall be immediately available at all reasonable times, for servicing of equipment.

.1 Pressure reducing valves;

.2 Booster systems;

.3 Sump pumps;

.4 Any other piece of equipment which requires servicing.

2 PRODUCTS

2.1 FLOOR AND ROOF DRAINS

1. Floor and roof drains shall be of **SMITH** or approval equal manufacturer, and of the following types as shown.

2. Floor drains in boiler room, storage rooms, equipment room, and areaways, shall be **SMITH** #2320, all duco coated drains with double drainage flange and weepholes and 160mm loose set anti-tilting grate.

3. Floor drains in laundry room and other finished areas shall be **SMITH** 2010A cast iron floor drains with 130mm nickel bronze strainer, double drainage flange, weepholes, bottom outlet and adjustable brass non-clog strainer.

4. Floor drains in transformer room shall be **SMITH** 2110D complete with #7012 backwater valve in line from floor drain, immediately external to transformer room. Provide access pit and cover for backwater valve. For exterior transformer room, provide SMITH 2110D with low profile dome.

5. All floor drains discharging into sanitary sewer shall have their trap connected to P.P.P. #PO-500 automatic trap seal primer or equal trap flush.

6. All floor and area drains shall be 75mm with 125mm diameter strainers, unless otherwise noted.

7. Roof drains shall be equal to **SMITH** 1310ECR all duco coated roof drains with large sump and flashing flange, integral anchoring flange, removable combined high dome and double reverse wedge non-puncturing flashing clamp device with integral gravel stop. Roof drains located in patio and traffic areas shall be as above, but with nickel bronze promenade top **SMITH**, 200mm x 200mm.

8. Drains for inverted roofs shall be as above, but with **SMITH** 1017EPRCAD.

2.1 FLOOR AND ROOF DRAINS - cont'd:-

9. Flow control roof drains shall be equal **SMITH** 1083ERC. Inverted roofs shall be **SMITH** 1017-85-EPRC.

10. Parking area drains on garage roof slabs shall be **SMITH SQ-1717-B-PE, ZURN ZU-610-Z-H-Y** or approved equal, heavy duty drain complete with hinged DURA coated cast iron grate and body, sediment bucket perforated DURA coat cast iron extension as required for 2 level drainage.

11. Parking area drains on interior structural slabs shall conform to **CSA-S413M** and shall be **SMITH SQ-2-2347, ZURN Model ZAL-625-HY, WATTS model FD-490-F-80** or approved equal, heavy duty parking structure drain with epoxy coated aluminum body, membrane clamping flange, anti-ponding slots, sediment bucket, heavy duty anti-tilt hinged slotted grate, stainless steel hinge pins.

12. All drains in waterproofed areas shall have flashing clamps.

13. Hub drains shall be provided with welded steel funnel caulked into hub and sized to accommodate all trades.

14. Backwater valve shall be **SMITH 7012.**

15. Sodded area drains, where shown on the drawings, shall be according to the detail drawings, **SMITH 2675** with bronze screen. For double drainage and extensions, provide **SMITH 2675 EP.**

16. Other drains shall be as noted on drawings.

2.2 TRAPS AND STRAINERS

.1 Every plumbing fixture and floor drain shall have an approved trap and every fixture, except water closets, shall have an approved strainer. All traps above ground shall have screw cleanouts or union connections on C.P. exposed traps. All exposed traps, piping supplies, etc., in washrooms and other finished areas, shall be heavily chrome-plated.

2.3 RECIRCULATION PUMPS

.1 Supply and install all bronze type **ARMSTRONG,** or equal, recirculating pumps on recirculation lines, as shown on the drawings.

.2 Impeller diameters are to be no greater than 85% of full diameter.

.3 All pump and motor bearings to be sleeve type of low noise level ball type.

.4 All pumps and motors shall be special quiet operating.

2.4 PRESSURE REDUCING VALVES

.1 Supply and install, where shown, water pressure reducing valves, equal to **WATTS #PV20-07** diaphragm actuated, pilot control globe type valves suitable for flow rates and pressure ranges required. The pilot system shall incorporate strainer and check valves to prevent reverse flow when the pressure on the valve discharge exceeds the inlet pressure. Valve shall include low flow by-pass and pilot system shut-offs.

.2 Reducing valves shall have iron body with bronze and resilient main valve trim and stainless steel and resilient pilot valve trim.

.3 Reducing valves for pressure drops over 50 psi (345 kPa) shall have stainless steel seat rings.

