

PART 1 MECHANICAL GENERAL PROVISIONS

1.1 GENERAL REQUIREMENTS

- .1 Comply with the requirements set out for the Contractor.

1.2 SECTION INCLUDES

- .1 This Section applies to and is part of all Divisions and Sections as follows:
 - .1 Division 21 - Fire Suppression All Sections
 - .2 Division 22 - Plumbing All Sections
 - .3 Division 23 - Heating, Ventilating and Air Conditioning (HVAC) All Sections
 - .4 Division 25 - Integrated Automation. All Sections
 - .5 Mechanical Equipment Schedules All Schedules
 - .6 Mechanical Drawings All Drawings

1.3 RELATED SECTIONS

- .1 Section 013300 Submittal Procedures
- .2 Section 017810 - Closeout Submittals

1.4 DEFINITIONS

- .1 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Mechanical Specifications" is used, it refers to Specification Divisions and Sections as follows:
 - .1 Division 21 - Fire Suppression All Sections
 - .2 Division 22 - Plumbing All Sections
 - .3 Division 23 - Heating, Ventilating and Air Conditioning (HVAC) All Sections
 - .4 Division 25 - Integrated Automation. All Sections
 - .5 Mechanical Equipment Schedules All Schedules
- .2 Wherever the phrase "approved equal" is used in the Mechanical Specifications it shall have the meaning "approved equal in accordance with B6".
- .3 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Contractor" is used in the Mechanical Specifications, it means the firm having a contract with "The City of Winnipeg" ("The City") to perform, supervise and coordinate all work.
- .4 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Sub-Contractor" is used in the Mechanical Specifications, it means the firm having a contract with the "Contractor" to perform, supervise and coordinate all work of that particular Division. This Sub-contractor shall be wholly responsible to the "Contractor" for all work of that Division.
- .5 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Engineer" is used in the Mechanical Specifications, it shall refer to Tower Engineering Group Inc., 208 - 897 Corydon Avenue, Winnipeg, Manitoba, R3M 0W7, Telephone: (204) 925-1150, Fax.: (204) 925-1155.
- .6 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Provide" is used in relationship to equipment, piping etc., in this Division, it means "Supply, Install and Connect".

- .7 Whenever "Drawings and Specifications" are referred to in these documents, it means "The Contract Drawings and Specifications" (including all addenda and post contract revisions) of all Disciplines (Architectural, Structural, Mechanical and Electrical).

1.5 TRADE DEFINITIONS

- .1 All work called for in the Contract Documents shall be considered to be within the scope of the Contract, and shall be the responsibility of the Contractor.
- .2 The arrangement of the Drawings and Specifications into Divisions, Sections, and Trades is purely arbitrary, with the sole intention of clarifying the scope and content of the work required to complete the project. The actual division of the work amongst the sub-contractors shall be the responsibility of the Contractor, and the actual division of the work between the sub-sub-contractors shall be the responsibility of the sub-contractors.
- .3 The Contractor, at his option and as per his contracts with the Sub-Contractors, may delegate responsibility to the Sub-contractors for the division of the work.
- .4 The Sub-contractors, at their option and as per their contracts with the sub-sub-contractors, may delegate responsibility to the sub-sub-contractors for the division of the work.
- .5 Sections of the Mechanical specifications, and specific but arbitrary responsibility divisions noted in the Mechanical Specifications, are not intended to delegate functions nor to delegate work to any specific trade, but may be useful to the Contractor or Sub-contractor when dividing the work amongst the Trades and Sub-trades.
- .6 In the event of a dispute regarding the responsibilities of the various trades and sub-trades, the Contractor and Sub-contractors may request information or a recommendation from the Contract Administrator. However, the Contractor and Sub-contractor shall be responsible for determining the final division of work.

1.6 SCOPE OF WORK

- .1 The Mechanical work shall include all labour, materials, equipment, and tools required to install, test and place into operation a complete and fully operational Mechanical System consisting of the various sub-systems as described in, but not necessarily limited to, the items in the following Specification Sections and Drawings:
- .1 Division 10 Specialties
 - .1 104420 Fire Extinguishers and Safety Blankets
 - .2 Division 21 Fire Suppression
 - .1 210501 Common Work Results - Mechanical General Provisions
 - .2 210504 Common Work Results - Mechanical Basic Materials And Methods
 - .3 210718 Thermal Insulation For Equipment
 - .4 210720 Thermal Insulation for Piping
 - .5 211313 Wet Pipe Sprinkler Systems
 - .3 Division 22 Plumbing
 - .1 224202 Plumbing Fixtures
 - .4 Division 23 Heating, Ventilating and Air Conditioning (HVAC)
 - .1 230593 Testing and Balancing
 - .2 230713 Acoustic And Thermal Insulation For Ducting
 - .3 230805 Commissioning

- .4 232105 Liquid Heat Transfer
- .5 232106 Radiant Floor Heating System (Infloor Heating System)
- .6 232513 Pipe Cleaning and Chemical Treatment
- .7 233100 Air Distribution

- .5 Division 25 Integrated Automation
 - .1 250111 EMCS: Start-up and Check-out
 - .2 250112 EMCS: Training
 - .3 250501 EMCS: General Requirements
 - .4 250502 EMCS: Shop Drawings, Product Data and Review Process
 - .5 250503 EMCS: Project Record Documents
 - .6 250554 EMCS: Identification
 - .7 250820 EMCS: Warranty and Maintenance
 - .8 251001 EMCS: Local Area Network (LAN)
 - .9 251002 EMCS: Operator Work Station (OWS)
 - .10 253001 EMCS: Building Controllers Family of Controllers
 - .11 253002 EMCS: Field Control Devices
 - .12 259001 EMCS: Site Requirements: Apps. & Systems Sequences of Operation

- .6 Mechanical Equipment Schedules
 - .1 A Mechanical Specifications Approved Substitute Schedule
 - .2 B Air Handling Unit Schedule
 - .3 C Condensing Unit Schedule
 - .4 D Fan Coil Unit Schedule
 - .5 E Fan Schedule
 - .6 F Heat Recovery Unit Schedule
 - .7 G Make Up Air Unit Schedule
 - .8 H Grille & Diffuser Schedule
 - .9 I Plumbing Fixture & Equipment Schedule
 - .10 J Boiler Schedule
 - .11 K Infloor Heating System Pump Schedule
 - .12 L Electric Heating Coil Schedule
 - .13 M Gas Fired Unit Heater Schedule
 - .14 O Alternate Plumbing Fixture & Equipment Schedule

- .7 Mechanical Drawings:
 - .1 M-1.1, Mechanical Legend And Drawing List
 - .2 M-1.2, Mechanical Roof Plan
 - .3 M-2.1, Main Floor Plan Plumbing Layout
 - .4 M-2.2, Main Floor Plan Drain, Waste And Venting Layout
 - .5 M-2.3, Mezzanine Floor Plan Plumbing Layout
 - .6 M-2.4, Mechanical Plumbing Details & Schematics
 - .7 M-2.5, Mechanical Plumbing Details & Schematics
 - .8 M-3.1, Main Floor Plan Ventilation Layout
 - .9 M-3.2, Mezzanine Floor Plan Ventilation Layout
 - .10 M-3.3, Mechanical Ventilation Details & Schematics
 - .11 M-3.4, Mechanical Ventilation Details & Schematics
 - .12 M-4.1, Main Floor Plan In-Floor Heating Layout
 - .13 M-5.1, Main & Mezzanine Floor Plan Fire Protection Layout

1.7 SEPARATE PRICES

- .1 Provide information for the following Separate Prices:

- .1 Separate Price M-1:

.1 R

- .2 For additional information regarding Separate Pricing, refer to Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements.
- .3 For additional information regarding Separate Pricing, refer to the Specifications set out for the Contractor.

1.8 CASH ALLOWANCES

- .1 For information regarding Cash Allowances, refer to Division 00 - Procurement and Contracting Requirements and Division 01 - General Requirements.
- .2 For information regarding Cash Allowances, refer to the Specifications set out for the Contractor.
- .3 Cash Allowances are to be carried by the Contractor, not by the Mechanical Subcontractor.

1.9 SITE EXAMINATION

- .1 Visit and inspect the site of the work to verify the location and elevation of existing items and services (such as piping, ductwork, lighting, conduit, ceilings, walls, columns, beams, etc.) which may affect the Bid and work of this Division, before submission of Bid and proceeding with the work.
- .2 Make allowance to relocate all existing items/services as required, or to provide alternate locations/routings of new items/services as required. Confirm alternate locations/routings with the Contract Administrator prior to submitting Bid in accordance with B6.
- .3 Claims for extra payments resulting from conditions which could have reasonably been foreseen during a pre-Bid site examination will not be considered.

1.10 MECHANICAL DRAWINGS

- .1 The Drawings for the Mechanical work are performance drawings, diagrammatic and approximately to scale, intended to convey the scope of work and indicate the general arrangement and approximate location of apparatus, fixtures and pipe/duct runs. These Drawings do not intend to show Architectural and Structural details.
- .2 Do not scale the Drawings. Obtain information involving accurate dimensions from dimensions shown on the Architectural and Structural drawings, and by site measurement.
- .3 Even though some piping and/or ductwork is not completely shown or is shown schematically, and all details are not shown or specified, it is expected that the contractors be familiar enough with their fields of work to complete the project to the standards generally adhered to by the local industry, including good workmanship and common sense. The Contract Administrator reserves the right to furnish any additional detail drawings, which, in the judgement of the Contract Administrator, may be necessary to clarify the work, and such drawings shall form a part of this contract. The work for such Clarifications shall be at no cost to The City.
- .4 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (pipes or ducts around beams, columns etc.), and to provide complete and adequate service clearance.

- .5 The exact location of the Mechanical components may be changed by the contractors to suit site conditions, provided the changes are reviewed with the Contract Administrator, the changes are duly noted on the 'Record' drawings, and the changes do not affect the operation or code-compliance of the system(s). Any such changes shall be at no cost to The City.

1.11 CHANGES TO THE SCOPE OF WORK

- .1 From time to time during construction, changes to the scope of work may be proposed by The City. These Proposed Changes are to be priced by the contractors in a timely manner. Only after The City has reviewed and accepted the pricing, will these Proposed Changes be added to the contract.
- .2 Pricing for the Mechanical portions of these Proposed Changes shall be submitted by the Sub-contractor to the Contractor complete with price breakdowns as follows:
 - .1 Sub-sub-contractors' prices c/w labor, material and overhead prices broken out.
 - .2 Sub-contractor's price c/w labor, material and overhead prices broken out.
 - .3 Pricing shall be submitted on an item-by-item basis. Each Proposed Change may contain more than one item.

1.12 PHASING

- .1 This project involves sequential demolition and construction in phases. Refer to the Architectural Drawings and Specifications for exact requirements.
- .2 During all phases of the work, certain portions of the facility must be kept fully functional. Re-route existing services and/or provide temporary service connections as required to meet this objective.
- .3 Coordinate with The City and other contractors as required for shut-down of services.
- .4 Provide start-up, testing, verification and certification of the Mechanical Systems at the Occupancy Stage of each construction phase.
- .5 Provide for pulley changes and rebalancing of systems as required to suit the partial use of systems which serve more than one phase.
- .6 The contractors shall be responsible for determining the exact requirements for Phasing.

1.13 LIABILITY

- .1 Maintain all necessary insurance coverage to save and indemnify The City.
- .2 Protect and maintain the work until the project has been completed and turned over to The City. Protect the building and contents from damage during the construction period. Repair all damages without additional cost to The City.
- .3 Special care shall be taken to insure that any existing equipment, structures, components and property are not damaged during the construction period. Repair all damages without additional cost to The City.

