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1 GENERAL

1.01 WORK DESCRIBED BY CONTRACT DOCUMENTS

- .1 The work of this contract comprises of the following scopes at the Gulf of Georgia Cannery Administration Building, located at 12138 Fourth Avenue, Richmond BC.:
 - .1 Building enclosure renewals,
 - .2 Partial seismic upgrades,
 - .3 Mechanical and electrical system upgrades.
- .2 Work to be performed under this Contract includes items covered in section 01 01 10 – Scope of Work of Contract documents and the following:
 - .1 Review of testing reports provided with Contract documents. Based on findings of testing reports provided with Contract documents: Contractor to determine if asbestos and lead abatement procedure is required.
 - .3 Contractor shall take possession of the project area and be contractually responsible for all construction activities. Cooperate with Parks Canada in scheduling operations to minimize conflict and to facilitate usage.

1.02 TIME OF COMPLETION

- .1 Commence work upon notification of acceptance and complete work within twenty four (24) weeks.

1.03 MINIMUM STANDARDS

- .1 Work to conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the National Building Code of Canada 2015 (NBC) and applicable Provincial and Municipal codes. In the case of conflict or discrepancy, the most stringent requirement applies.
- .2 Work must be carried out in conformance to WorkSafe BC safety standards and requirements.
- .3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.

1.04 CONTRACT DOCUMENTS

- .1 The Contract documents, drawings and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the work. Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work. Drawings have been prepared in colour for clarity purposes and are intended to be printed in colour. Contractor is responsible for any misinterpretations caused as a result of printing in black and white.

1.05 DIVISION OF SPECIFICATIONS

- .1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.

- .2 A division may consist of the work of more than one subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.
- .3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

1.06 TAXES

- .1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

1.07 REGULATORY REQUIREMENTS

- .1 A Building Permit is not required. Obtain and pay for - Certificates, Licenses and other permits required by regulatory municipal, provincial or federal authorities to complete the work.
- .2 Provide inspection authorities with plans and information required for issue of acceptance certificates.
- .3 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.

1.08 PROJECT MEETINGS

- .1 Contractor will schedule a project start-up meeting following notice of acceptance.
- .2 Agenda to include lines of communication, contact information, scheduling and coordination.
- .3 Subsequent meetings will be called as required.

1.09 CONTRACTOR'S USE OF SITE

- .1 Use of site:
 - .1 The Gulf of Georgia Cannery Administration Building will remain open. Parks Canada Western Region has control over the building. All activities and security controls must remain operational at all times unless otherwise indicated. Coordinate with the Departmental Representative for all activities that impact on-going operations.
 - .2 Work restrictions and security provisions will be enforced.
 - .3 Assume responsibility for assigned premises for laydown and storage areas as indicated and for performance of this work.
 - .4 Be responsible for coordination of all work activities on site, including the work of other contractors engaged by the Departmental Representative.
- .2 Perform work in accordance with Contract documents.
- .3 Do not unreasonably encumber site with material or equipment.
- .4 Maintain scaffolding and hoarding throughout duration of work. Do not exceed areas indicated unless written approval by Departmental Representative is provided.
- .5 Execute work with least possible interference or disturbance to normal use. Make arrangements with Departmental Representative to facilitate work as stated.

- .6 Maintain existing services and provide for personnel, visitor and vehicle access.
- .7 Where security is reduced by work, provide temporary means to maintain security. Review measures with Departmental Representative before proceeding.
- .8 **Provide temporary heating inside the building to maintain acceptable operating conditions for staff during mechanical system down-time and upgrades. Interior temperatures to be maintained between 20°C and 25°C.**

1.10 HOURS OF WORK

- .1 The Gulf of Georgia Cannery Administration Building is operational for staff daily from 08:30 to 17:30.
 - .1 Interior work must be carried out after hours or phased in coordination with Parks Canada staff to ensure continued use of Administration Building by staff.
- .2 Hours of work:
 - .1 Contractor may submit work schedule in cooperation with Departmental Representative.
- .3 Notify Departmental Representative and seek approval of all after hours work, including weekends and holidays.

1.11 SECURITY

- .1 For Contractor access to building interior and for contractor access to exterior work after 17:30 hours, coordinate with and pay for the services of a commissionaire from the BC Commissionaires from the time of beginning work on site until substantial completion of the work. The contractor shall provide the Departmental Representative with an estimate of the total cost for that requirement after contract award at which time the Departmental Representative will then contract directly with Commissionaires BC for that work and pay for those costs directly accordingly since they will not work directly for the contractor. Upon completion of the contract work, a change order credit will be issued for the full cost of the Commissionaires so the contractor shall allow for that cost in their contract pricing. Contractor can refer to the following web site as a reference:
<http://www.commissionaires.bc.ca>
- .2 Provide required service for any security to contractor's forces for further works to be done between substantial and final completion.

1.12 NON SMOKING ENVIRONMENT

- .1 Smoking is not permitted on site.