2.5 BACKFLOW PREVENTER

.1 Supply and install, on each main water supply line to lawn sprinkler, a backflow preventer, equal to **WATTS Series 500,** of size as shown on the drawings.

.2 Assembly shall be comprised of two (2) independent check valves with intermediate relief valve, gate valves, ball type test cocks, inlet and outlet unions and strainers. Unit shall comply with all applicable standards and be approved for the application.

2.6 SUMP AND SEWAGE PUMPS

.1 Supply and install as shown on the drawings, sump and/or sewage pumps, equal to **LEADER PUMP,** having capacities as shown. Pumps shall be vertical, heavy duty type with motor and thrust bearing located above sump cover plate and impeller located not more than 6" (152mm) above bottom of sump pit with shaft length to suit. Submersible pump(s) shall be equal to **BARNES.**

.2 Provide suitable galvanized steel angle frame with trim bar and bolted galvanized steel coverplate with handhole. Sewage pump coverplate and handhole shall be gasketted.

.3 Pumps shall be complete with high water level alarm bell, transformer, **CSA** approved automatic alternators, duplex unit, float switch, and starters.

.4 Minimum solids capacity shall be as follows:-

Sump pumps	-	3/4" (19mm)
Sewage pumps	-	2-1/2" (63mm)
Bilge pumps	-	1" (25mm)

2.7 BOOSTER SYSTEM

.1 Supply and install as shown on the drawings, and as follows, a **ARMSTRONG, ITT**, or approved equal, two-pump package booster system, designed for the capacity and head specified. The package shall be completely factory-assembled and shipped to the installer as an integral unit, including the variable speed controller, if called for on the drawings, ready to receive suction and discharge piping and incoming power supply.

.2 The pumps shall be bronze fitted centrifugal type, equipped with stainless steel, mechanical seal. Driving motors shall be of the removable coupling squirrel cage induction type with drip proof enclosure.

.3 Pumps shall be suitable for 1725 kPa working pressure.

.4 The pumps shall be complete with all necessary gate valve, non-slam check valves, **CLAYTON P.R.V.**, and inter-connecting pipework, neatly arranged and supported by the framework of the unit. All leak-off circuit, comprising regulating valves, thermostat, and solenoid valve, shall be provided to protect the pumps, during prolonged periods of low demand.

.5 The control panel shall incorporate the following control features and instrumenatation:-

- **NEMA 1,** general purpose enclosure
- **C.S.A.** approval
- Main disconnect switch
- Fused circuit for each motor
- Magnetic starters with three overloads
- Liquid crystal touch screen display
- **"HAND-OFF-AUTO"** switch
- Control circuit transformer
- Current sensing relay
- Low limit pressure switch
- Low pressure alarm
- Time delay for lag pump

.6 If called for on the drawings, supply packaged booster with variable frequency drive with digital microprocessor control of latest **IGBT** technology, with all safety and overload protections, factory pre-wired and tested.

.7 All components shall be assembled on a fabricated steel baseplate with structural steel framework, adequately ribbed and braced to ensure rigidity. Rubber mountings shall be provided to isolate the piping from the framework. The overall width of the package shall be 736mm or less, to permit passage through the standard door frames.

.8 The complete unit shall be tested hydraulically and electrically at the manufacturer's plat, prior to shipment. All control devices shall be pre-set to suit actual job conditions.

.9 See pump schedule for pump data and pumping conditions on the drawings.

.10 Impeller shall not exceed 85% of the maximum impeller size for the pump casing being supplied.

.11 The specified capacities shall be monitored at the discharge connection of the packaged unit.

2.8 PLUMBING FIXTURES

.1 All fixtures shall be **CSA** listed and shall be new and free from flaws or blemishes. All finished surfaces shall be clear, smooth and bright and guaranteed not to craze, discolour, or scale. All visible parts of the trimmings of all fixtures, including faucets, escutcheons, wastes, strainers, traps, supplies, stops, etc., shall be heavily chrome plated.

.2 Fixtures shall be complete with all accessories, supplies, frames, wall hangers, etc. Fixtures shall be securely installed to structure and lavatories shall be supplied with expansion shields or bolted through. Provide all fixtures with required type and size trap, and wheel handle stops in suites and screwdriver stops in Public Areas, unless otherwise called for, on supplies.

.3 Fixtures shall be **AMERICAN STANDARD, ELJER** as called for in this Section. Other fixtures and trim may be quoted, if approved by the Owner, but in each case a list must be submitted with the tender indicating any price difference.

.4 Shower valves shall be pressure balancing type with check stops and maximum temperature limit stop.