1.14 WORK SCHEDULE

- .1 Unless otherwise noted, the work shall be scheduled for normal hours. The contractors shall be aware that off-hour work may be necessary for certain locations or types of work, and shall include the extra costs in the Bid price.
- .2 Where the work requires the contractors to be in occupied areas , or where building services may be disrupted, the contractors shall closely coordinate the hours and areas of work with The City and the Occupants.
- .3 It shall be the responsibility of the Contractor to schedule the work to meet The City's completion date. The Contractor shall coordinate the sub-trades and adjust the workforce as required to meet the schedule.

1.15 SUPERVISION

- .1 Maintain at this job site qualified personnel and supporting staff with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.
- .2 Supervision personnel and their qualifications are subject to the approval of The Contract Administrator.

1.16 ENGINEERING SITE REVIEW

- .1 The Sub-Contractor's work will be reviewed periodically by The Contract Administrator, or their representatives, solely for the purpose of determining the general quality of the work. Guidance will be offered to the contractors in regard to interpretation of plans and specifications, to assist them in carrying out the work. Inspections, and directives given to the contractors, do not relieve the Contractor, and his agents, servants and employees, of his responsibility to provide the work in all of its parts, in a safe and workmanlike manner, and in accordance with the plans and specifications, nor impose upon The City, and/or The Contract Administrator and/or their representatives, any responsibility to supervise or oversee the erection or installation of any work.
- .2 The Contract Administrator will issue inspection reports and deficiency lists from time to time. All deficiencies shall be cleared up to the satisfaction of The Contract Administrator within a reasonably short time.

1.17 PATENTS

- .1 Pay all royalties and license fees, and defend all suits or claims, for infringement of any patent rights, and save The City and Engineer harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Contractor or anyone directly or indirectly employed by him, or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement on such letters patent or rights.

1.18 CONSTRUCTION DRAWINGS

- .1 Where requested, prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structures, and all inserts, equipment bases, sumps and pits, supports, etc.

1.19 MUNICIPAL AND UTILITY SERVICES

- .1 Coordinate, arrange, and pay for all municipal and utility relocations, terminations and connections as required and shown on the drawings, complete with all required metering.
- .2 Install all metering equipment in accordance with municipal or utility requirements.
- .3 Test all services and provide report(s) as required by the Authorities Having Jurisdiction.

1.20 CODES, PERMITS, FEES AND INSPECTIONS

- .1 Comply with the most stringent requirements of the latest editions of the applicable C.S.A. standards; the requirements of the Authorities Having Jurisdiction; Federal, Provincial and Municipal Codes; and the applicable standards of the Underwriters' Association. These codes and regulations constitute an integral part of these specifications.
- .2 In case of conflict, the codes take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.
- .3 Before starting any work, submit the required number of copies of Drawings and Specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify The Contract Administrator immediately of such changes, for proper processing of these requirements. Prepare and furnish any additional drawings, details or information as may be required. Information such as heat loss calculations, and other data that may be required can be obtained from The Contract Administrator. Should the authorities require the information on specific forms fill in these forms by transcribing the information provided by The Contract Administrator.
- .4 Apply for, obtain, and pay for all required permits, licenses, inspections, examinations, and fees.
- .5 Arrange for the inspection of all the work by the Authorities Having Jurisdiction over the work. On completion of the work, present to the The Contract Administrator the final unconditional certificate of approval of the inspecting authorities. When the Authorities Having Jurisdiction do not normally issue certificates, provide a declaration confirming that the Authorities have inspected and accepted the work.

1.21 DESIGN NOISE LEVELS

- .1 The maximum design noise levels for this project shall be as per ASHRAE Standards.
- .2 All equipment, components and systems shall be selected and installed with the intent of not exceeding these noise levels.
- .3 Where the equipment, components and systems fail to meet the noise level criteria, modifications shall be made as required, at no additional cost to The City.

1.22 SHOP DRAWINGS

- .1 Present a schedule of shop drawings within 2 weeks after the award of the contract, indicating the shop drawing submission and equipment delivery dates.

- .2 Shop Drawings submitted by the Contractor shall contain:
 - .1 Project Information such as Name and Address
 - .2 Contractor Information such as Name, Address, Phone Numbers
 - .3 Supplier Information such as Name, Address, Phone Numbers
 - .4 Equipment Identification using the same System Name and Identification Number as the Contract Documents.
 - .5 In addition to transmittal letter referred to in Section 013300 - Submittal Procedures use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
 - .6 All Equipment Information required for the The Contract Administrator to assess the suitability such as:
 - .1 Make, Model, Size
 - .1 including schedules where numerous similar items are provided
 - .2 Physical Data such as:
 - .1 Dimensions
 - .2 Materials
 - .3 Weights
 - .4 Installation Requirements
 - .5 Installation Clearances
 - .3 Performance Data such as:
 - .1 Volume
 - .2 Pressure
 - .3 Capacity
 - .4 Performance Curves (with specified performance clearly marked)
 - .4 Motor Data such as:
 - .1 Horse Power
 - .2 Voltage/Phases
 - .3 Efficiency
 - .5 Specialty Items such as:
 - .1 Bearings
 - .2 Filters
 - .3 Internal Controls including safety lockouts
 - .4 Safety Items such as relief valves and regulators
 - .5 Options
 - .6 Wiring and Control Diagrams
- .3 Equipment Information may contain standard manufacturer's brochures, catalogue sheets, schematics, diagrams performance charts, illustrations, etc., but must have:
 - .1 Information which is not applicable crossed off
 - .2 Available listed options which are being provided clearly marked
 - .3 Certification of compliance to applicable codes
- .4 Shop Drawing Review:
 - .1 In addition to project identification, date, etc., the form of stamp used in shop drawing review shall contain the following format:
 - .1 Drawing:
 - .1 Reviewed
 - .2 Reviewed As Noted
 - .3 Revise and Re-Submit

.4 Not Reviewed

- .2 This review by The Contract Administrator is for the sole purpose of ascertaining conformance with the general design concept.
- .3 This review shall not mean that The Contract Administrator approved the detail design inherent in the shop drawings, the responsibility for which shall remain with the Sub-contractor submitting same, and such review shall not relieve the Sub-contractor of his responsibility for errors or omissions in the shop drawings, or of his responsibility for meeting all the requirements of the contract documents. The contractors are responsible for confirming and correlating dimensions at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades, as well as compliance with codes and inspection authorities such as C.S.A., etc.
- .5 Bind one complete set of final shop drawings in each operating and maintenance instruction manual.
- .6 Refer to Division 01 - General Requirements for additional information.

1.23 COORDINATION

- .1 The Contractor shall be responsible for the complete coordination amongst all trades, including timing, completion, deliveries, interference of building components and sequencing of the trades.
- .2 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure compatibility of the system components.
- .3 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure access to control panels on mechanical equipment for the purpose of completing fire alarm panel connections.
- .4 The Contractor shall coordinate all trades to ensure that access doors and panels are of the same manufacturer, and of a style appropriate for the intended use.

1.24 EXPEDITING

- .1 Continuously check and expedite delivery of equipment and materials. If necessary, inspect at the source of manufacture.
- .2 Continuously check and expedite the flow of necessary information to and from all parties involved.
- .3 Immediately inform the Contractor if information is required from him.

1.25 RECORD DRAWINGS

- .1 Obtain two sets of white prints and, as the job progresses, neatly and clearly mark these prints to accurately indicate the installed work. Use different colour waterproof ink for each service. Have the white prints available for inspection at the site at all times, and present for scrutiny at each job meeting.
- .2 At the completion of the work, submit these sets of "Record" drawings to the The Contract Administrator for review. Make changes as requested by the The Contract Administrator and

resubmit. This process will continue until the "Record" drawings are deemed complete by the The Contract Administrator.

- .3 Arrange and pay for:
 - .1 Three colour copies of the final 'Record' Drawings to be produced and labeled 'As Constructed'. Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS CONSTRUCTED DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
 - .2 Individually scanning each 'Record' 'As-constructed' drawing at "full size" in a minimum of 8 bit colour at a minimum of 300 dpi to individual Adobe Acrobat "PDF" files for storage on a single storage disk - either CD or DVD. Each individual drawing file name to consist of drawing "Sheet No." and drawing "Sheet Title" from the scanned drawing. Refer to Mechanical Drawing list for example. Provide three copies of the storage disk.
- .4 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of 'Record' drawings. Perform testing, adjusting and balancing for HVAC using 'Record' drawings
- .5 Submit the "Record" and "As-constructed" drawings to The City.
- .6 For Additional Information, refer to Division 01 - General Requirements.

1.26 CUTTING AND PATCHING

- .1 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening. The opening size shall be the minimum required. Patching will be the responsibility of the trades normally engaged in working with the finishing materials required to restore the opening to the original or specified conditions.
- .2 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.
- .3 Cutting, patching, and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment, piping and/or ductwork, and/or installation of new equipment, piping and/or ductwork in existing buildings is to be included in the Bid price.

1.27 WORK IN EXISTING AREAS

- .1 Do the work in existing areas to best suit the available space and not interfere with or obstruct the use of the existing facilities.
- .2 Cut, cap-off, modify, or extend as necessary or as directed by The Contract Administrator, existing material or equipment to be removed, reused or relocated to suit the work under this contract.
- .3 Where disruptions of existing mechanical services are required, coordinate the shut down with The City and do the work at a time and in a manner mutually acceptable. Carefully schedule disruptions to keep "Down Time" to a minimum. Submit a concise written schedule of each disruption at least 72 hours in advance and obtain The City's written consent prior to implementation.

1.28 TEMPORARY SERVICES

- .1 Do not use any of the permanent mechanical systems during construction unless specific written approval is obtained from The Contract Administrator.
- .2 The use of permanent facilities for temporary construction service shall not affect, in any way, the commencement date of the warranty period.
- .3 If the permanent mechanical systems are used during construction, the equipment and systems shall be cleaned and refurbished as required to bring them back to a new/unused condition.

1.29 CHANGING OF EQUIPMENT DRIVES

- .1 If required, as determined from the review of the preliminary balancing report, changes to the equipment drives shall be carried out as follows:
 - .1 The Balancing Subcontractor shall be responsible for calculating the new drive requirements.
 - .2 For new equipment, the Contractor who supplied the equipment shall be responsible for obtaining and installing the new drive components.
 - .3 For existing equipment, the Balancing Subcontractor shall be responsible for obtaining and installing the new drive components.
- .2 The contract shall include one drive change for each New Air Handling Unit and each New Fan with adjustable pulley drive.

1.30 TEMPORARY AND TRIAL USAGE

- .1 The City has the privilege of trial usage of mechanical systems, or parts thereof, for the purpose of testing and learning the operational procedures.
- .2 Assist in the trial usage over a length of time, as deemed reasonable by The Contract Administrator, at no extra cost, and do not waive any responsibility because of trial usage.
- .3 Trial usage shall not be construed as acceptance by The City.
- .4 Provide and pay for all testing required on the system components where, in the opinion of The Contract Administrator, Manufacturer's ratings or specified performance is not being achieved.

1.31 SAFETY DEVICE TESTING

- .1 Make complete inspections of all safety devices such as: back flow preventers, fire extinguishers, hose cabinets; freeze protection devices; fire dampers, smoke dampers, fire stops, and the like to ensure:
 - .1 That safety devices are complete in accordance with the specifications and Manufacturer's recommendations.
 - .2 That the safety devices are connected and operating according to all local regulations, and appropriate access is provided.
- .2 On completion of the inspections, provide letters and/or certificates, confirming that inspections have been completed. Insert in each O & M Manual.