1.13 WORK SCHEDULE

- .1 Provide detailed project schedule (Gantt Bar Chart) within 5 working days of Award of Contract date showing activity sequencing, interdependencies and duration estimates. Include listed activities as follows:
 - .1 Shop drawings.
 - .2 Samples.
 - .3 Approvals.
 - .4 Procurement.
 - .5 Construction.
 - .6 Installation.

- .7 Site works.
- .8 Testing.
- .9 Acceptance.

- .2 Do not change approved schedule without notifying and receiving approval from Departmental Representative.

- .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.

- .4 Schedule Work in consultation with Departmental Representative to minimize impact on public use of facility during operating hours.

1.14 SUBMITTALS

- .1 Product Data: Manufacturers catalogue sheets, brochures, literature, performance charts and diagrams.
 - .1 Submit electronic copies of documentation.
 - .2 Delete information not applicable to project.
 - .3 Cross-reference product data information to applicable portion of Contract Documents.

- .2 Samples: examples of materials, equipment, quality, finishes and workmanship.
 - .1 Provide two samples of each material as indicated in technical sections.
 - .2 Where colour, pattern or texture is criterion, submit full range of samples.
 - .3 Reviewed and accepted samples will become standard of workmanship and material against which installed work will be verified.

- .3 Shop Drawings:
 - .1 Submit electronic copies of all shop drawings to include:
 - .1 Date.
 - .2 Project Title and number.
 - .3 Name and address of Subcontractor, Supplier and Manufacturer.
 - .4 Fabrication.
 - .5 Key plan and layout, showing dimensions, including identified field dimensions and clearances.
 - .6 Setting or erection details.
 - .7 Relationship to adjacent work.
 - .8 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .9 Revised shop drawing submissions to be bubbled identifying revisions.
 - .2 Submit drawings stamped and signed by professional engineer registered and licensed in the Province of British Columbia as indicated.

1.15 COST BREAKDOWN

- .1 Before submitting the first progress claim, submit a breakdown of the Contract lump sum prices in detail as directed by the Departmental Representative and aggregating Contract price.

1.16 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:

- .1 Contract Drawings.
- .2 Contract Specifications.
- .3 Addenda to Contract Documents.
- .4 Copy of approved work schedule.
- .5 Environmental Protection Plan.
- .6 Reviewed and approved Shop Drawings.
- .7 List of Outstanding Shop Drawings.
- .8 Change Orders.
- .9 Other Modifications to Contract.
- .10 Field Test Reports.
- .11 Reviewed and approved samples.
- .12 Copy of Approved Work Schedule.
- .13 Manufacturer's installation and application instructions.
- .14 National Building Code, 2015.
- .15 Health and Safety Plan and Other Safety Related Documents.
- .16 Other documents as specified.

1.17 HEALTH, SAFETY AND HAZARDOUS MATERIALS

- .1 Comply with Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Comply with British Columbia Workers Compensation Act.
- .3 Perform duties in accordance with the British Columbia Occupational Health and Safety Regulation.
- .4 Submit copies of WCB Clearance Letter and WCB Contractor Rating. Submit copy of Final WCB Clearance Letter at completion of project.
- .5 Submit letter stating that Contractor assumes the role of Prime Contractor for the purposes of site safety responsibility and the Workers Compensation Act.
- .6 Submit copies of work site health and safety meeting minutes, inspection reports, reports or directions issued by Federal, Provincial or Municipal health and safety inspectors, incident and accident reports, and follow-up reports.
- .7 Work at site may involve contact with PCB and lead-containing paint. Take appropriate precautions.
- .8 Notify the Departmental Representative 48 hours for access to interior work and advise if work involves hazardous substances (Canada Labour Code, Part II, Section 10) or caulking.
- .9 Ensure fire code requirements are continued to be met during the course of construction. Ensure emergency exits from the building, exterior emergency egress paths, or access areas for emergency vehicles are not restricted.

1.18 EXAMINATION

- .1 Examine site and be familiar and conversant with existing conditions likely to affect work.
- .2 Provide photographs of surrounding objects and structures liable to be damaged or be the subject of subsequent claims (photographs not to include staff on duty).

1.19 EXISTING SERVICES

- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by the authorities having jurisdiction.

1.20 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment indicated or specified are to be considered as approximate.
- .2 Locate equipment to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain his approval for actual location.
- .4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative and/or as specified.

1.21 SETTING OUT OF WORK

- .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Provide devices needed to lay out and construct work.

1.22 ACCEPTANCE OF SUBSTRATES

- .1 Each trade shall examine surfaces prepared by others and job conditions which may affect his work, and shall report defects to the Contractor. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

1.23 QUALITY OF WORK

- .1 Remedial Work:
 - .1 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of work.
 - .2 Perform remedial work required to repair or replace part or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Ensure that quality workmanship is performed through use of skilled and experienced tradesmen, under supervision of qualified journeyman.
- .3 The workmanship, erection methods and procedures to meet minimum standards set out in the National Building Code Construction Standards.
- .4 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative whose decision is final.

1.24 WORKS COORDINATION

- .1 Coordinate work of subtrades:
 - .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.