.5 Fixtures and trim for Barrier-Free washroom shall be certified by **CSA** for such usage. Water closets shall be 405mm (16") high.

.6 All lavatory basins to have overflow drain holes.

.7 Check latest Architectural drawings for exact type, location and quantity of fixtures.

.8 Final fixtures and trim types shall be as called for and approved by the Owner.

.9 Refer to Appendix 'A', following the end of this Section, for fixtures and trim.

3 EXECUTION

3.1 COLD WATER DISTRIBUTION

.1 Bring in water service from street line to building of size and in location shown on the drawings. This main shall be cast iron underground, up to the main shut-off valve inside the building. Install main shut-off valve inside the building with drip where shown and pay all charges and do all work required for a complete water assembly including meter, check valves, and three valve by-pass, all as shown on the drawings.

.2 Connection from street line to municipal services will be arranged and paid for by the Owner.

.3 Provide and install a complete system of cold water distribution and connect to each piece of equipment, fixture, and outlet requiring cold water.

.4 Provide water piping to within 5' (1.5m) of boiler water feed connections. Final connections will be by the **Boilers and Water Heaters, Section 15550.**

.5 Provide, for use during construction, 3/4" (20mm) temporary water services, including connections, from street line to municipal services. Each temporary service shall be extended 100' (30m) within property line at locations to Owner's instructions. Also, provide hose connections at each apartment building floor in phase with construction, including all necessary piping and pumping to supply water at a flow rate of not less than 10 U.S. gpm (0.6 litres)/sec. at 30 psi (210 kPa) pressure at any floor.

3.2 HOT WATER DISTRIBUTION

.1 Supply and install all piping associated with domestic hot water heating and storage equipment as shown. Pipe all relief valves and drains to hub drain or catchbasin.

.2 Provide and install complete systems of hot water distribution and connect to each piece of equipment, fixture and outlet requiring hot water.

.3 Hot water heaters and storage tanks are as specified under the **Boilers and Water Heaters, Section 15550.**

3.3 NOISE CONTROL

.1 All equipment and materials shall be supplied and installed to eliminate all objectionable noise and vibration. This shall apply to both the details of manufacture of the various equipment and to methods and details of installation.

.2 All piping shall be isolated from building structure, walls, furring, other piping, etc., to avoid noise transmission.

.3 Provide vibration isolators as called for in the **Sound Control Section 15240** of these specifications.

3.4 RECIRCULATION

.1 Connect the ends of all hot water risers to recirculating mains and continue this main back to the recirculating pumps, making connections, including valves, around the pumps. No circulating main shall be less than 3/4" 920mm) size. Provide bronze type circuit setter balancing valves equal to **ARMSTRONG CBV-MS** on all branch lines and risers.

3.5 DRAIN CONNECTIONS

.1 Connect all stacks, leaders, floor drains and equipment drains.

.2 Co-ordinate connections with Underground Drainage Contractor. Connections from street line to municipal sewers will be arranged and paid for by the Owner.

.3 Verify all inverts of street sewer connections prior to installation of building drains. Bring to the attention of the Engineer of any major discrepancies.

3.6 BACK VENTS

.1 Provide every fixture with its own trap and vent these traps in accordance with the Provincial Plumbing Code, or any local by-laws having jurisdiction.

3.7 AIR CHAMBERS

.1 Hot and cold water supplies to each individual or group of plumbing fixtures, shall be fitted with air chambers of ample size to prevent water hammer. Air chambers shall be branch size or 3/4" (20mm) minimum diameter, and not less than 36" (915mm) in length. Approved type shock absorbers will also be acceptable.

3.8 PRESSURE REDUCING VALVES

.1 Water pressure reducing valve assemblies shall be installed, complete with isolating valves at inlet and outlet, pressure gauges at inlet and outlet, and inlet strainer.

3.9 WEEPING TILE CONNECTIONS

.1 Weeping tile shall be as called for in **Section 15410** of this specification. Connect weeping tile to drains or sump pits as required.

3.10 SUMP AND SEWAGE PUMPS

.1 The Electrical Division will mount starter and wire from starter to float switch and motor and alarm bell in Superintendent's suite, office, or as instructed on the site.

.2 Install non-slam check valve and gate valve in pump discharge.

3.11 WASHING MACHINES

.1 Washing machines will be supplied by the Owner for connection under this Division.

.2 Supply and install hub drain and 1/2" (13mm) hot and cold water pipes for each washing machine.

3.12 BACKFLOW PREVENTER

.1 Supply and install **WATTS** approved type bronze construction backflow preventers where domestic water connections occur to all heating, cooling and process systems. Pipe each open relief to nearest drain.