1.32

CLEANING

.1 General Clean-up:

- .1 The worksite shall be maintained in a condition of general cleanliness and tidiness.
- .2 Provide, erect, maintain and remove temporary protective barriers and shelters. Use drop sheets, temporary walls or other means necessary to limit the spread of construction dirt and debris. Barriers shall be used to minimize the spread of dust, smoke, fumes and noise to other portions of the building.
- .3 For renovation work, and for phased work where part of the building is occupied, coordinate and cooperate with the occupants throughout the duration of the project to maintain the site in a usable condition.
- .4 For renovation work, and for phased work where part of the building is occupied, clean the site to the satisfaction of the occupants at the end of each work day, so as to neither inconvenience the occupants nor hinder the use of the facility.
- .5 For renovation work, at the end of the project, provide cleaning services to leave the site in as clean a condition as existed before the commencement of the work.

.2 Mechanical Systems Clean-up:

- .1 At the completion of the project, leave all systems in full operation, the exterior of all new and renovated systems clean, and the work areas cleaned to the satisfaction of The Contract Administrator and The Occupants.
- .2 Clean exposed surfaces of new and renovated mechanical equipment, ductwork, piping, etc.
- .3 The level of cleaning shall be consistent with the intended use of the building and the mechanical systems.
- .4 The City reserves the right to inspect the Mechanical Systems to determine the effectiveness of the cleaning. Where cleaning is deemed to be unacceptable, the cleaning shall be re-done at no extra charge to The City.

.3 Special Cleaning:

- .1 Polish plated work.
- .2 Vacuum clean and remove debris from the inside of air handling systems, fans, ducts, coils, terminal units, etc.
- .3 For all New Ductwork, provide High Velocity Vacuum Cleaning. Provide Duct Access Doors as required.
 - .1 High Velocity Vacuum Cleaning shall be:
 - .1 Portable
 - .2 Capable of a minimum of 4,000 cfm

- .3 Equipped with HEPA filtration which is 99.97% efficient for particles no greater than 0.3 microns in size, when system exhausts into the Workplace or Occupied Area
- .4 For Kitchen Grease Exhaust Hoods and Ductwork, provide Hot Water / Steam Cleaning. Provide Duct Access Doors as required.
 - .1 Prior to cleaning, ensure all electrical devices and manual overrides serving the cooking equipment, fan and fire protection system are locked out.
 - .2 Cleaning shall:
 - .1 be performed in accordance with NFPA-96
 - .2 include fan, ductwork, hood, drip tray(s) and all associated appurtenances
 - .3 be done to bare metal using approximately 3000 psi
 - .4 not include the use of flammable solvents or other flammable chemicals
 - .5 not allow cleaning chemicals on fusible links or other fire protection devices of the Automatic Extinguishing System.
 - .3 After Cleaning:
 - .1 all areas where water may pool or puddle shall be vacuumed out
 - .2 do not coat the system(s) with a powder or other substance
 - .3 ensure all electrical devices and manual overrides serving the cooking equipment, fan and fire protection system are left on, and the system(s) are ready for use.
 - .4 Provide a report and certification.
 - .5 Duct Cleaning Specialist(s) shall provide a report at the Occupancy Stage of each Construction Phase, which shall include:
 - .1 Name, Address and Phone Numbers of the Company.
 - .2 Name(s) of Individuals Performing the Work.
 - .3 Description of the Work Performed, including methods, equipment, and extent of ductwork.
 - .4 A Video Tape showing the Complete Interior of the Full Length of all Main Ducts, with camera angles looking down each Branch Duct.

1.33 INSTRUCTIONS TO THE CITY

- .1 Prepare a Suitable List/Sign-off Sheet to indicate the Instructions and Materials provided.
 - .1 List shall Include all Systems.
 - .2 List shall Include all Materials.

- .3 List shall include spaces for Sign-off Names and Dates for The Contract Administrator.
- .2 Instruct The Contract Administrator in all aspects of the operation of the systems and equipment.
- .3 Arrange and pay for the services of Manufacturers' representatives required for the instruction on specialized portions of the installation.
- .4 Assemble three Operation and Maintenance Manuals in three ring binders with index tabs, each containing:
 - .1 this Sub-contractor's and suppliers names and telephone numbers,
 - .2 a complete set of reviewed shop drawings,
 - .3 brochures,
 - .4 data sheets,
 - .5 operating, maintenance, and lubricating instructions,
 - .6 valve charts,
 - .7 wiring diagrams,
 - .8 air and water testing and balance reports,
 - .9 controls 'As-Built' shop drawings,
 - .10 commissioning information,
 - .11 warrantee certificates.
 - .12 storage disk containing scans of 'As-constructed' Mechanical Drawings
- .5 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
- .6 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .7 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as Specified.
- .8 Present all copies of the Operation and Maintenance Manuals to The Contract Administrator for review. The Contract Administrator will review the manuals and return them with comments. The Sub-contractor shall make all requested changes. This process shall continue until the Manuals are deemed complete by The Contract Administrator. The Sub-contractor shall turn over the completed manuals to The City.
- .9 Present all copies of the Final Record Drawings to The City.

1.34 SPECIAL TOOLS AND SPARE PARTS

- .1 Prepare a Suitable List/Sign-off Sheet to indicate the Materials provided.
 - .1 List shall Include all Materials.
 - .2 List shall include spaces for Sign-off Names and Dates for The Contract Administrator.
- .2 Provide spare parts as follows:
 - .1 One set of drive belts for each piece of machinery.
 - .2 One set of filters for each filter section installed.
 - .3 One set of pump seals for each pump.
 - .4 One casing joint gasket for each size of pump.
 - .5 One glass for each gauge glass.
 - .6 One cartridge for each thermostatic mixing valve.
 - .7 Two screens for each size of strainer.
 - .8 One spare rim gasket for each Hydraulic Filter Housing Installed.
- .3 Identify spare parts containers as to contents and replacement parts number.
- .4 Provide one set of all specialized tools required to service equipment as recommended by the Manufacturers.
- .5 Furnish one grease gun, and specialized adapters to suit different types of grease and grease fittings.
- .6 Furnish one Strap Wrench for the Fluid Filter Housings supplied with the Water Treatment System.

1.35 WARRANTIES

- .1 No certificate issued, payment made, or partial or entire use of the system(s) by The Contract Administrator, shall be construed as acceptance of defective work or material.
- .2 Include copies of all warranty and guaranty certificates and declarations in the Operating and Maintenance Manuals, in the appropriate sections.
- .3 Provide a certificate or declaration indicating the warranty and conditions.
- .4 Warranty satisfactory operation of all work and equipment installed under this contract. Repair or replace at no charge to The City, all items which fail or prove to be defective within the Warranty period, provided that the failure is not due to improper usage by The City. Make good all damages incurred as a result of the failure and of the repair of the system(s).

- .5 The warranty shall be for all parts and labor. Do not expect any participation from The City's personnel in the correction of warranty related work.
- .6 For systems, equipment and components which are used continuously throughout the year, the normal warranty period shall be one calendar year from the date of Substantial Completion. For seasonal equipment, components and systems which are not normally used continuously throughout the year, the warranty period shall include at least one full season of satisfactory operation.
- .7 When equipment or systems are put into use subsequent to the acceptance of the building, or a portion of the building, the warranty period for seasonally used equipment and systems shall be deemed to commence from the date of satisfactory operation, not from the date of final acceptance by The City.
- .8 The City retains the right to demand, and to receive, an extension of the original construction warranty for any equipment, component or system which consistently fails to perform, or which requires repeated repair or adjustment.
- .9 Wherever manufacturer's warranties in excess of the Contractor's warranty are provided, furnish The City with copies of the Certificates, dated and acknowledged, and inserted in the O and M Manuals. The Contractors Warranty shall include a list of the Manufacturer's extended warranties.
- .10 Warranty work shall be carried out within a reasonable time period following the reporting of the problem. Should the repair time for any failed component be unreasonably long, as determined by The City, make alternate arrangements to have a temporary replacement component made available until such time that the original component is repaired and re-installed. There shall be no additional cost to The City for any temporary replacement component or for any labor required to implement the work.

1.36 DOCUMENTATION AND SYSTEM(S) ACCEPTANCE

- .1 The Contractor shall prepare a suitable document to be signed by The Contract Administrator, confirming:
 - .1 The City has received satisfactory instruction in the operation and maintenance of all equipment and systems.
 - .2 The Operation and maintenance manuals have been received and reviewed by The City.
 - .3 The "Record" and "As-constructed" drawings have been received and reviewed by The City.
 - .4 Specified spare parts, components, keys, removable handles, tools and the like, have been accepted by The City.

1.37 COMPLETION

- .1 The Contractor shall be aware that it is The Contract Administrator's intention to withhold recommendations for payment of progress claims totalling more than 95% of the mechanical contract until the project is declared Substantially Complete.
- .2 The close-out procedure may entail a take-over and occupancy of the building in more than one stage, depending on the specified phasing and The City's timetable.

.3 SUBSTANTIAL COMPLETION

- .1 The project will be ready for a Substantial Completion inspection only when it is ready for The City to occupy and utilize the building for it's intended purpose.
- .2 At Substantial Completion, The City will realise that some deficiencies may still exist.
- .3 In preparation for the inspection to determine Substantial Completion for all or a portion of the project, the Contractor shall ensure and declare in writing that:
 - .1 Except for seasonal deficiencies, the Start-up and Verification of the Commissioning Process has been completed, and all systems are fully functional.
 - .2 All systems and equipment have been cleaned.
 - .3 All systems and equipment have been identified and labelled.
 - .4 The preliminary Record drawings have been submitted for review.
 - .5 One set of preliminary O and M Manuals have been submitted for review.
 - .6 One copy of the preliminary Balancing Report has been submitted for review.
 - .7 Instructions to the The City's Representative have been given.
 - .8 Maintenance Materials and Spare Parts have been provided.
- .4 When the Contractor is satisfied that the entire project is completed, and after making his own inspection, he shall apply, in writing, to The Contract Administrator, for an inspection to determine if the project can be deemed to be Substantially Complete.
- .5 In the letter of request, a date shall be specified upon which the project can be delivered and be Substantially Complete.
- .6 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.
- .7 Based on the inspection report, The City will retain a sum of money, sufficient in his estimation to cover the cost of completing the deficiencies.

.4 TOTAL COMPLETION

- .1 When the Contractor has determined that the deficiencies noted during the Substantial Completion inspection have been completed or corrected, he shall apply, in writing, to The Contract Administrator, for a final inspection to determine if the project can be deemed to Totally Complete.
- .2 In the letter of request, a date shall be specified upon which the project can be delivered and be Totally Complete.
- .3 In preparation for the inspection to determine Total Completion for all or a portion of the project, the Contractor shall ensure and declare in writing that:
 - .1 All aspects of the Commissioning Process have been completed.

- .2 The final Record and As-Constructed drawings have been submitted, reviewed and accepted.
- .3 The final O and M Manuals have been submitted, reviewed and accepted.
- .4 The final Balancing Reports have been submitted, reviewed and accepted.
- .5 The deficiencies noted during the Substantial Completion inspection have been corrected or completed.
- .4 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.
- .5 Based on the inspection report, The City will retain a sum of money, sufficient in his estimation to cover the cost of completing the deficiencies.
- .6 Final Payment will only be made after the project has been determined to be Totally Complete, with all deficiencies satisfactorily corrected.

END OF SECTION 210501

SUB-CONTRACTOR INFORMATION

<u>ITEM</u>	<u>SUB-SUB-CONTRACTOR</u>	<u>COST</u>
INSULATION	_____	_____
PLUMBING	_____	_____
WELLS	_____	_____
FIRE PROTECTION	_____	_____
HEATING AND COOLING	_____	_____
AIR DISTRIBUTION	_____	_____
CONTROLS	_____	_____
TESTING & BALANCING	_____	_____
COMMISSIONING	_____	_____

SEPARATE PRICE INFORMATION

<u>ITEM</u>	<u>ADD</u>	<u>DEDUCT</u>
M-1 G	_____	_____

ALTERNATE PRICE INFORMATION

<u>ITEM</u>	<u>ADD</u>	<u>DEDUCT</u>
M-1 G	_____	_____

UNIT PRICE INFORMATION

<u>ITEM</u>	<u>ADD</u>	<u>DEDUCT</u>
M-1 F	_____	_____

END OF SECTION 210503

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with the requirements of Section 210501, Mechanical General Provisions.
- .2 Comply with the requirements of Mechanical Equipment Schedule A, Mechanical Specifications Approved Substitute Schedule.