- .2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
 - .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
 - .2 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
 - .1 Pay particularly close attention to overhead work or near to building structural elements, including existing roof.
 - .2 Identify on coordination drawings, building elements and interface requirements.
 - .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
 - .4 Publish minutes of each meeting.
 - .5 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.
- .3 Submit shop drawings and of rebuilt components only after coordination meeting for such items has taken place.
- .4 Work cooperation:
 - .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of interference.
 - .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, patching and removal or replacement of completed work.
 - .3 Ensure disputes between subcontractors are resolved.
- .5 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.
- .6 Maintain efficient and continuous supervision. Full-time site superintendent required throughout project.

1.25 APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 In accordance with Section 01 33 00 - Submittals Procedures, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.
- .2 Allow sufficient time for the following:
 - .1 Review of product data.
 - .2 Approval of shop drawings.
 - .3 Review of re-submission.
 - .4 Ordering of approved material and/or products - refer to technical sections.

1.26 TESTING AND INSPECTIONS

- .1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative.
- .2 The Contractor will appoint and pay for the services of testing agency or testing laboratory as specified, and where required for the following:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.

- .1 Mill tests and certificates of compliance.
 - .2 MPI Painting Inspections.
 - .3 Tests specified to be carried out by Contractor under the Departmental Representative's supervision.
- .3 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of corrected work.
- .4 Contractor shall furnish labour and facilities to:
- .1 Notify Departmental Representative in advance of planned testing.
- .5 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .6 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
- .7 The Departmental Representative may require, and pay for, additional inspection and testing services.
- .8 Provide Departmental Representative with 2 copies of testing laboratory reports as soon as they are available.

1.27 AS-BUILT DOCUMENTS

- .1 The Departmental Representative will provide 2 sets of drawings, 2 sets of specifications, for "as-built" purposes.
- .2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.

1.28 CLEANING

- .1 Daily conduct cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.
- .2 Ensure cleanup of the work areas each day after completion of work.
- .3 In preparation for interim and final inspections:
 - .1 Examine all sight-exposed exterior surfaced and concealed spaces.
 - .2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed exterior finished surfaces, including glass.
- .4 Use cleaning materials and methods in accordance with instructions of the manufacturer of the surface to be cleaned.

1.29 PUBLIC WAY CONSTRUCTION

- .1 Design, erect and maintain hoarding and covered pedestrian walkways to support all loads including windloads and provide protection, complete with signs and electrical lighting as required by authority having jurisdiction and Departmental Representative.

1.30 RELICS AND ANTIQUITIES

- .1 Relics and antiquities and items of historical or scientific interest shall remain property of Department. Protect such articles and request directives from Departmental Representative.
- .2 Give immediate notice to Departmental Representative if evidence of historical or archeological finds are encountered during remediation work and await Departmental Representative's written instructions before proceeding with work in this area.

1.31 ENVIRONMENTAL PROTECTION

- .1 Contractor is responsible for environmental protection during all construction activities at all locations work is performed.
- .2 Prevent extraneous materials from contaminating air beyond construction area, by providing temporary extensions to Mechanical intake louvres during work.
- .3 Environmental degradation arising from construction activities shall be prevented, abated, controlled and minimized by complying with all applicable federal, provincial and local laws and regulations concerning environmental pollution control and abatement.
- .4 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers. Construction methods shall be employed to ensure no fuels, oils, wood preservatives or other contaminants enter the Fraser River. As general Mitigation Measures for this project, it must be enforced and closely supervised and monitored as follows:
 - .1 All contractors and work crews must be briefed upon the importance of adhering to prescribed best practices or mitigation measures. Project meeting prior to commencement of the work shall indicate the above requirements have been fully explained to the contractor and staff.
 - .2 A copy of the mitigation measures shall be posted in a conspicuous location on site or readily accessible for reference.
 - .3 Conduct work in a manner which clearly separates visitors from the active construction area on site to minimize potential accidents for public safety.
 - .4 Contractor and sub trade personnel must develop and maintain spill response and reporting procedures including containment methods. In the event of a spill, contact the Provincial Emergency Program at 1-800-663-3456.
 - .5 The Contractor is to have personnel on site that are trained and ready to use spill containment kits. Ensure proper disposal procedures in accordance with all applicable provincial and municipal regulations. Fires and burning of rubbish on site is not permitted.
 - .6 The Contractor must have all spill containment kits ready for immediate deployment, containing sufficient quantities of absorbent materials on site in close proximity to working machinery and equipment such as fuel portable generator, air compressors, hoist and tools.
 - .7 Ensure all equipment used on site is clean and free from contaminants.
- .5 Ensure proper disposal procedures in accordance with all applicable provincial regulations.

1.32 MAINTENANCE MATERIALS, SPECIAL TOOLS AND SPARE PARTS

- .1 Specific requirements for maintenance materials, tools and spare parts are specified in individual technical sections.

1.33 ADDITIONAL DRAWINGS

- .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with plans referred to in the Contract documents.
- .2 Upon request, Departmental Representative may furnish up to a maximum of 5 sets of Contract documents for use by the Contractor at no additional cost. Should more than 5 sets of documents be required the Departmental Representative will provide them at additional cost.