3.13 ANTI-SUDSING CONNECTIONS

.1 Provide separate auxiliary soil and waste stacks for all stack offsets and at bottom of stacks to prevent detergent suds back-up.

3.14 PIPE COVERING

.1 Cover piping as specified in the **Pipe Covering Section 15250** of these specifications.

3.15 KITCHEN AND SERVERY

.1 Kitchen equipment including dishwashers will be installed by Kitchen Equipment Contractor, this Trade is responsible for plumbing and drainage connections, including final hook-up of all equipment.

.2 Refer to floor plan, and kitchen consultant's design drawings for requirements of plumbing and drainage.

3.16 COMPLETION

.1 After work of all trades is completed, all water and drain lines shall be flushed and cleaned out to remove any material left from construction.

END OF SECTION

FIXTURE	TYPE125	MAKE OR EQUAL
Toilet	Floor mounted elongated china, barrier free, low flow, c/w **CENTCO #AM82-STS** white seat less cover, flush valve **SLOAN "Royal'** Model **#111-1.28-YG**, 4.8 litre per flush	**AMERICAN STANDARD 'Madera'** Model **3462.128**
Toilet	Floor mounted elongated china, low flow, c/w **CENTCO #AM500-STS** white seat less cover, flush valve **SLOAN 'Royal'** Model **#111-1.28-YG**, 4.8 litre per flush	**AMERICAN STANDARD 'Madera'** Model **3452.128**
Basin	Semi-counter mounted china, barrier free, 4" centres, overflow, c/w offset chrome p-trap, electronic faucet **SLOAN 'Optima'** Model **#ETF-600-LT-VPB**, 1.9 lpm, c/w transformer **EL154**	**AMERICAN STANDARD 'Mezzo' #9960.403**
Basin	Wall mounted china, barrier free, 4" centres, overflow, c/w offset chrome p-trap, electronic faucet **SLOAN 'Optima'** Model **#ETF-600-LT-VPB**, 1.9 lpm, c/w transformer **EL154**, carrier **J.R. SMITH** Model **0800**	**AMERICAN STANDARD 'Declyn' #0321.075**
Urinal	Wall mounted china low flow c/w carrier **J.R. SMITH** Series **0637** electronic flush valve to be **SLOAN 'Royal' #186-0-125-ES-S**, 0.47 litre flush, c/w transformer **EL154**	**AMERICAN STANDARD 'Washbrook' #6550.125**

NOTE:-

1. ALL FIXTURES TO BE WHITE.
2. ALL FIXTURES TO BE CSA APPROVED.
3. BARRIER FREE BASIN TO BE COMPLETE WITH OFFSET P-TRAPS, 'ARMAFLEX' INSULATION AND PVC COVERS.
4. ALL SINKS AND BASINS TO BE COMPLETE WITH STOPS, P-TRAP, AND C.O., S.S. BRAIDED FLEXIBLE CONNECTORS, ESCUTCHEON, ALL EXPOSED FITTINGS TO BE CHROME PLATED.
5. ALL BASINS TO BE COMPLETE WITH OVERFLOW HOLE.

FAUCETS	TYPE	MAKE OR EQUAL
Sink	Single bowl S.S. sink 20" x 20" x 8" deep, c/w strainer, back ledge, p-trap, **#8912C** faucet to be goose-neck with 4" blades, **CHICAGO #100V-GN2A-317-XK**	**KINDRED #QSL2020-8-3**
Eyewash	Deck mounted for the above sink, single action swing down all polished chrome unit with twin ABS plastic eyewash heads	**HAWS #7610**
Bar Sink	Single bowl S.S. bar sink 15" x 15" x 6" deep, c/w strainer, back ledge, p-trap **#8912C**, faucet to be goose-neck with **CHICAGO #895-V-XK**	**KINDRED #QSL1515-6-2**
Mop Sink	24" x 24" x 10" (610mm x 610mm x 254mm) deep, floor mounted, precast terrazzo and integral drain with strainer. Trim fitting T-10-VB faucet, c.p. 8" (203mm) C.C. wall mounted, solid cast brass body with cast metal handles, vacuum breaker, integral stops, #T-35 hose, S.S. bracket, vacuum breaker, 'P' trap 3" (75mm) aluminum bumper guards.	**STERN WILLIAMS #MTB-2424**
Shower	Pressure balancing shower valve assembly with maximum temperature stop, single metal level, shower head, arm, flange	**AMERICAN STANDARD #GD-1495-5120**

ARTICLE NAME PAGE

1. GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to all applicable provisions of the Mechanical General Requirements, Section 15010.