1.2 SECTION INCLUDES

- .1 This Section applies to and is part of all Divisions and Sections as follows:
 - .1 Division 21 - Fire Suppression All Sections
 - .2 Division 22 - Plumbing All Sections
 - .3 Division 23 - Heating, Ventilating and Air Conditioning (HVAC) All Sections
 - .4 Division 25 - Integrated Automation. All Sections
 - .5 Mechanical Equipment Schedules All Schedules
 - .6 Mechanical Drawings All Drawings

1.3 RELATED SECTIONS

- .1 Section 013300 - Submittal Procedures
- .2 Section 016100 - Product Requirements
- .3 Section 017000 - Examination And Preparation
- .4 Section 017330 - Cutting And Patching
- .5 Section 017810 - Closeout Submittals

1.4 SUBMITTALS

- .1 Submit shop drawings on access doors, air vents, strainers, thermometers and gauges, flow measurement devices, and air filters.

1.5 STANDARD OF EQUIPMENT, MATERIALS AND COMPONENTS

- .1 All equipment, materials and components shall be new and of first class quality.
- .2 All equipment, materials and components shall be of proven design, and of current models with published ratings, for which replacement parts are available.
- .3 All equipment, materials and components shall be tested, certified and labeled by ULC and/or CSA for use in Canada. The certification and labeling shall be appropriate for the intended function of the item being supplied, as dictated by the relevant codes and standards.
- .4 Where items are not adequately certified and labeled by the manufacturer, the contractor supplying the item shall be responsible for obtaining approval for the use of the item from the local Authority Having Jurisdiction, and shall bear all associated costs.
- .5 Where a manufacturer's name, make or model is specified, it is for the sole purpose of setting a standard of quality, performance, capacity, appearance, size and/or serviceability. Refer to Mechanical Equipment Schedule A, Mechanical Specifications Approved Substitute Schedule for approved 'Substitutes' and 'Alternates'.

- .6 Use only Copper, Bronze, Brass and Stainless Steel (no iron) for materials coming in contact with Domestic Water Systems.
- .7 Use only Plastic for materials coming in contact with Reverse Osmosis Water Systems.

1.6 IDENTIFICATION

- .1 All equipment, including motors shall come with proper nameplates affixed thereto, showing the manufacturer, make, model, size, serial number, horsepower, voltage, cycles, and all other pertinent data usually provided.
- .2 Identify all new equipment, panels and controls with lamacoid nameplates indicating Identification Name and Number.
- .3 Identify all new piping with direction-of-flow-arrows and service.
- .4 Identify all new valves with brass or Lamacoid numbered tags.
- .5 Identify all new ductwork with direction-of-flow-arrows and service.
- .6 Provide Special Signage as Specified or Noted on the Drawings.

1.7 CONSTRUCTION TECHNIQUES AND METHODS OF INSTALLATION

- .1 The selected techniques, methods of fabrication and installation, and the size of the labor force shall be suitable to meet the completion schedule.
- .2 The contractors shall be responsible for determining the most appropriate construction techniques and methods of installation for their portions of the work.
- .3 The contractors shall be responsible for laying out the systems, equipment, and components for their portions of the work.
- .4 The contractors shall consult with the manufacturers to obtain their installation recommendations, and shall comply with such recommendations and/or with local code requirements, whichever is the most stringent.

1.8 FIRE STOPPING

- .1 Fire Stop Materials shall be provided at all penetrations through fire and smoke separations. Refer to the Architectural Drawings for the locations of all separations.
- .2 Fire Stop Materials shall be as approved by the Authorities Having Jurisdiction.
- .3 Fire Stop Material installation shall be as per Manufacturer's recommendations.
- .4 Fire Stopping shall be carried out by a specific Sub-contractor to the Contractor. Refer to the Architectural specifications, especially Section 078400 - Firestopping.

PART 2 PRODUCTS AND MATERIALS

2.1 ACCESS PANELS AND DOORS

- .1 The Contractor and Sub-contractor shall coordinate as required to ensure that access doors supplied by different sub- and sub-sub-contractors shall be of the same manufacturer, and of a style appropriate for the intended use.
- .2 Provide access doors equal to the fire rating of the wall or ceiling in which it is installed.
- .3 Lay-in type tiles, properly marked, may serve as access panels.
- .4 In concealed locations, provide access doors of welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat.
- .5 In exposed locations in non-rated partitions and ceilings, provide Bauco model BP 'Invisible Seam' type access doors as distributed by:
 Bauco Products Incorporated
 407 St. Charles Street
 Victoria, B.C., V8S 3N4
 Phone: 1-877-592-0033 – or – (205) 592-0033
 Fax: 1-877-592-7587 – or – (205) 595-0513
- .6 All access panels and doors shall be minimum 300 mm x 300 mm (12" x 12"). Where personnel entry is required, minimum size shall be 600 mm x 600 mm (24" x 24").
- .7 Refer to Air Distribution Specification Section for Duct Access Doors.

2.2 HANGERS

- .1 Provide adjustable Clevis type equal to Grinnell Fig. 65 for pipe sizes up to and including N.P.S. 2.5. For pipe sized N.P.S. 3 and over, provide adjustable Clevis type equal to Grinnell Fig. 260. Use rod sizes as recommended by the manufacturer.
- .2 On copper piping, provide copper plated type hanger or separate piping from hanger with an approved insulating tape or plastic coating.
- .3 Provide oversized hangers to pass over insulation on all insulated water piping. Use insulation saddles to protect insulation.

2.3 INSERTS

- .1 Use factory-made threaded or toggle type inserts as required for supports and anchors, properly sized for the load to be carried.
- .2 Use factory made expansion shields where inserts cannot be placed, but only as approved by The Contract Administrator in writing and for light weights.
- .3 Do not use explosive powder activated tools except with the written permission of The Contract Administrator.

2.4 SLEEVES

- .1 Provide the following for pipe sleeves:
 - .1 Through interior walls, exterior walls above grade, interior non waterproof floors: Machine cut schedule 40 steel pipe, medium cast iron or 18 gauge galvanized steel or plastic.
 - .2 Through walls below grade, waterproof floors, floors in janitor's closets, equipment rooms, and kitchens: machine cut medium cast iron, D.W.V. copper or copper sheet extended 100 mm (4") above the floor and cut flush with the underside.
- .2 Provide the following for ductwork:
 - .1 Where fire dampers are not required in poured walls: removable wood box of required size.
 - .2 Where fire dampers are not required in block or brick walls: masonry to be built around ducting.
 - .3 Where fire dampers are required: 18 gauge galvanized steel or heavier sleeves complete with steel angle framing both sides installed in accordance with requirements of Authorities.
 - .4 Through Equipment Room floors: provide 100 mm (4") high curbs and install as described above.

2.5 AIR VENTS (AUTOMATIC)

- .1 Provide air vents equal to Maid-O-Mist No. 7 series.

2.6 STRAINERS

- .1 Provide where shown on the drawings, strainers equal to Toyo 380 for N.P.S. 1/2" to 2" and Toyo 381 JA for N.P.S. 2.5 and over, rated at 860 kPa (125 psi).
- .2 Strainer baskets: Type 304 stainless steel or Monel, 1.14 mm (0.045") perforations for steam and 3 mm (0.125") perforations for water.

2.7 THERMOMETERS AND PRESSURE GAUGES

- .1 Provide pressure gauges where shown on the drawings: These to be 115 mm (4.5") complete with Tee and snubbers. Scale: kPa and psi to suit application. Range: Indication at middle third of gauge.
- .2 Provide thermometers where shown on the drawings. These to be vari-angle in 175 mm (7") case. Scale: Celsius and Fahrenheit to suit applicaation. Ranges as required to suit systems.
- .3 To attach, use Style 923 Viclets/Style 924 Vic-Wells from Victaulic.

2.8 FLOW MEASUREMENT VENTURI

- .1 Where flow measurement is required for equipment, pumps and coils, the use of Venturi's is needed. Victaulic Style 733 Venturi between 1/2" and 30" is acceptable.
- .2 Piping and Balancing Contractors shall coordinate for exact locations and requirements.

2.9 DIELECTRIC CONNECTIONS

- .1 All connections between copper and carbon steel shall be joined with Victaulic Style 47 clearflow Dielectric Waterway. Brass valves and fittings are acceptable.

2.10 PIPE AND FITTINGS

- .1 Domestic and Tempered Water (above grade):
 - .1 Type L hard copper with wrought copper or cast bronze fittings using lead-free solder.
- .2 Building Water Service (Domestic or Fire):
 - .1 PVC pressure water pipe.
- .3 Compressed air, heating water and glycol piping:
 - .1 For pipe sizes up to and including N.P.S. 2, type L hard copper with wrought copper or cast bronze fittings using lead-free solder. Rated at 860 kPa (125 P.S.I.).
or
 - .2 Schedule 40 ASTM specification A53 steel black pipe with standard black malleable screwed fittings rated at 860 kPa, (125 P.S.I.) for pipe sizes up to and including N.P.S. 2.
or
 - .3 Schedule 40 ASTM specification A53 wrought steel black pipe with standard black steel welding fittings for pipe sizes N.P.S. 2.5 and over.
or
 - .4 Mechanical Joints may be used on steel piping.
- .4 Fire Protection (Sprinkler or Standpipe) piping (above grade):
 - .1 Wrought or black steel pipe, or copper piping, or plastic piping, with screwed, mechanical welded or soldered joints as allowed by the Authorities Having Jurisdiction.
- .5 Condensate drip drains:
 - .1 Drainage grade copper tubing with soldered copper drainage fittings.
- .6 Sanitary Drainage and Vent - internal and within 2.0m (5'-0") of building line:
 - .1 Buried: Medium weight cast iron soil pipe with M.J. fittings with corrugated CSA approved M.J. clamp,
or
Where approved by the Authorities Having Jurisdiction:
PVC or ABS with fusion welded fittings.

- .2 Suspended: Medium weight cast iron soil pipe with M.J. fittings with corrugated CSA approved M.J. clamp,
or
DWV copper with soldered copper or cast bronze drainage fittings,
or
Where approved by the Authorities Having Jurisdiction:
PVC or ABS with fusion welded fittings.
- .3 Vertical Risers in shafts below the top floor:
Medium weight cast iron soil pipe with M.J. fittings with corrugated CSA approved M.J. clamp,
or
Where approved by the Authorities Having Jurisdiction:
PVC or ABS with solvent welded fittings.
- .7 Storm Drainage - internal and within 2.0m (5'-0") of building line:
 - .1 Buried: Medium weight cast iron soil pipe with M.J. fittings with corrugated CSA approved M.J. clamp,
or
Where approved by the Authorities Having Jurisdiction:
PVC or ABS with fusion welded fittings.
 - .2 Suspended: Medium weight cast iron soil pipe with M.J. fittings with corrugated CSA approved M.J. clamp,
or
Where approved by the Authorities Having Jurisdiction:
PVC or ABS with solvent welded fittings.
- .8 Sanitary Drainage - external beyond 2.0m (5'-0") of building line:
 - .1 PVC pressure sewer pipe.
- .9 Sewage and Sump Pump discharge pipe:
 - .1 PVC pressure sewer pipe.
or
 - .2 DWV copper with soldered copper or cast bronze drainage fittings,
- .10 Natural Gas, Fuel Oil and Propane Piping:
 - .1 As allowed by code and approved by the Authorities Having Jurisdiction.