1.34 SYSTEM OF MEASUREMENT

- .1 The metric system of measurement (SI) will be employed on this Contract.

1.35 SUBMISSION OF TENDER

- .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

2 PRODUCTS

2.01 NOT USED

- .1 Not used.

3 EXECUTION

3.01 NOT USED

- .1 Not used.

END OF SECTION

GENERAL

1.01 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.02 SCOPE OF WORK

- .1 Connect to the utility company's gas meter set, or to the supplier's site mounted storage tank.
- .2 Provide all gas piping, fittings, valves, pressure regulators, unions, hangers and supports, and all other components as required for a complete installation generally as depicted on the drawings.
- .3 Distribute gas to all gas outlets, appliances and equipment that require gas service.
- .4 Submit to the Provincial Gas Inspection Department documentation and detailed drawings as required, pay for and obtain a permit and approval for the gas installation prior to commencing work.
- .5 All materials and installations shall comply with CAN/CSA B149.1 Natural Gas and Propane Installation Code, and B.C. Code Amendments.

1.3 PAINTING AND COLOR CODING

- .1 Painting of all gas piping, equipment and material installed under this Division of the specification shall be included under this Division of the work.
- .2 Paint all exterior piping including the section of piping from the gas meter or tank to the building entry, and all exterior pressure regulating valve vent piping.
- .3 Painting shall consist of one coat of Rust-Oleum 769 damp proof red primer, one coat of Rust-Oleum 960 zinc chromate and two finish coats of Rust-Oleum 850 grey enamel paint.
- .4 Provide yellow color coding identification banding of the gas piping as required by the gas code.

2 PRODUCTS

2.01 BELOW GROUND PIPING

- .1 No gas piping shall be installed below the building.

2.02 ABOVE GROUND PIPING

- .1 Schedule 40 seamless carbon steel to ASTM A53 and CSA B-63.

2.03 FITTINGS

- .1 Screwed fittings up to 50 mm diameter shall be malleable iron with beaded ends, Class 150 to ANSI B16.3.
- .2 Welded fittings 65 mm and larger shall be forged steel of the same weight as the connecting pipe. Steel butt weld fittings to ANSI B16.9a. Steel pipe flanges and flanged fittings to ANSI B16.5.
- .3 Unions shall be malleable iron with ground joints to ANSI B16.3.
- .4 Thredolets or Weldolets: - Acceptable Products: Grinnell, Anvil, CCTF, Bonny Forge.
- .5 Provide dielectric fittings where a buried service enters and connects to the building piping.

2.04 JOINT MATERIALS

- .1 Screwed: Thread lubricant or teflon paste.
- .2 Teflon tape is unacceptable.
- .3 Flanged: Full faced gasket materials to ANSI B16.20, ANSI B16.21 or ANSI B21.11, flanged steel weld neck, raised face type, carbon steel (ASTM A307) square headed bolts with hexagon nuts to ANSI B18.2.1 and ANSI B18.2.2. Bolts shall be full diameter of bolt holes.

2.05 MANUAL ISOLATION VALVES

- .1 Provincial Gas Department approved and suitable for the temperature to which they are exposed.
- .2 Screwed end valves up to 50 mm and flanged end valves 65 mm and larger.
- .3 Acceptable Products: Red & White / Toyo 5044A, Kitz 58, Homestead 601, Emco, Mueller, Rockwell, DeZurik.

2.06 PRESSURE REGULATING VALVES

- .1 High tensile iron body with synthetic rubber diaphragm and valve disc.
- .2 CSA listed for use in gas piping systems.
- .3 Acceptable Products: Rockwell, Fischer.

3 EXECUTION

3.01 PIPE JOINTING

- .1 Install all piping in accordance with CSA B149.1, Natural Gas and Propane Installation Code.
- .2 Cut pipe ends square utilizing proper pipe cutting tools. Ream pipe ends and clean scale and dirt from inside and outside the pipe before and after assembly.
- .3 Protect all openings in piping and equipment, by capping or plugging to prevent the entry of dirt or debris during construction.

- .4 Slope piping down in the direction of flow to low points and provide dirt legs with capped ends.
- .5 Interior gas piping - screw or weld up to 50 mm [2"]; weld 65 mm [2½"] and larger.
- .6 Interior gas piping located in unvented spaces, in supply or return air ceiling plenums, or operating at 35 kPa [5 psi] pressure or higher - weld all sizes.
- .7 Exterior gas piping - weld all sizes. Use welding tees to make all branch connections, except those less than half the diameter of the main. Branch connections less than half the diameter of main may be made with weldolets or threadolets.
- .8 Use eccentric reducers at changes in pipe size, to provide for positive drainage.
- .9 Remake all leaking joints.
- .10 Do not paint dielectric isolating couplings.
- .11 Provide pressure regulators and lockable shut-off valves at the discharge of the gas meter before entry into the building.
- .12 Provide heat shrink factory extruded polyethylene sleeves over bare metallic pipe at welds.