1.2 SCOPE OF WORK

.1 Supply all labour, equipment and materials required for the complete installation and testing of a new heating and air conditicning system, as shown on the drawings, and/or herein specified. The work shall be left complete and in satisfactory operating, all to the approval of the Engineer. In general, the major divisions of the work are:-

.1 Heating water systems (for new and existing buildings).

.2 Boiler-burners supplied and installed as outlined in the **Boiler and Water Heater** Section of these specifications.

.3 Radiant floor heating system.

.4 Variable air volume boxes.

.5 Heat exchangers.

.6 Pipe covering, as outlined under the **Pipe Covering** section of these specifications.

.7 Expansion tanks, pumps, etc.

.8 Unit heaters and force flow units.

.9 Piping of relief valves and pump glands to hub drains.

.10 Equipment and piping vibration isolation as outlined under the **Sound Control** section of these specifications.

.11 Water treatment.

.12 Controls, as outlined under the **Thermostatic Control** Section of these specifications.

1.3 WARRANTY

.1 Warranty for chiller, installed at this project, shall be provided by the manufacturer to cover the equipment for one (1) year and the compressors for five (5) years, labour and parts inclusive.

.2 All other equipment, installed at this project, shall be provided by the manufacturer to cover the equipment for one (1) year, labour and parts, inclusive.

1.4 MANUFACTURERS' REPRESENTATION

All manufacturers of the following equipment shall maintain local sales and service representation, which shall be available at all reasonable times, for servicing of equipment.

.1 Pumps

.2 Controls

.3 Water treatment

.4 Unit heaters and force flow heaters

.5 Heating and ventilating units

.6 Filters

.7 Vibration isolators

.8 Radiant Floor Heating System

.9 Radiation

.10 Heat exchangers

.11 Indoor fluid cooler

.12 Heat pump units

.13 Any other items of equipment requiring servicing

2 PRODUCTS

2.1 EXPANSION TANKS

.1 Air cushion tanks shall be located where shown and shall be piped to vent air from boiler. The tanks shall be of welded steel construction, designed for working pressures as shown. The tanks shall be complete with valved air, drain and vent connections and gauge glasses. Tank to be complete with one (1) coat of primer paint.

2.2 CIRCULATING PUMPS

.1 Supply and install circulating pumps of **ARMSTRONG** or **BELL & GOSSETT**, with resiliently mounted motors, mechanical seals, sleeve bearings, spring couplings, bronze impellers, and hardened alloy steel shafts.

.2 Base-mounted pumps to be equal to **ARMSTRONG** Series 4030 models with resiliently mounted motors, mechanical seals, sleeve bearings, spring couplings, bronze impellers, and hardened alloy steel shafts.

.3 Small pipe mounted pumps to be equal to **ARMSTRONG** Series H with resiliently mounted motors, mechanical seals, sleeve bearings, spring couplings, bronze impellers and hardened alloy steel shafts.

.4 Larger vertical in-line pumps shall be **ARMSTRONG** Series 4300 nd 4380 radially split casing, close-coupled, single stage centrifugal type with bronze fitted construction. The motor shall be of the vertical, solid shaft, drip-proof squirrel cage induction type.

.5 Pumps over 7-1/2hp to have split spacer type rigid coupling, with flush lines, equal to **ARMSTRONG** Series 4380.

.6 All pumps and motors shall be specially quiet operating.

.7 Impeller diameters are to be no greater than 85% of full diameter that casing can normally accommodate.

.8 Pumps for domestic water service shall be of all bronze or stainless steel construction,

.9 All pumps shall be rated for the requirements of the service.

2.3 RADIANT FLOOR HEATING SYSTEMS

.1 Provide as shown on the drawings a complete radiant floor heating system in compliance with all applicable Standards and Codes, including **CSA** and **ASTM**.

.2 Entire system shall be engineered and designed by system manufacturer. Provide shop drawings for review and coordination with other Trades.

.3 System control to be compatible for a DDC based Energy Control Management System, as described in **Section 15950**.

.4 Heating control and manifold shall be installed inside a factory supplied steel box with access door, as located on the Floor Plan.