2.11 VALVES

- .1 General
 - .1 It is generally preferable that ball valves and butterfly valves be used in place of gate valves providing they meet the pressure, temperature, and fluid handling requirements of the system.
- .2 Gate Valves
 - .1 Valves N.P.S. 2 and smaller for threaded ends: Jenkins #810, Crane #428, Toyo 293, Lunkenheimer #2125, Kitz 24, Nibco T111, Milwaukee #148, Newman Hattersley T607M.

- .2 Valves N.P.S. 2 and smaller for soldered ends: Jenkins #813, Crane #1324, Toyo 299, Lunkenheimer #2131, Kitz 43, Nibco 5134, Milwaukee #149, Newman Hattersley T609M.
- .3 Valves N.P.S. 2.5 and larger: iron body non-rising stem, Jenkins #452, Crane #461, Toyo #415A Lunkenheimer #1428, Kitz 75, Nibco F619, Milwaukee F2882-M, Newman Hattersley T501.
- .4 Lockshield valves N.P.S. 2 and smaller: Crane 428 Lockshield, Toyo 293, Lunkenheimer #2127, Kitz 24, Nibco T111LS.
- .3 Ball Valves:
 - .1 Valves N.P.S. 2 and smaller for threaded ends: Bronze construction with TEF packing and seat, raised lever handle, Jenkins 33, Crane 9302, Toyo 5044A Lunkenheimer 747 F, Kitz 56, Nibco T580, Milwaukee BA100, Newman Hattersley 1969.
 - .2 Valves N.P.S. 2 and smaller for soldered ends: Crane 9322, Toyo 5049, Kitz 57, Nibco S580, Milwaukee BA150, Newman Hattersley 1979.
- .4 Check Valves:
 - .1 Spring checks at pumps N.P.S. 2 and larger: Moyes and Groves Ltd. I512WM5S, Checkrite 12CBTU, APCO 300 & 600, Nibco W960.
 - .2 Miscellaneous locations:
 - .1 Valves N.P.S. 2 and smaller: Jenkins #4092, Crane #37, Toyo #236, Lunkenheimer #2144, Kitz 22, Nibco T433B, Milwaukee 509, Newman Hattersley 47.
 - .2 Valves N.P.S. 2.5 and larger: Iron body flanged, Jenkins #587, Crane #373, Toyo #435A, Kitz 78, Lunkenheimer #1390; Victaulic 2.5" to 3" style 716, 4" to 8" style 715 and 8" to 12" style 711, Nibco F918B, Milwaukee F2474-M, Newman Hattersley 651.
- .5 Drain Down Valves:
 - .1 N.P.S. 3/4" to 2": Brass construction ball action valve complete with cap and chain rated 150 psi steam 600 w.o.g. Toyo 5046, Milwaukee BA100H.
- .6 Balancing Cocks:
 - .1 Where gate valves are used for terminal isolation provide DeZurik series 425.
- .7 Butterfly Valves:
 - .1 Cast iron body, bronze or stainless steel discs, Buna N "O" rings, bronze bushings straight through or pinned shafts and stainless steel stem.
 - .2 EPDM rubber resilient seat with temperature range of -40° to 120°C.
 - .3 Tight shut-off to 1100 kPa (150 PSI) and 120°C (250°F).
 - .4 Lug type body tapped for 1100 kPa (150 psi) A.N.S.I. drilling may be used in lieu of spool pieces for equipment removal.

- .5 Handles and operators: 2" to 6", use lever with multi-position adjustment. For N.P.S. 8 and over use wheel operated, worm gear actuator.
- .6 Acceptable Standard: Keystone F1000/F1020, Crane Regent 55 Y 4E, Jenkins 2232E, Victaulic "Vic 300", Nibco LD2000-3, Milwaukee M, Newman Hattersley 45-31552, Toyo 918-BES-L.
- .8 Natural Gas, Propane and Fuel Oil valves:
 - .1 Approved plug type.
- .9 Water Service Valves:
 - .1 N.P.S. 2" and smaller - Mueller to utility standard.
 - .2 N.P.S. 2" and larger - Mueller, McAvity, to utility standard.
- .10 Fire Service:
 - .1 N.P.S. 4" and larger above ground: iron body, bronze trim O S & Y, flanged 200 psi, U.L.C./FM approved. McAvity 10269, Nibco F6070TS ULC.
 - .2 N.P.S. 4 and larger buried: non-rising stem, iron body bronze trim, S.S. bolts, integral bonnet, ULC/FM approved, McAvity series 616 or Nibco F609/M609 ULC to suit pipe connections.
 - .3 Indicator post to be cast iron body ULC/FM approved. McAvity 6225, Nibco NIPIAJ ULC.
- .11 Fire Hydrants:
 - .1 Cast iron construction ULC/FM approved for (9'-0") bury with 1 @ 4" (100 mm) pump and 2 @ 2.5" (65 mm) hose connections, compression valve, SS bolting for 6" (150 mm) line connection, constructed to AWWA C502 standard: McAvity M-67.

2.12 WIRING AND ELECTRIC MOTORS

- .1 Electrically operated equipment shall bear a C.S.A. approval label.
- .2 Electric power wiring for equipment provided by mechanical trades is specified in Division 26.
- .3 Electric control wiring for equipment provided by mechanical trades is specified in Division 25.
- .4 The wiring of all temperature, level, and flow devices required for the operation or control of mechanical equipment provided under this division, shall be installed under the scope of work of Division 25 - Integrated Automation, to the standards established under Division 26 and in accordance with code requirements. This is with the exception of line voltage controls for 120V or 208V single phase cycling such as force flow thermostats, level controls and the like which shall be wired under Division 26 scope of work.
- .5 Generally all motors 375 watt (1/2 H.P.) and smaller to be 120 volt, single phase, 60 cycle. Motors shall meet NEMA standard for maximum sound level ratings under full load and have a 1.15 service factor. Single phase motors to be permanent split capacitor type.

- .6 All motors 375 watts to 37.5 kilowatts (1/2 Hp to 50 Hp) supplied under this contract must meet or exceed the following minimum criteria:
 - .1 Shall be Cema Design Normal torque, low starting current with Class B insulation for operation in maximum ambient of 40°C (105°F).
 - .2 Bearings to be rated for minimum B-10 life of 20,000 hours with a V-belt drive.
 - .3 Service factor shall be 1.15.
 - .4 Motors shall be drip proof unless otherwise specified.
 - .5 Motors shall meet or exceed the following efficiency and power factor criteria for 1800 RPM motors.

EFFICIENCY TIMES POWER FACTOR (Note: F.L. means Full Load)

<u>H.P. (Kw)</u>	<u>F.L.</u>	<u>0.75 F.L.</u>	<u>0.50 F.L.</u>
1 (0.75)	0.57	0.49	0.36
1.5 (1.12)	0.61	0.54	0.41
2 (1.50)	0.65	0.58	0.45
3 (2.25)	0.60	0.55	0.43
5 (3.75)	0.69	0.64	0.53
7.5 (5.62)	0.64	0.58	0.47
10 (7.50)	0.69	0.65	0.54
15 (11.25)	0.71	0.69	0.61
20 (15.00)	0.73	0.70	0.61
25 (18.75)	0.72	0.68	0.62
50 (37.50)	0.79	0.77	0.70

2.13 IDENTIFICATION

- .1 Valves:
 - .1 Provide 35 mm (1-3/8") diameter brass or Lamacoid tag, with stamped numbers, secured by brass chains or thick plastic straps to the valve.
- .2 Equipment:
 - .1 Provide 3mm (1/8") thick lamacoid plastic name plate of approved size with bevelled edges having engraved white letters on a black background, giving the name of the equipment or equipment service and it's number, ie: 'Fume Hood Exhaust Fan EF-27'.
- .3 Piping:
 - .1 Piping identification shall be pre-manufactured labels, suitably attached for permanence, or stencils with painted lettering. Painted stencils shall be of a suitable color to contrast with the pipe/insulation color.
- .4 Ductwork:
 - .1 Ductwork identification shall be painted stencils of a suitable color to contrast with the duct/insulation color.

2.14 AIR FILTERS

- .1 Unless specifically noted otherwise, all filters shall be replaceable panel type, for slide-in application, into galvanized steel racks.
- .2 All filter panels shall be pleated media type in cardboard frames. Media shall be 'Medium Efficiency', equal to Farr 30/30.
- .3 Unless specifically noted otherwise, all filters shall be replaceable media type in removable/re-useable galvanized steel frames. Frames shall have hold down bars/screens as required for easy change out of media. Frames shall be suitable for slide-in application, into galvanized steel racks.
- .4 Media shall be 'Standard Efficiency', oil-impregnated fibres.
- .5 All filter media shall be constructed of unbreakable synthetic micro-fibres in 3 stage variable density media.
- .6 Filters shall be listed at least Class II UL flammability.
- .7 No filter shall contain asbestos, micro-glass or Urea-formaldehyde.

PART 3 INSTALLATION AND EXECUTION

3.1 GENERAL INSTALLATION

- .1 Install equipment, ductwork, conduit and piping in a workmanlike manner to present a neat appearance and to function properly to the acceptance of The Contract Administrator. Install ducts and pipes parallel and perpendicular to building planes. Install piping and ductwork concealed in chases, behind furrings or above ceilings. Install exposed systems neatly, and group to present a neat appearance.
- .2 Install all equipment and apparatus requiring wiring, maintenance, adjustment or eventual replacement with due allowance therefore.
- .3 Include in the work all requirements of manufacturers shown on the shop drawings.
- .4 Replace all work unsatisfactory to The Contract Administrator without extra cost.
- .5 Install all ceiling mounted components (Diffusers, Grilles, Sprinklers) in accordance with reflected ceiling drawings, accepted by The Contract Administrator.
- .6 Leave space clear and install all work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or materials supplied by other trades. Verify spaces in which work is to be installed. Install pipe runs etc., to maintain maximum headroom and clearances and to conserve space in shaft and ceiling spaces.
- .7 Confirm on the site the exact location of outlets and fixtures. Confirm location of outlets for equipment supplied by other trades.

3.2 ACCESS PANELS AND DOORS

- .1 Install all concealed Mechanical equipment requiring adjustment or maintenance in locations easily accessible through access panels or doors. Install systems and components to result in a minimum number of access panels.
- .2 Provide access doors in walls and ductwork at all fire dampers, motorized dampers, duct mounted coils, smoke detectors, fan inlets and outlets, etc. Indicate access panels on "Record" drawings.
- .3 Access doors shall be supplied by the trade requiring the door, and shall be installed by the appropriate architectural or finishing trade. All pertinent information required for the installation of the access door shall be provided by the supplying trade to the installing trade.
- .4 Prepare detail drawings showing location and type of all access doors in coordination with other trades before proceeding with installation and hand these to the Contractor for approval.
- .5 Size access doors to provide adequate access and commensurate with the type of structure and architectural finish.
- .6 Ensure proper rating of doors in fire separations.

3.3 HANGERS

- .1 Hanger rods may be attached to beam or joist clamps, brackets, or concrete inserts. Explosive actuated tools are not permitted. Do not weld to structural steel unless The Contract Administrator's approval is given.
- .2 The following tables will determine support points for all piping on this installation:

STEEL PIPE:	<u>NOMINAL SIZE</u>	<u>DISTANCE BETWEEN SUPPORTS</u>
	Up to N.P.S. 1.25	2,400 mm (8 ft.)
	N.P.S. 1.5 - N.P.S. 2.5	3,000 mm (10 ft.)
	N.P.S. 3 and over	3,600 mm (12 ft.)
COPPER PIPE:	<u>NOMINAL SIZE</u>	<u>DISTANCE BETWEEN SUPPORTS</u>
	Up to N.P.S. 3/4	1,800 mm (6 ft.)
	N.P.S. 3/4 - N.P.S. 1	2,400 mm (8 ft.)
	N.P.S. 1.25 - N.P.S. 2	3,000 mm (10 ft.)
	N.P.S. 2.5 and over	3,600 mm (12 ft.)