3.02 CONNECTIONS TO EQUIPMENT, APPLIANCES AND SPECIALTY COMPONENTS

- .1 Provide a manual isolation valve on each branch line to an individual piece of equipment, appliance and gas outlet or specialty component upstream of dirt legs, unions and flanges.
- .2 Install unions or flanges on connections to all pressure regulators, equipment, appliances and specialty components.
- .3 Arrange piping connections to allow ease of access and for removal of equipment.
- .4 Align and independently support piping connections to prevent piping stresses being transferred to equipment.

3.03 MANUAL ISOLATION VALVES

- .1 Install gas manual isolation valves complete with handles at the following locations:
 - .1 At all locations shown on the drawings.
 - .2 At the service entry point to each building immediately prior to entry.
 - .3 Immediately upstream of all pressure regulating valves.
- .2 All building isolation valves shall possess locking lugs.

3.04 SEISMIC ACTUATED SHUT-OFF VALVES

- .1 Install gas seismic actuated automatic shut-off valves at the service entry point to each building immediately prior to entry.

3.05 PRESSURE REGULATING VALVES

- .1 Install pressure regulating valves in each equipment room or at each piece of equipment where the gas supply pressure exceeds low pressure ("W.C.).

- .2 Pipe the relief vent ports full diameter to atmosphere in accordance with the requirements of CSA B149.1, Natural Gas and Propane Installation Code.

3.06 VENT TERMINALS

- .1 Terminate vent outlets to atmosphere at the following minimum lateral distances:
 - .1 1.5 metres from any door, openable window or building opening including building mechanical exhaust openings and louvers.
 - .2 3.0 metres from any mechanical forced air intake.

END OF SECTION

1.1 SECTION INCLUDES

- .1 Pipe and pipe fittings.
- .2 Equipment: Water heaters, pumps.

1.2 RELATED SECTIONS

- .1 Section 23 05 00 - Mechanical Requirements.

1.3 SUBMITTALS

- .1 Section 01 33 10: Submission procedures.
- .2 Shop Drawings: Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, finishes, connections to other equipment and piping, performance data, power requirements, and certified pump curves.
 - .1 Installation Data: Manufacturer's special installation requirements.
 - .2 Manufacturer's Certificate: Certify that specified Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Section 01 70 00: Submission procedures.
- .2 Operations and Maintenance Data:
 - .1 Include fixture trim exploded view and replacement parts lists.
 - .2 Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- .3 Record Documentation: Accurately record actual locations of piping and floor drains.

1.5 WARRANTY

- .1 Warranty Period:
 - 1.1 Five (5) years all products unless otherwise noted.
 - 1.2 Heating Appliance Warranty - Combination domestic water heater and in-line circulator
 - 1) Package: Five Year Parts and Labour,
 - 2) Heat Exchangers: ten years.

Part 2 Products

2.1 WATER PIPING, ABOVE GRADE

- .1 Copper tubing type K hard drawn; with cast brass or wrought copper fittings; 95/5 solder joints.

2.2 FLANGES, UNIONS, AND COUPLINGS

- .1 Pipe Size 50mm and Under: Malleable iron unions for ferrous piping; soldered bronze unions for copper pipe.

2.3 BALL VALVES

- .1 Valves Up to 50 mm: Bronze body, stainless steel ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends with union.

2.4 GAS COCKS

- .1 Cocks Up to 50 mm: Bronze body, bronze tapered plug, non-lubricated, teflon packing, threaded ends.

2.5 SWING CHECK VALVES

- .1 Valves Up to 50mm: Bronze swing disc, solder or screwed ends.

2.6 WATER PRESSURE REDUCING VALVES

- .1 Valves Up to 50mm: Bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, double union ends.

2.7 RELIEF VALVES

- .1 Valves: Bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.8 COMMERCIAL GAS FIRED COMBI WATER HEATER, CB-1

- .1 Automatic, natural gas-fired, demand heating/domestic water unit with stainless steel dual primary and secondary heat exchangers suitable and approved for light commercial application.
- .2 Fully self-contained controls with separate domestic hot water and hydronic set-point and reset curves, set-back and all low water and safety cut-outs.
- .3 Integral heating circulation pump.
- .4 Suitable for coaxial sealed combustion venting.
- .5 Nominal efficiency: 94% at return water temperature.
- .6 Shall come complete with condensate neutralizer, outdoor reset sensor, coaxial venting assembly for vertical application (roof) and integrated pump controller.
- .7 Basis of Design/Standard of Acceptance: NTI Trinity Tx.
- .8 Capacity:
 - .1 Domestic water production: 0.32 l/s at 10C IncWT, 49C OWT (5.1 GPM at 50F incoming water temperature, 120F outlet water temperature)
 - .2 Heating capacity: 13kW (44.8 MBH) Heating at 0.23 l/s (3.5 USGPM); temp LWT 160 (71c) with 130 (54c) EWT ret water (condensing)
- .9 Acceptable Products: NTI, Navien NCB-E

Part 3 Execution

3.1 INSTALLATION

- .1 Install equipment in accordance with manufacturer's instructions.
- .2 Install piping to conserve building space and not interfere with use of space. Route piping in orderly manner and maintain gradient. Group whenever practical at common elevations.
- .3 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide clearance for installation of insulation and access to valves and fittings.
- .4 Slope water piping and arrange to drain at low points.
- .5 Install unions downstream of valves and at equipment or apparatus connections.
- .6 Provide non-conducting dielectric connections wherever jointing dissimilar metals. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- .7 Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- .8 Install globe valves for throttling, bypass, or manual flow control services.
- .9 Install water hammer arrestors complete with accessible isolation valve.