.5 System shall be equal to **WATTS, REHAU, WIRSBO,** or approved alternate, and include as a minimum the following materials:-

- ½" Pex piping
- PVC protective sleeve bend guides
- Tube tie
- Nail clip
- Dual floor/air thermostat
- Mixing control
- High limit cut out
- Circuit power head
- Transformer, 24V, 40VA
- Three-way valve
- Provide additional controls, valves, and pumps as may be required for a functioning system
- Supply and return manifolds with valves, balancing valves and flow rate indicators
- Steel cabinet with access door housing a pre-assembled manifold, controls, and circulator pump. All pre-wired and tested
- Factory couplings and fittings
- Provide air pressure test and witness installation of concrete to guarantee no leaks
- Provide inspection report, as-built drawings and warranty
- Low voltage thermostat and wiring by control contract of **Division 15** as part of Building Automation System.

2.4 ELECTRICAL WORK

1. Supply motor starters, and controls, as specified herein, or as required for all equipment of this Division.

2. All wiring, not factory-installed, will be provided and installed by the Electrical Division, including interlocking of motors, disconnects where required, control wiring, etc.

3. Provide, to the Electrical Division, all wiring diagrams and equipment specifications required. The responsibility for the proper operation of the equipment, control, etc., shall remain with this Division, and this Contractor shall satisfy himself, before start-up, that all wiring is to the approval of the H.E.P.C., the local utility, the manufacturer of the equipment, and the Architect.

4. Eight (8) copies of shop drawings of the wiring and interlocking sequence shall be submitted by this Division for approval prior to erection.

2.5 PIPING

1. Supply and install piping system for hot water heating, for refrigeration, and for condensat water, as shown.

2. Supply and install valves at each air conditioning unit coil, at each reheat box, at all equipment and pumps.

3. Provide vents and drain valves where required. See also System Venting Sub-Section of this Division of the Specifications.

4. Install control valves as specified in the Thermostatic Control Section of this Specification, and make provisions in the pipework for the installation of all thermostatic bulbs, temperature control devices, etc., as called for therein.

5. Supply and install cold water feed and make-up water piping to cooling tower and for tower water treatment from main as shown on drawings.

6. Supply and install bleed piping and drain piping to hub drain as shown for cooling tower.

7. Pipe condensate drain piping to hub drain for each air conditioning unit. Co-ordinate with Plumbing Contractor to provide hub drains at suitable locations, for condensate piping termination.

2.6 BACKFLOW PREVENTERS AND PRESSURE REDUCING VALVE

.1 The backflow preventer on the cold water fill lines to the various closed loop hydronic systems, shall be of the type and characteristics as required and as approved by the local authorities.

.2 Pressure reducing valves on cold water fill line to closed-loop hydronic piping systems shall be **WATTS** or equal, complete with strainer, factory-set at pressures shown on the drawings, and shall be suitable for pressure adjustment within a range of 20 psi (138 kPa) above or below the set pressure. Provide three-valved line size bypasses around the reducing valves only.

2.7 STRAINERS

.1 Strainers shall be 'Y' type, equal to **ATLAS ENGINEERING** or **DARLING**, having 1/8" (3mm) perforated metal screens, and pressure ratings as for valves.

2.8 THERMOMETERS AND GAUGES

.1 Thermometers shall be 6" (150mm) long scale, equal to **WEKSLER**.

.2 Pressure gauges shall be 4" (100mm) diameter dial, equal to **WEKSLER**, each shall be complete with ball valve type gauge cock.

2.9 CHEMICAL POT FEEDER AND PIPING SYSTEM CLEANING

.1 Each closed hot water heating and chilled water system shall have a bypass feeder and a micron filter equal to 5% of the circulation rate of the recirculating pump and one (1) flow meter. Supply one (1) set of spare filter tubes. chemical treatment system shall include two (2) plugged tees on both sides of filter for coupons and ½" (12mm) sample valve on filter inlet line, with reamed nipple orifice.

.2 Provide test equipment, complete with wall mounting cabinet plus water treatment chemicals for the initial start-up and one (1) month's supply after turnover of the system. Technical service calls and written test reports for the first year.

.3 All closed recirculating systems shall be chemically cleaned under the supervision of **SPECIALTY CHEMICALS LIMITED** and approved by them. Written reports shall be submitted to the Architect on system's acceptance.

2.10 UNIT HEATERS AND FORCE FLOW HEATERS

.1 Units shall be equal to **TRANE, ENGINEERED AIR**, etc., and shall be of size, type and have characteristics and capacities indicated on schedules on drawings.

.2 Unit heater shall have fan guard, 1/4" (6mm) maximum opening size.

.3 Units shall be provided with thermostats equal to **HONEYWELL #T-473**, with locking setting and guards, where called for and where required, and with starter equal to **C.G.E. #CR-1061** key operated, and with speed switch where called for on drawings.