3.4 INSERTS, SLEEVES AND ESCUTCHEONS

- .1 Place inserts only in portion of the main structure and not in any finishing material.
- .2 Supply and locate all inserts, holes, anchor bolts and sleeves in time when walls, floors and roof are erected.
- .3 Seal all sleeves as follows:
 - .1 Through all walls: Stop insulation flush with all wall surfaces and seal space between duct or pipe and sleeve with ram packed mineral wool.
 - .2 Through Shaft and Equipment Room walls, and at outside walls: apply an approved caulking compound over the ram packed mineral wool on both sides.

- .3 At Fire Separations and Rated Walls: Provide intumescent 'donut(s)'.
- .4 Through floors of Equipment Rooms, Kitchens and Janitor's closets: seal as described above for Equipment Room Walls.
- .5 Through foundation walls, co-operate with the Waterproofing trade and apply an approved caulking compound over ram-packed mineral wool on both sides. Over this, on both sides, apply a layer of glassfab tape imbedded in two coats of an approved mastic compound.
-or-
Provide a 'Link-Seal' gasket.
- .4 Cover sleeves and openings around exposed piping in all finished areas with split chrome plated escutcheons. Cover exposed duct sleeves in finished areas with an 18 gauge galvanized steel collar fixed to wall or floor.

3.5 AIR VENTS

- .1 Provide air vents on closed-loop water piping at all high points in the system and at each piece of equipment. Provide shut off cocks to automatic vents.
- .2 Provide automatic air vents on piping mains except where a possibility from water damage would occur, in which case, use manual vents.
- .3 Provide manual air vents at each piece of equipment.

3.6 CONTROL COMPONENTS

- .1 Mount all pipe line devices supplied by the control sub-contractor such as flow switches, valves, separable wells for temperature controllers and sensors.
- .2 Install control devices to guarantee proper sensing. Shield elements from direct radiation and avoid placing them behind obstructions.

3.7 PIPE INSTALLATION

- .1 The piping shown on the drawings is diagrammatic for clearness in indicating the general run and connections, and may or may not be, in all instances, shown in its true position. This does not relieve this Sub-contractor from the responsibility for the proper erection of systems of piping in every aspect suitable for the work intended and as described in the specifications.
- .2 Install all piping in the best workmanlike manner in accordance with the best practices of the trade.
- .3 Install brass and copper pipe tubing free from surface damage. Replace damaged pipe or tubing.
- .4 Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.
- .5 Where steel piping is required to be buried, apply two coats of flint-guard 410-02 (or equal) bituminous paint to all buried surfaces after assembly and testing.

- .6 Install groups of piping parallel to each other on trapeze hangers, spaced to permit service access, application of insulation, and identification.
- .7 Install piping straight, parallel and close to walls and ceilings, with specified pitch. Use manufactured fittings for direction changes.
- .8 Install piping to avoid any interference with the installation of equipment, other piping, ducts etc. Where it is necessary to offset piping to avoid obstructions, use 45 degree rather than 90 degree elbows.
- .9 Provide long turn pipe fittings not less than pipe wall thickness. Provide line size tees, and where branch lines are more than two sizes smaller than the main, weldolets may be used.
- .10 All openings in pipes and fittings shall be kept plugged or capped during installation, to prevent the entry of dirt and debris.
- .11 Install systems so that they can be thoroughly drained and all air eliminated. Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.
- .12 Provide hose end valves at all low points for complete system drainage, whether shown on the drawings or not.
- .13 Slope all condensate drip drains, and provide suitable cleanouts on every other change in direction.
- .14 Ream the ends of pipes and tubes before installation. Clean the ends of pipes/tubing, and the recesses of fittings to be brazed or soldered. Assemble joints without binding.
- .15 During welding or soldering procedures, provide a fire retardant cloth, mat or blanket to protect the structure, and adequate fire protection equipment at all locations where work is being done. Close off shaft or confined areas with a fire retardant mat or cloth to prevent sparks or pieces of hot metal from falling down the shaft or area way.
- .16 Make all threaded pipe joints using a thread paste or teflon tape applied to the male thread. Use only non-toxic lubricants which are non-injurious to the gasket material, and suitable for the service for which the pipe is to be used. Use of hemp or similar materials on threaded joints will not be permitted.
- .17 Place all valves and specialties to permit easy operation and access.
- .18 Install gauges and thermostats to permit easy observance.
- .19 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.
- .20 Regulate and adjust all packing glands, regulating valves and relief valves on completion of the work.

3.8 DRAINS

- .1 Pipe all discharge from relief valves to the floor.
- .2 Pipe all discharge from drain pans and drain valves to the nearest floor drain or suitable receptacle.

- .3 Provide N.P.S. 3/4 gate valves with hose end outlets at strainers, all low points, at pumps, coils and at each piece of equipment.

3.9 PIPING SYSTEM TESTS

- .1 Do not insulate piping systems until completed, perfected, and proven tight.
- .2 Should leaks develop in any part of the piping system, remove and replace defective sections, fittings, etc.
- .3 Test piping systems and prove tight.
 - .1 Test piping system in sections as required by the progress of this and other contractors work and provide all required isolating valves.
 - .2 Test all drain and vent piping pneumatically to a pressure of 14 kPa (2 psi) and prove tight for a period of 1 hour.
 - .3 Test all domestic water piping hydraulically to a pressure of 518 kPa (75 psi) and prove tight for a period of 4 hours.
 - .4 Test all chilled water, heating water, glycol, steam, and steam condensate piping hydraulically to a pressure of 690 kPa (100 psi) and prove tight for a period of 8 hours.
 - .5 Test all compressed air piping pneumatically to a pressure of 1035 kPa (150 psi) and prove tight for a period of 4 hours.
 - .6 For sprinkler, propane and fuel oil piping, test as required to the satisfaction of the Authorities Having Jurisdiction.

3.10 PUMP AND EQUIPMENT CONNECTIONS

- .1 Install piping connections to pumps and all other equipment without strain at the pipe connection to this equipment. Where requested by The Contract Administrator, remove the bolts in flanged connections, or disconnect the piping after the installation is complete, to demonstrate that the piping has been so connected.
- .2 Equipment Connections:
 - .1 All fittings N.P.S. 2 and below connecting to equipment: use unions, extra heavy duty pattern, having ground joints, brass seats and diagonal screw.
 - .2 Connections to equipment N.P.S. 2½ and above: Flanged, standard weight provided with ring gaskets.
 - .3 Install the shut-off valves and flanges/unions, in locations so as to permit the removal of the equipment without disturbing the piping systems.

3.11 WELDING

- .1 Only persons who have passed welding tests to the satisfaction of the Authorities Having Jurisdiction and who are certified by them to be qualified welders, shall be permitted to do any welding on this contract.

3.12 DIRT ACCUMULATION UNDER CONTROL VALVES

- .1 If dirt accumulates under the seats of automatic control valves, this Sub-Contractor is responsible, during the first year's operation, to remove the collected materials under the valve seats and if the seat is damaged, replace same, at no additional cost to The City.

3.13 PROTECTION

- .1 Cover openings in equipment, and cover equipment where damage may occur to the finish from weather or construction.
- .2 Cover temporary openings in ducts and pipes with polyethylene sheets, until final connection is made.

3.14 RIGGING OF EQUIPMENT

- .1 Provide all rigging, hoisting and handling of equipment as necessary in order to place the equipment in the designated area in the building.
- .2 Direct this work by qualified people normally engaged in rigging, hoisting and handling of equipment.

3.15 CONCRETE

- .1 Concrete work required for mechanical work and shown on architectural or structural drawings: Provided by Contractor.
- .2 Concrete work required for mechanical work and not shown on Architectural or Structural drawings - to be provided by The Mechanical Subcontractor.
- .3 Provide in good time, all inserts, sump frames, anchors etc., for mechanical services, required to be built into the forming.
- .4 Provide concrete thrust blocks at each change of direction for underground water piping, as per drawing details.

3.16 METALS

- .1 Steel construction required solely for the work of mechanical trades and not shown on architectural or structural drawings: Provided by this Sub-contractor to the acceptance of The Contract Administrator.

3.17 IDENTIFICATION

- .1 Equipment:
 - .1 Identify all equipment, panels, automatic control devices, etc., with lamacoid name plates.
 - .2 The wording shall be the same as the Drawings and Specifications. Prior to ordering, the wording of all equipment tags shall be submitted to The Contract Administrator for review.

.3 Mechanically affix the tags to the equipment using pop rivets or sheet metal screws.

.2 Valves:

.1 Provide all major valves with brass or Lamacoid numbered tags,

.2 Prepare an approved list detailing the valve location, tag numbers and purpose it serves.

.3 Mount one (1) copy of the valve list in a glazed frame where advised by The City and provide one additional copy in each O & M manual.

.4 The numbering system shall include the service designation (i.e.: DHW, DCW, HWS, HWR, etc.). The service designations shall be the same as the Drawings.

.3 Piping:

.1 Identify all piping as to service and direction of flow:

.2 Piping identification shall be provided at each equipment connection, behind each access door, in each room, and every 9 m (30 ft.) on straight runs of pipe.

.3 The location and height of the lettering shall be suitable to be easily read from a standing position in the vicinity of the piping.

.4 The service designations (i.e.: DHW, DCW, HWS, HWR, etc.) shall be the same as the Drawings and Specifications.

.4 Ductwork:

.1 Identify all ductwork as to service and direction of flow:

.2 Ductwork identification shall be provided at each equipment connection, behind each access door, in each room, and every 9 m (30 ft.) on straight runs of ductwork.

.3 The location and height of the lettering shall be suitable to be easily read from a standing position in the vicinity of the ductwork.

.4 The service designations (i.e.: S/A, E/A, O/A, etc.) shall be the same as the Drawings and Specifications.

.1 Where there is more than One Fan System, or more than One Controlled Zone per System, include the Fan or Zone Designation.

3.18 FLASHING

.1 Flash all mechanical parts passing through or built into an outside wall, or a waterproof floor.

.2 Provide copper flashing for sleeves passing through exterior walls or waterproof floors.

.3 Provide counterflashing on stacks, ducts and pipes passing through roofs to fit over curb flashing.

3.19 EXCAVATION AND BACKFILL

.1 Do all excavation, bedding, backfill and related work required for mechanical work in accordance with the requirements of the Contractor's specifications, except as varied by this article.

- .2 Grade the bottom of the pipe trench excavation as required.
- .3 In firm undisturbed soil, lay pipes directly on the soil and shape soil to fit the lower 1/3 segment of all pipes and pipe bells. Ensure even bearing along the barrels. Backfill excavation and compact to the following standard Proctor densities:
 - .1 Sodded area, excavated material to 50% P.D.
 - .2 Under paving, sand to 95% P.D.
 - .3 Under Floor slabs, sand to 100% P.D.
- .4 In rock and shale excavate to 150 mm (6") below and a minimum of 200 mm (8") to either side of the pipe. Fill back with a bedding of 10 mm (3/8") crushed stone or granular 'A' gravel.
- .5 Prepare new bedding under the pipe in unstable soil, in fill, and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls of buildings, at manholes and catch basins. Compact to maximum possible density and support the pipe by 200 mm (8") thick concrete cradle, spanning full length between firm supports.
 - .1 Install reinforcing steel in cradle or construct piers every 2400 mm (8 ft.) or closer, down to solid load bearing strata. Provide a minimum of one pier per length of pipe. Use the same method where pipes cross.
- .6 Where excavation is necessary in proximity to, and below the level of, any footing, provide a bed of 14,000 kPa (2000 psi) concrete to the level of the highest adjacent footing. Proximity is determined by the angle of response as established by The Contract Administrator.
- .7 Provide support over at least the bottom one third segment of the pipe in all bedding methods.
- .8 Do not open trench ahead of pipe laying and bedding more than weather will permit.
- .9 Break up rocks and boulders and remove these by drilling and wedging. Do not use blasting unless specifically approved by The Contract Administrator. Do not use for backfill.
- .10 Do all backfilling in 150 mm (6") layers with clean selected materials acceptable to The Contract Administrator.
- .11 During freezing weather or where frozen material is excavated, backfill with dry sand.
- .12 Provide concrete thrust blocks at each change of direction for underground water piping, as per drawing details.
- .13 Dispose of surplus excavated material as directed by the Contractor.