3.2 SERVICE CONNECTIONS

- .1 Make connections to existing services in building.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Pipe and pipe fittings, valves, strainers,
- .2 Expansion tanks, air vents, air separators.
- .3 Valves, relief valves.
- .4 Circulators and pumps.

1.2 RELATED SECTIONS

- .1 Section 23 05 50 - Mechanical Insulation.

1.3 SUBMITTALS

- .1 Section 01 33 00: Submittal Procedures.
- .2 Product Data: Include manufacturer's data on pipe material pipe fittings, valves and accessories.
- .3 Shop Drawings:
 - .1 Include component sizes, rough-in requirements, service sizes, and finishes. Include produce description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
 - .2 Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- .4 Manufacturer's Certificate: Certify that specified Products meet or exceed specified capacities.

1.4 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Closeout Submittals.
- .2 Operations and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, assembly views and replacement parts list.
- .3 Record Documentation: Accurately record actual locations of piping and pumps. Record changes in piping location and type.

1.5 QUALITY ASSURANCE

- .1 All works to comply with the requirements of Codes Canada 2015, or the BC Building Code 2012, whichever is more stringent.
- .2 Conform to ASME (Boiler and Pressure Vessels Code) BPVC-VIII - Rules for Construction of Pressure Vessels for manufacture of tanks.
- .3 Conform to ASME B31.9 - Building Services Piping.

Part 2 Products

2.1 HEATING WATER PIPING

- .1 Copper Tubing: Type L hard drawn, with cast brass or wrought copper fittings, 95/5 solder or silver braze.

2.2 EQUIPMENT DRAINS AND OVERFLOWS

- .1 Copper Tubing: Type M hard drawn, with cast brass or wrought copper fittings, 95/5 solder or silver braze.
- .2 PVC Pipe: Schedule 40 or SDR 21 or 26, with PVC fittings, solvent weld joints.

2.3 FLANGES, UNIONS, AND COUPLINGS

- .1 Pipe Size 50mm and Under: Malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- .2 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.4 GLOBE VALVES

- .1 Up to 50mm: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, solder or screwed ends, with back seating capacity.

2.5 BALL VALVES

- .1 Up to 50mm: Bronze one piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends with union.

2.6 PLUG COCKS

- .1 Up to 50mm: Bronze body, bronze tapered plug, non-lubricated, teflon packing, threaded ends, with wrench operator.
- .2 Over 50mm: Cast iron body and plug, pressure lubricated, teflon packing, flanged ends, with wrench operator with set screw.

2.7 SWING CHECK VALVES

- .1 Up to 50mm: Bronze swing disc, solder or screwed ends.
- .2 Over 50mm: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

2.8 SPRING LOADED CHECK VALVES

- .1 Iron body, bronze trim, stainless steel spring renewable composition disc, screwed, wafer or flanged ends.

2.9 RELIEF VALVES

- .1 Bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 HYDRONIC HEATING COIL, HC-1

- .1 Aluminium fins on copper tubing, and header(s) with galvanized metal frame, suitable for installation in sheet metal plenum.
- .2 Nominal size: 700 x 700 (28" x 28"), 14 fpi, 2 row-3 circ heating service.
- .3 Net Capacity: 13 kw at 0.23 l/s (44.3 mbh at 3.5 USGPM), at 70C (160 F) EWT, 15.5C (60 F) EAT, 54 C (130 F) LWT
Nominal air flow: 755 l/s at 50 Pa APD (1600 cfm at 0.2" wg)
- .4 Acceptable Products: Heatcraft, Ventrol

2.11 DIAPHRAGM - TYPE COMPRESSION EXPANSION TANKS

- .1 Compression Tank: Welded steel with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- .2 Accessories: Pressure gage and air-charging fittings, tank drain; pre-charge to .
- .3 Size: to suit capacity of service.

2.12 AIR VENTS

- .1 Manual Air Vents: 3 mm brass needle valve.
- .2 Float Type: Brass or semi-steel body, copper float, stainless steel valve and valve seat, isolating valve.
- .3 Washer Type: Brass with hydroscopic fibre discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.13 AIR SEPARATORS

- .1 In-line Air Separators: Cast Iron for Sizes 40 mm and smaller, or steel for sizes 50mm and larger.

2.14 STRAINERS

- .1 Size 50mm and Under: Screwed Brass or iron body Y pattern with 0.8 mm stainless steel perforated screen.