2.11 SYSTEM PIPING VENTS

.1 Air eliminators on hydronic piping system and equipment shall be equal to **MAID-O-MIST #7, #24,** OR **#74**.

2.12 WATER TREATMENT FOR HEATING SYSTEM

.1 Supply and install a complete heating system water treatment system, as sold and supervised by **DREW CHEMICALS**, to include pot feeder, chemical and micro by-pass filter.

.2 Complete system shall be installed as shown on the drawings and in accordance with supplier's drawings and instructions.

.3 Provide test equipment complete with wall mounting cabinet and water treatment chemicals for initial start-up plus one (1) month's supply after turnover of the system.

.4 Provide complete written instructions for the use of all water treatment equipment and testing apparatus. In addition, the treatment chemical's supplier shall provide personal instructions to the permanent operator of the system in all phases of testing applying chemicals, etc. The supplier shall make periodic visits during the first year of operation to ensure that water treatment is being applied properly and that results are satisfactory.

.5 Supplier's representatives shall monitor the water treatment during first year of operation to ensure that the proper level of chemical concentration is maintained at all times.

2.13 GLYCOL ANTI-FREEZE PROTECTION

.1 When closed loop water piping system is installed outdoor or in unheated location which is subject to freezing and as called for on the drawings, provide enough concentration of anti-freeze solution in the piping system to prevent freezing in winter condition.

.2 Anti-freeze solution shall be ethylene glycol as supplied by Drew Chemical.

.3 Provide sufficient concentration of inhibitor in the system to prevent corrosion.

2.14 AIR SEPARATOR

.1 Air separator on hydronic piping system be centrifugal type with fabricated steel body constructed to meet ASME Code for 125 psig working pressure.

.2 Unit shall have flanged/NPT inlet and outlet connections tangential to the vessel shell. Inlet and outlet connections shall be the same size as the system piping.

.3 Unit shall have a NPT vent outlet at the top to be piped to an air tank.

.4 Unit shall have a blown down connection piped to the nearest drain complete with valve.

.5 Vessel shell shall be a minimum of three times the nominal inlet and outlet pipe diameter.

.6 Unit shall be **ARMSTONG** Model VA of **BELL & GOSSETT** Model Rolairtrol, or an approved equal.

2.15 HEAT EXCHANGERS

.1 Plate heat exchangers shall be equal to **ALFA-LAVAL, BELL & GOSSETT,** or **S.A. ARMSTRONG,** of size and performance called for in schedules on drawings.

.1 Heat exchanger of plate and frame type shall be constructed and stamped to certify compliance to latest A.S.M.E. Code for pressure vessels and ARI-400 for performance, and shall be selected to suit duty, medium, temperature and system operating working pressure.

.2 Heat exchangers shall include 304 stainless steel plates, EPDM gaskets, bolts and flanges, and steel-frame sized for minimum 20% excess plates than specified requirements, and be able to disassemble for individual plate cleaning.

.3 Heat exchanger for domestic water heating shall be gasket double wall stainless steel plate type, **CSA** approved for domestic water use. Material to be **AISI 316** stainless steel with EPDM gasket. Minimum working pressure is 150 psig. All piping connections shall be flanged type with dielectric fittings, complete with threaded hose end drain and valve at bottom connections.

.2 Shell and tube heat exchangers shall be equal to **BELL & GOSSETT** or **S.A. ARMSTRONG** of size and performance as called for on drawings.

.1 Heat exchangers shall be steel construction and copper u-bend removable coils, constructed to latest A.S.M.E. code and stamped and selected to suit duty, medium, temperatures and systems operating working pressures.

.2 Provide steel support and mount heater 4 feet (1200mm) above floor.

.3 Heat exchanger for domestic water heating shall have brass head, brass tube sheet and double wall copper tubes.

.3 Brazed plate heat exchanger shall be equal to **BELL & GOSSETT** or **S.A. ARMSTRONG**, of size and performance called for in Schedule on drawings.

.1 Heat exchanger of plate and frame type shall be constructed and stamped to certify compliance to latest A.S.M.E. Code for pressure vessels and ARI-400 for performance, and shall be selected to suit duty, medium, temperature and system operating working pressure.

.2 Heat exchanger shall include 316 stainless steel plates of all brazed construction for working pressure of minimum 150 psig.

2.16 HEATING RADIATION

.1 Heating units throughout shall be of the types shown or indicated on the drawings or in the specifications.