3.20

PAINTING

- .1 Provide all exposed ferrous metal work on equipment with at least one factory prime coat, or paint one prime coat on the job. Clean up or wire brush all equipment, etc., before painting. Finish painting will be by other Divisions unless otherwise noted.
- .2 This Sub-Contractor is not required to prime coat or paint ductwork or piping, except to paint gas piping as per code requirements.
- .3 For factory applied finishes, including prime coats, repaint or refinish surfaces damaged during shipment, erection or construction work.

END OF SECTION 210504

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 013300 - Submittal Procedures.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - .2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M, Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533, Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
 - .7 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .8 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .9 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .10 ASTM C921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Thermal Insulation Association of Canada (TIAC)
 - .1 National Insulation Standards 2005.
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 PRODUCT DATA

- .1 Submit Product Data in accordance with Section 013300 - Submittal Procedures.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with 013300 - Submittal Procedures.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.6 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions recommended by manufacturer.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
- .2 Maximum flame spread rating: 25.
- .3 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre: includes glass fibre, rock wool, slag wool.

- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
 - .1 Insulation: ASTM C533.
 - .2 Maximum "k" factor: ASTM C533.
 - .3 Design to permit periodic removal and re-installation.
- .4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: ASTM C547.
 - .2 Jacket: to CGSB 1-GP-52Ma.
 - .3 Maximum "k" factor: ASTM C547.

2.3 CEMENT

- .1 Thermal insulating and finish
 - .1 To: ASTM C449/C449M.
 - .2 Cement on mineral wool, to ASTM C449.

2.4 JACKETS

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: Compatible with insulation.
- .2 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Stucco embossed.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.5 INSULATION SECUREMENTS

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.
- .6 Facing: 25 mm steel hexagonal wire mesh on one face of insulation.
- .7 Fasteners: pins with 35 mm square clips. Length of pin to suit thickness of insulation, trim excess.

2.6 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

PART 3 EXECUTION

3.1 PRE- INSTALLATION REQUIREMENTS

- .1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards
 - .1 Hot equipment: To TIAC code 1503-H.
 - .2 Cold equipment: to TIAC code 1503-C.
- .2 Elastomeric Insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.
- .3 Provide vapour retarder as recommended by manufacturer.
- .4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.
- .5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports outside vapour retarder jacket.

.7 Supports, Hangers:

- .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 EQUIPMENT INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Breechings, engine exhausts and mufflers:

- .1 TIAC code A-2 with 25 mm air gap, mechanical fastenings bands and 13 mm cement reinforced with one layer of reinforcing mesh.

.3 Cold equipment:

.1 Water Meter:

- .1 TIAC A-3 with mechanical fastenings bands and 13 mm cement reinforced with one layer of reinforcing mesh.

- .2 Thicknesses: 50 mm.

.2 Roof Drain Bodies:

- .1 TIAC A-3 with mechanical fastenings.

- .2 Thicknesses: 50 mm.

.4 Finishes:

- .1 Equipment in mechanical rooms: TIAC code CEF/1 with Aluminum jacket.
- .2 Equipment elsewhere: TIAC code CEF/2 with 13 mm cement and treated fabric jacket.

END OF SECTION 210718

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 013300 - Submittal Procedures.
- .2 Section 079200 - Joint Sealing.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - .2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .6 ASTM C921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards 2005.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings

1.3 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.5 SAMPLES

- .1 Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.6 MANUFACTURERS' INSTRUCTIONS

- .1 Submit manufacturers' installation instructions in accordance with Section 013300 - Submittal Procedures.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.7 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 °C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: Rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .5 TIAC Code C-2: Mineral fibre blanket faced with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
- .6 TIAC Code A-6: Flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum metric "k" factor: 0.038.
 - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

2.3 INSULATION SECUREMENT

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.

- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Thermal insulating cement on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type [and sheet] to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: by Contract Administrator.
 - .3 Minimum service temperatures: -20°C.
 - .4 Maximum service temperature: 65°C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.5 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements:
 - .1 UV rated material at least 0.5 mm thick suitable for use outdoors.

- .2 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: Compatible with insulation.
- .3 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Stucco embossed.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.8 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking to: Section 079200 - Joint Sealing.

PART 3 EXECUTION

3.1 PRE- INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: At expansion joints, valves.
- .2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: same as system.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: Tape at 300 mm oc.
 - .2 Seals: Vapour Retardant lap seal adhesive, Vapour Retardant lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .3 TIAC Code: A-3.
 - .1 Securements: Tape at 300 mm oc.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .4 TIAC Code: A-6.
 - .1 Insulation securements: compatible with insulation
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .5 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements: Tape at 300 mm oc.
 - .2 Seals: Vapour Retardant lap seal adhesive, Vapour Retardant lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.

.6 Thickness of insulation to be as listed in following table.

- .1 Run-outs: piping to individual units and equipment not exceeding 4000 mm long.
- .2 Do not insulate exposed run-outs to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic Hot Water Supply	49	A-3	25	25	25	38	38	38
Hydronic Infloor Heating System Supply & Return Piping	49	A-3	25	25	25	38	38	38
Refrigerated Drinking Water		A-1	25	25	25	25	25	25
Domestic Cold Water Supply		A-1	25	25	25	25	25	25
Refrigerant suction	4 - 13	A-6	25	25	25	25	25	25
Rain Water Leaders and Roof Drain Bodies		C-2	25	25	25	25	25	25
Cooling Coil Condensate Drains		A-1	25	25	25	25	25	25

.7 Finishes:

- .1 Exposed indoors: TIAC code CPF/1 with treated canvas jacket.
- .2 Exposed in mechanical rooms: TIAC code CPF/3 with aluminum jacket.
- .3 Concealed, indoors:
 - .1 Valves & fittings to TIAC code CPF/1 with treated canvas jacket.
 - .2 Pipes: No further finish.
- .4 Outdoor Refrigerant Suction Piping: PVC jacket.

END OF SECTION 210720

PART 1 GENERAL

1.1 DESCRIPTION

- .1 Comply with the requirements of Section 210501 Common Work Results - Mechanical General Provisions
- .2 Comply with the requirements of Mechanical Equipment Schedule A Mechanical Specifications Approved Substitute Schedule
- .3 Comply with the requirements of Section 210504 Common Work Results - Mechanical Basic Materials And Methods.

1.2 WORK PERFORMED UNDER THIS SECTION

- .1 Provide the following fire protection systems:
 - .1 Automatic sprinkler systems.
 - .2 Hand held fire extinguishers.

1.3 SEPARATE PRICES

- .1 Refer to Specification Section 210501 for Separate Pricing.
 - .1 Provide Separate Pricing for

1.4 START-UP AND COMMISSIONING

- .1 Start-up and Commissioning shall be undertaken prior to the Occupancy stage of each Construction Phase.
- .2 Provide the Equipment, Personnel and Material necessary to put the Fire Protection Systems into Operation.
- .3 Provide the Equipment, Personnel, Material and Information necessary to assist the Mechanical Subcontractor in completing the Commissioning Process.
- .4 Complete the required forms as set forth in Specification Section 230805 Commissioning.

1.5 REFERENCE STANDARDS

- .1 Do work to the following except where specified otherwise:
 - .1 Federal, Provincial, and Municipal building and fire regulations as approved by the Provincial Fire Marshal and/or the Fire Commissioner of Canada.
 - .2 National Fire Protection Association Standards:
 - .1 NFPA 13, Installation of Sprinkler systems.
 - .2 NFPA 14, Standpipe and hose systems.
 - .3 NFPA 10, Portable Fire Extinguishers.
 - .4 NFPA-20, Fire Pumps
 - .3 Insurer's Advisory guide to NFPA.
 - .4 Factory Mutual System, approval guide.

- .5 FCC 401-M1976 Fire Extinguishers
- .6 FCC 402-1977 Standpipe and Hose Systems
- .7 FCC 403-M1982 Sprinkler Systems
- .8 FCC 410-M1979 Fire Alarm Systems.

1.6 FIRE DEPARTMENT APPROVAL

- .1 The Provincial and/or Municipal Fire Authorities shall approve the design, entire installation, equipment, and materials.
- .2 FCC (Fire Commissioner of Canada) shall approve the design, entire installation, equipment, and materials, as well as inspect the installation and supervise all tests.

1.7 CERTIFICATES

- .1 Provide written certificate that components are compatible, and where applicable, certified for intended use by nationally recognized testing agency.

1.8 SPRINKLER SYSTEM DESIGN CRITERIA

- .1 Design data shall be as specified on the drawings.
- .2 Design to NFPA-13.
- .3 Design to Ordinary Hazard, Group 2.
- .4 Water supply shall be based on the existing Municipal System. Contact the Utility Company for available water supply.
- .5 Design For:
 - .1 Light hazard occupancy.
 - .2 Hydraulic design density to be based on area of sprinkler operation according to NFPA-13 and to FCC requirements.
- .6 Water supply is based on the following:
 - .1 10 l/s at residual pressure of 200 kPa.
 - .2 Combined NPS 6 Domestic/Fire connection from Municipal watermain to edge of building, and separate NPS 2 Domestic and NPS 6 Fire connections entering building.

1.9 SHOP DRAWINGS

- .1 Submit shop drawings of the fire protection system c/w hydraulic calculations to the The Contract Administrator for review. Make any requested changes and resubmit the revised shop drawings to the Authorities Having Jurisdiction, and obtain approvals prior to commencing the work.
- .2 Shop drawings of the fire protection system, including drawings and hydraulic calculations, shall be sealed and signed by a Registered The Contract Administrator in the employ of the Fire Protection Contractor.
- .3 Shop drawings shall clearly indicate:

- .1 Name of Department of Agency.
 - .2 Location, including street address.
 - .3 Point of compass.
 - .4 Ceiling construction.
 - .5 Full height cross section.
 - .6 Location of fire walls.
 - .7 Occupancy of each area or room.
 - .8 Location and size of blind spaces and closets.
 - .9 Any questionable small enclosures in which no sprinklers are to be installed.
 - .10 Size of city main in street, pressure and whether dead-end or circulating and if dead end, direction and distance to nearest circulating main, with city main test results.
 - .11 Other sources of water supply, with pressure or elevation.
 - .12 Make, type and orifice size of sprinklers.
 - .13 Temperature rating and location of high temperature sprinklers.
 - .14 Number of sprinklers on each riser and on each zone by floors, and total area protected by each zone on each floor.
 - .15 Number of sprinklers on each riser and total per floor.
 - .16 Make, type, model and size of alarm.
 - .17 Kind and location of alarm bells.
 - .18 Cutting lengths of pipe or centre to centre dimensions.
 - .19 Crosses, riser nipples and size.
 - .20 Type of hangers, inserts and sleeves.
 - .21 All control valves, checks, drain pipes and test pipes.
 - .22 Small hand hose and hose equipment.
 - .23 Provision for flushing.
 - .24 Name and address of Contractor.
- .4 Over and above that called for above, show the following for hydraulically designed systems:
- .1 Hydraulic reference points to be designated by letter or number and to correspond to the comparable reference points shown in the hydraulic calculation sheets.
 - .2 Description of sprinklers used.
 - .3 System design criteria: minimum rate of water application and water application for both inside and outside hose streams.
 - .4 Actual calculated requirements: total quantity of water and pressure required at a common reference point for each system.
 - .5 Elevation data including relative elevation of sprinkler junction points and supply of reference points.
- .5 Submit calculations of hydraulically designed systems on form sheets, including summary sheet, detailed work sheets and graph sheet.
- .6 On summary sheet, clearly indicate:
- .1 Date.
 - .2 Location.
 - .3 Name of Department or Agency.
 - .4 Building number or other identification.
 - .5 Description of hazard.
 - .6 Name address of contractor or designer.
 - .7 Name of approving agency.
 - .8 System design requirements, including design area of water application, minimum rate of water application density and area per sprinkler.
 - .9 Total water requirements as calculated including allowance for inside hose and outside hydrants.
 - .10 Water supply information.