Part 3 Execution

3.1 INSTALLATION

- .1 Install equipment in accordance with manufacturer's instructions.
- .2 Install piping to conserve building space and not interfere with use of space and other work. Route piping in orderly manner and maintain gradient. Group whenever practical at common elevations.
- .3 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide clearance for installation of insulation and access to valves and fittings.

- .4 Slope piping and arrange to drain at low points. Use eccentric reducers to maintain top of pipe level.
- .5 Provide valved drain and hose connection on strainer blow down connection.
- .6 For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- .7 Pipe relief valve outlet to nearest floor drain.
- .8 Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings.

3.2 APPLICATION

- .1 Use grooved mechanical couplings and fasteners only in accessible locations.
- .2 Install unions downstream of valves and at equipment or apparatus connections.
- .3 Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- .4 Install gate, ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- .5 Install globe, ball or butterfly valves for throttling, bypass, or manual flow control services.
- .6 Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.
- .7 Provide 20 mm (3/4 inch) drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- .8 Provide manual air vents at system high points and as indicated.
- .9 Provide air separator on suction side of system circulating pump and connect to expansion tank.
- .10 Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

END OF SECTION

Part 1 General**1.1 SECTION INCLUDES**

- .1 Materials and methods for mechanical work.

1.2 RELATED SECTIONS

- .1 Division 01 - General Requirements.

1.3 INTENT

- .1 Provide complete and fully operational mechanical systems with facilities and services to meet requirements described herein and in complete accord with applicable codes and ordinances.
- .2 Drawings are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and quality and are not detailed installation instructions.
- .3 Connect to equipment furnished in other sections and by Owner, including uncrating equipment, installing, starting, and testing.

1.4 CUTTING AND PATCHING - EXECUTION

- .1 Locate holes and provide sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.
- .2 Perform patching in finished construction of building under the sections of specifications covering these materials.

1.5 SEISMIC RESTRAINT

- .1 Provide restraint on all piping, ductwork, equipment and machinery, which is part of the building mechanical service systems to prevent injury or hazard to persons and equipment and to retain equipment in its normal position in the event of an earthquake. This specification covers equipment, which is not specifically covered in SMACNA.
- .2 Provide all seismic restraint related hardware, (including bolts and anchors) from point of attachment to equipment through to and including attachment to structure.
- .3 When equipment is mounted on concrete housekeeping pads, and / or concrete curbs the anchor bolts shall extend through the pad into the structure.
- .4 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.
- .5 Seismic restraints may only be omitted where permitted by SMACNA.

1.6 SHOP DRAWINGS AND PRODUCT DATA

- .1 Section 01 33 00: Submittal Procedures.
- .2 Indicate manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Indicate sizes, types, model numbers, ratings, capacities and options being proposed.
- .3 Include dimensional data for roughing in and installation, and technical data sufficient to confirm that equipment meets requirements of drawings and specifications.
- .4 Include wiring, piping and service connection data, motor sizes complete with voltage ratings and schedules.
- .5 Manufacturer's Certificate: Certify that specified Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Closeout Submittals.
- .2 Operations and Maintenance Data: Provide capacity extension type catalogue binders bound with heavy fabric, hot stamped lettering front and spine. Provide [two (2)] copies to Owner and one (1) copy to Consultant.
 - .1 Index binder to following system:
 - .1 Tab - 1.0 - Mechanical Systems: Title page with clear plastic protection cover.
 - .2 Tab - 1.1 - List of Mechanical Drawings.
 - .3 Tab - 1.2 - Description of Systems: Provide complete and detailed description of systems.
 - .4 Tab - 1.3 - Operating Division: Provide complete and detailed operation of major components.
 - .5 Tab - 1.4 - Maintenance and Lubrication Division: Provide preventative maintenance and lubrication schedule for major components.
 - .6 Tab - 1.5 - List of Equipment Suppliers and Contractors: Provide list of equipment suppliers and contractors, including address and telephone number.
 - .7 Tab - 2.1 - Certification: Include copy of test data on heating system, tests performed on piping systems, balancing data for air and water systems, valve tag identification and pipe colour code, inspection approval certificates for plumbing, heating, and ventilation systems and operational tests on gas-fired equipment.
 - .8 Tab - 3.1 - Shop Drawings and Maintenance Bulletins: Provide materials received in compliance with clause 'Shop Drawings', arrange alphabetically.
 - .2 Submit documents to Consultant for approval prior to being turned over to the Owner.
- .3 Record Drawings and Documentation:

- .1 Keep on site, an extra set of Drawings and specifications recording changes and deviations daily.
- .2 Accurately record actual locations and tags.
- .3 Contractor to provide digital and hard copies of record documentation to the departmental representative.

1.8 ACCEPTABLE MATERIALS AND EQUIPMENT

- .1 Contract: Based on materials and equipment specified.
- .2 Submit proposals to supply alternative materials or equipment in writing, to the Consultant, at least ten working days prior to closing date of bids for mechanical sections.
- .3 Equipment manufacturers listed in individual sections are approved alternatives for this project and are subject to requirements of drawings and specifications. Revisions required to adapt alternatives shall be the responsibility of the Contractor.