.2 All units shall have enclosures or cabinets of type noted on the drawings and shall be 'Finish Painted' in the field using electrostatically applied, two-component epoxy paint, in a colour approved by the Architect. Units shall be complete with hangers, brackets, end pieces and extra enclosures as required or as indicated on the drawings. Installation to be neatly finished and customized to suit building conditions.

.3 Heating elements provided shall have active fin lengths equal to element lengths shown on drawings and shall be positioned to cover full width of glazing and to give equal output if partitions are located at window mullions. Elements' hanger shall be adjustable for height and of the rolling free expansion type.

.4 .1 Units shall be of gauges as called for on drawings, and be suitably braced and reinforced to provide stiffness and prevent flexing of enclosure, and cabinet front or enclosure shall be securely fastened by easily removable fasteners.

.2 Custom enclosures shall be fabricated from (minimum) 18 gauge cold rolled steel and suitably braced and reinforced to ensure squareness and prevent flexing. One piece louvred top and front shall be easily removable, but securely fastened to and supported by adjustable height centre mullion and end support pieces. Cabinet and exposed accessories shall be supplied in baked enamel primer. Base plate shall be of minimum 14 gauge steel, as above.

.3 Where required, suitably sized separate hinged access doors with cam-locks and/or suitably reinforced and easily removable access panels shall be installed.

.5 Heating units shall be guaranteed to provide test capacities based on the average water temperatures shown on the drawings.

.6 Where required, heating units shall be equipped with air vents as called for in System Venting Sub-section.

.7 Each heating loop between risers shall be equipped with a control valve and lockshield pattern shut-off radiator valves with union ends.

.8 Heating radiation shall be **ROSEMEX, SIGMA, TRANE**, or approved manufacturer.

1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Conform to all applicable provisions of the **General Mechanical Requirements**, Section 15010 and the **Basic Materials and Methods**, Section 15050.

1.2 SCOPE OF WORK

.1 Provide all products, materials, equipment services and labour to supply and install all thermal insulation, vapour barriers, sealants and finishes specified herein this specification, as indicated on drawings and as required for a complete finished work.

.2 All insulation and accessory materials used shall comply to code requirements for fire spread rating and smoke developed classification.

.3 All insulation and accessory material shall be **Fiberglas Canada Inc.** or an approved equal.

.4 Materials shall be delivered to site, and handled, in good order, in original packaging, labelled for thickness and density.

.5 Provide insulation for the following ductwork:-

.1 Supply air ducts for all air conditioning units.

.2 Outdoor air intake ducts to fresh air units and fans.

.3 First 1.8m of all side wall exhaust ducts.

.4 Air plenums.

.5 Air conditioning and heating ducts in unheated space.

.6 Provide insulation for the following piping:-

.1 Chiller water piping.

.2 Heating water piping.

.3 Dual temperature fan coil system distribution piping.

.4 Exposed condensing water piping for cooling tower of a four-pipe fan coil system.

.5 Heat pump piping when installed in unheated space.

.6 Refrigeration piping.

.7 Domestic hot and cold water piping.

.8 Condensate drain piping.

.9 All electrically traced piping:-

- Sanitary drain
- Sanitary traps
- Fire line
- Wet sprinkler line
- Sewage and sump pump discharge line
- Drum drip

2 PRODUCT

2.1 DUCT INSULATION

.1 Insulate exposed air conditioning and heating duct on roof with 2" (50mm) A.P.C. boards, covered with one layer of glass-fab, and two (2) coats of **#C-29 FLINTKOTE**.

.2 Insulate the following ductwork with 1" (25mm) **FIBERGLAS**, AF530 3lb/cuft. (48Kg/cubicmeter) density, rigid duct insulation, with non-combustible vapour barrier:-

- All air conditioning supply air ducts in Public Areas
- Fresh air supply ducts within Mechanical Room
- Mixed air plenum and duct
- Exhaust duct within 6 feet (1.8m) of louvre.

.3 Insulate the following ductwork with 1-1/2" (40mm) **FIBERGLAS**, AF530 3lb/cuft (48Kg/cubicmeter) density, rigid duct insulation, with non-combustible vapour barrier:-

- Outdoor intake air duct from louvre to fresh air heating unit
- Stair pressurization intake duct (horizontal) inside heated ceiling plenum, as indicated on drawings
- Air conditioning and heating duct in unheated space.

.4 Flexible insulation shall be applied to round duct only and shall be equal to **FIBERGLAS** type 75, 0.75lb/cuft density, with non-combustible vapour barrier.

.5 All seams and joints shall be taped with foil type duct tape for a neat and professional finish.