- .7 On detailed work sheets or computer printout sheets, clearly indicate:
 - .1 Sheet number.
 - .2 Sprinkler description and discharge constant K.
 - .3 Hydraulic reference points.
 - .4 Flow in l/s.
 - .5 Pipe size.
 - .6 Pipe lengths, centre to centre of fittings.
 - .7 Equivalent pipe lengths for fitting and devices.
 - .8 Friction loss in kPa/m of pipe.
 - .9 Total friction loss between reference points.
 - .10 Elevation head in kPa between reference points.
 - .11 Required pressure in kPa at each reference point.
 - .12 Velocity pressure and normal pressure if included in calculations.
 - .13 Notes to indicate starting points, reference to other sheets or to clarify data shown.
- .8 Graph paper of semi-logarithmic type to contain water supply curves and systems requirements plus inside and outside hose requirements so to present a graphic summary of complete hydraulic calculation.
- .9 Include standpipe system cabinets, valves, racks, hoses, and wrenches.
- .10 Include sprinkler system valves, heads, alarms, air compressor and pumps.
- .11 Include portable extinguishers including wall brackets.

1.10 MAINTENANCE DATA

- .1 Provide maintenance data for fire protection equipment for incorporation into the Operation and Maintenance manual.
- .2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

1.11 MAINTENANCE MATERIALS

- .1 Provide lockable metal cabinet containing spare sprinklers of each type and melting point temperature as per NFPA requirements. Install cabinet where indicated. Include sprinkler wrenches and 2 keys, for emergency repair work.

PART 2 PRODUCTS AND MATERIALS

2.1 PIPE AND FITTINGS

- .1 Provide piping and fitting materials as allowed by code.
- .2 Steel pipe:
 - .1 Schedule 40 for sizes under NPS 8, schedule 30 for sizes NPS 8 and over
 - .1 black or galvanized, to ASTM A53-80.
 - .2 Fittings: 1200 kPa working pressure of following:
 - .1 cast iron, screwed, to ANSI B16.4 - 1977, 860 kPa

- .2 malleable iron, screwed, to ANSI B16.3-1977, 860 kPa
- .3 cast iron, flanged, to ANSI B16.1-1975, 860 kPa.
- .4 Mechanical, B31.3-1980.
- .5 All fittings to withstand 1.4 MPa test pressure.
- .3 Flange bolts: Square or hex head bolts with heavy hex nuts to ASTM A307.78.
- .4 Flange gaskets: 1.6 mm thick plain or cloth inserted red rubber to ANSI B16.20-1973 and ANSI B16.21-1978.

.3 Copper pipe and fittings:

- .1 Type K hard copper
- .2 Pipe to bear marking together with listee's name, Type and pipe size.
- .3 ULC listed materials may be used when jointed by means of silver or copper phosphorus brazing compounds to AWS A5.8-77 for systems with maximum working pressure of 1.2 MPa.

2.2 VALVES

- .1 Provide valves approved for Fire Protection Use.
- .2 Valves controlling main water supplies on fire lines and standpipes: equip with contacts and devices necessary for the operation of the supervisory system specified under 'Fire Detection and Alarm System'.
- .3 General:
 - .1 Of one manufacturer, approved for fire protection use
 - .2 ULC listed
 - .3 bearing manufacturer's name trademark and FM identification figure number and pressure rating.
 - .4 Unless otherwise specified or indicated, design for 1.2 MPa working water pressure.
- .4 Valves over NPS 2 shall have rising stems and be repackable under pressure. Provide malleable iron handwheels.
- .5 Valves under NPS 2 use rising or non-rising stems.
- .6 Gate valves:
 - .1 Valves NPS 2 and under: Bronze to ASTM B61-80 double disc and screwed ends.
 - .2 Valves NPS 2½ and over: Underwriters' Laboratories pattern, iron body, bronze mounted, with os&y double disc or wedge, flanged ends.
- .7 Globe valves:
 - .1 Valves NPS 2 and under: bronze to ASTM B61-80 screwed ends, composition disc replaceable without removing valve from line.
 - .2 Valves NPS 2½ and over: iron body, bronze mounted os&y, flanged ends bolted bonnet and yoke, bronze seat, solid bronze disc, seat and disc replaceable without removing valve from line.
- .8 Check valves:
 - .1 Valves NPS 2 and under: bronze to ASTM B61-80 for both horizontal and vertical mounting with replaceable composition disc, screwed cap and ends.

- .2 Valves NPS 2½ and over: Underwriters' Laboratories pattern, iron body, bronze mounted, regrind-renew bronze disc and seat ring, bolted cap flanged ends. Design for either horizontal or vertical mounting.
- .3 Acceptable Manufacturer: Victaulic Style 717 check valve. 4" - 12" only.

2.3 PIPE HANGERS

- .1 Conform to NFPA and Section 210501 Common Work Results - Mechanical General Provisions.

2.4 SIGNS

- .1 Signs: bilingual fabricated from metal with chain suspension; white letters on red background.

2.5 SPRINKLER HEADS

- .1 Provide heads of current manufacturer.
- .2 In concealed spaces, (attic, ceiling space, crawlspace), use brass upright heads.
- .3 In Mechanical Rooms, use brass upright heads.
- .4 In Finished areas with dropped ceilings:
 - .1 Base bid: concealed pendant type with white painted coverplates.
- .5 In Finished areas without dropped ceilings:
 - .1 Chrome plated sidewall type with chrome plated escutcheons, where piping is installed in walls, bulkheads, and neighboring ceiling spaces.
 - .2 Chrome plated upright type, pipe mounted, where piping is exposed.
- .6 Sprinklers shall be listed with, and bear certification marking of, a nationally recognized testing agency.
- .7 Provide minimum NPS 1/2 diameter discharge orifice.
- .8 Provide red wire guards for all heads in gymnasium, shop areas, and parking garages.

2.6 WET PIPE SYSTEM(S)

- .1 Provide complete with the following:
 - .1 Piping and fittings.
 - .2 Hangers.
 - .3 Main indicating control valve.
 - .4 Backflow preventer.
 - .5 Alarm valve(s).
 - .6 Flow and pressure switches.
 - .7 Water pressure gauges.
 - .8 Outside water rotary gong(s).
 - .9 Inside electric gong(s) and circuit closer.
 - .10 Outside electric gong(s) and circuit closer.
 - .11 Automatically controlled Excess Pressure Jockey Pump.
 - .12 Zone Valves and Flow Switches.

- .13 Drain and Test Valves.
- .14 Wall, floor and ceiling escutcheon plates.

- .2 In areas subject to freezing, provide an anti-freeze U-loop as per NFPA-13, c/w valved filling arrangement and anti-freeze solution .

2.7 EXCESS PRESSURE (JOCKEY) PUMP

- .1 Provide in the amounts, locations and arrangements shown on the drawings.
- .2 Excess pressure pump shall be capable of raising system pressure within 15 minutes to 170 kPa (25 psi) in excess of normal pressure.
- .3 All bronze construction, with stainless steel shaft, packing seal, carbon bearings, and accessory package. 1/4HP, 120V, Single Phase. Albany or approved equal in accordance with B6.
- .4 Provide automatic control.
- .5 Provide with supports, safety valve, gauge, starter and connections to wet pipe sprinkler system.

2.8 FIRE DEPARTMENT SIAMESE INLET CONNECTION

- .1 Provide a Fire Department Siamese Inlet Connection to the fire line header system.
- .2 Provide type NPS 2½ female hose connections fitted with caps and chains. Thread connection to suit local fire department.
- .3 Provide not less than NPS 4 piping from connection.
- .4 Provide check valve and automatic drip.
- .5 Designate with bilingual sign having raised letters at least 25 mm (1 inch) in height. Sign shall conform to requirements of local Authority Having Jurisdiction.

PART 3 INSTALLATION AND EXECUTION

3.1 INSTALLATION

- .1 Connect outside water rotary gong to alarm valve as required.
- .2 Do not recess, paint or conceal piping accessories or work prior to inspection and approval.
- .3 Allow for expansion and contraction when installing pipe hangers.
- .4 Discharge drains to a safe location, and arrange them so they can be fully opened without flooding.
- .5 Install signs as required by the Authorities Having Jurisdiction. Secure outdoor signs with stainless steel bolts.
- .6 Install alarm valves and electric gongs as indicated and as specified.

- .7 Install horizontal valves with stems upright where space allows.
- .8 Install fire hose and extinguisher cabinets so the angle valve is 1.5 m (5 feet) above the floor.
- .9 Install fire hose and extinguisher cabinets so the door, when open, does not obstruct any other door opening.
- .10 Install or mount fully charged extinguishers in cabinets or on brackets provided by the extinguisher manufacturer, and as indicated.
- .11 All exposed materials, except pipe and fittings, shall be chrome plated.
- .12 Ceiling Heads mounted in T-bar/Acoustic Tile Ceilings shall be centered both ways.
- .13 Ceiling Heads mounted in the same room shall be mounted in-line with each other.
- .14 Coordinate head locations with other ceiling components such as lighting, diffusers, etc. Refer to Architectural Reflected Ceiling Plans.
- .15 Coordinate head locations with room furnishings, cabinets, cupboards, etc. Refer to Architectural Plans.

3.2 FIELD QUALITY CONTROL

- .1 Upon completing the installation of the piping and apparatus for the systems, test the joints for tightness and condition. When testing with water, install pressure gauge(s) at the highest point of installation. If it is impossible to test the whole installation in a single operation, sub-divide the system(s) into several zones and test each zone in the manner described.
- .2 Hydrostatically test the system(s), including the water supply connection(s) and fire department connection(s), at 350 kPa (50psi) in excess of normal working pressure but not less than 1035 KPa (150psi) for 2 h without loss of pressure.
- .3 Subject systems and equipment to operational test.
- .4 During tests, repair any leaks and replace or repair any defective part(s). Perform test over again until satisfactory results are obtained.
- .5 Provide a written report describing the testing, and certifying that the system is complete and operational.
 - .1 This Report shall be Signed and Sealed by an The Contract Administrator in the Employ of the Fire Protection Contractor.

3.3 ADJUSTMENT

- .1 Adjust equipment to the satisfaction of the Authorities Having Jurisdiction and the The Contract Administrator.

3.4 PROTECTION OF COMPLETED WORK

- .1 Assume responsibility for protecting heads during painting. Replace damaged and painted components.

- .2 Except where special finishes are factory provided, exposed steel pipe and fittings shall be painted in accordance with the Painting Specifications.
- .3 Securely mount red wire guards for sprinkler heads where specified.
- .4 In Paint Spray Booths, cover the sprinkler head with an ordinary paper bag held in place by a rubber band.

3.5 START-UP AND COMMISSIONING

- .1 Prior to the Occupancy Stage of each Construction Phase:
 - .1 Start up the Equipment and Systems as per Specification Section and Section 230805 Commissioning.
 - .2 Calibrate and Adjust all items provided under this contract.
 - .3 Assist in the commissioning Process as required. Refer to Specification Section 230805 Commissioning.
 - .4 Provide instructions to the The City as required. Refer to Specification Section 210501 Common Work Results - Mechanical General Provisions.

END OF SECTION 211313