1.9 EQUIPMENT PROTECTION AND CLEAN-UP

- .1 Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Protect equipment with polyethylene covers and crates.
- .3 Operate, drain and flush bearings and refill with change of lubricant before final acceptance.
- .4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Provide extended nipples for lubrication.
- .5 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not re-use existing materials and equipment unless specifically indicated.

1.10 MATERIAL AND EQUIPMENT

- .1 Material and Equipment: New and quality specified. Statically and dynamically balanced rotating equipment for minimum vibration and low operating noise level.

1.11 MATERIAL IDENTIFICATION

- .1 Identify piping, ductwork and equipment throughout with labels and direction of flow arrows. Apply labels at 15 m intervals, before and after pipes pass through walls, at access door openings or closer. Labels shall be black, 20 mm minimum letters on yellow backgrounds.
- .2 Identify electric starting switches and remote push-button stations with 6 mm laminated plastic plates.

1.12 EQUIPMENT BASES AND SUPPORTS

- .1 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

1.13 SLEEVES

- .1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
- .2 Extend sleeves through potentially wet floors 25 mm (1.0 inch) above finished floor level. Caulk sleeves full depth and provide floor plate.
- .3 Where piping or ductwork passes through floor, ceiling or wall, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.
- .4 Install chrome plated escutcheons where piping passes through finished surfaces.
- .5 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

1.14 INSERTS

- .1 Inserts: Malleable iron case of [galvanized] steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.
- .2 Size inserts to suit threaded hanger rods.

1.15 FLEXIBLE PIPE CONNECTIONS

- .1 Steel Piping: Stainless steel inner hose and braided exterior sleeve.
- .2 Copper Piping: Bronze inner hose and braided exterior sleeve.
- .3 Spool Pieces: Construct to exact size for insertion of flexible connection.

1.16 FIRESTOPPING

- .1 Provide firestopping where piping, ducts, or wiring passes partially or full through the fire separations (mechanical room), in accordance with the BC Building Code or National Building Code of Canada, whichever is the more stringent.

END OF SECTION

1 GENERAL

1.01 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.02 TESTS

- .1 Give written 24-hour notice of date for tests.
- .2 Do not externally insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.
- .3 Bear costs including retesting and making good.
- .4 Refer to Piping Sections for specific test requirements.
- .5 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.03 TESTING AND BALANCING

- .1 Employ an approved independent testing and balancing agency to test and balance the following systems. Prior to finalizing contractual arrangements with the balancing agency, submit the names, qualifications and years of direct field testing and balancing experience in the testing and balancing field for all members of the balancing team that is scheduled to carry out the balancing work. The senior site technologist must have a minimum of five years testing and balancing experience of similar projects. Provide a list of a minimum of ten comparable projects successfully completed by all key members of the balancing team.
- .2 The Agency shall be responsible to the Contractor but report jointly to the Consultant and the Contractor. Report in writing to the Consultant any lack of cooperation and any discrepancies or items not installed in accordance with the contract documents.
- .3 Procedures shall be in general accordance with AABC'S National Standards for Field Measurement and Instrumentation and ASHRAE Standards.
- .4 The balancing agency shall agree to perform spot checks, where requested, in the presence of the Consultant's designated representative.
- .5 Work with the agency to:
 - .1 Ensure that all mechanical systems are complete and ready to be balanced and provide sufficient time for testing and balancing prior to substantial performance.
 - .2 Make corrections to achieve system balance without delay, include all corrections made during the balancing procedure on "As Built" Drawings. Mechanical Contractor to provide "As Built" information to the balancing agency before balancing commences.
 - .3 Adjust fan drives, change blade pitch angles and change sheaves and belts as directed by the agency.
 - .4 Maintain all systems in full operation during the complete testing and balancing

- period.
- .5 Employ the journeyman millwright to check the alignment of any V-belt drives and/or shaft coupling drives if they have been adjusted during the balancing process. Belt tension correctness to be verified.
 - .6 Consult with the Consultant to clarify the design intent where necessary or in case there are any problems foreseen as the balancing processes.
 - .7 Accuracy: Balance to maximum flow deviation of 10% at terminal device and to 5% at equipment. Measurements to be accurate to within plus or minus 5% of actual values.
 - .8 This agency shall remove and re-install ceiling tile to provide access to ductwork and piping. The balancing agency will make good any damage or soiling caused by his forces.
 - .9 Instrument calibration: At the Consultants request, the balancing agency shall submit a dated calibration chart for all instruments.
 - .10 Permanently mark final settings on valves, dampers and other adjustment devices. Set and lock all memory stop balancing devices.
 - .11 Seal all holes with snap plugs or approved alternate method, used for flow and pressure measurements.
 - .12 The controls contractor and balancing agency are to allow for checking and making adjustments during the 12-month warranty period, when weather conditions provide natural loads and in cases where complaints arise.
 - .13 Submit a draft balance report to the Consultant for approval and submit approved copies to the agency preparing the O & M manuals for inclusion in each operating and maintenance manual. Provide field notes in the balancing report to clearly identify unusual conditions, problem areas and report on any cases where the specified flow rates or conditions could not be achieved by adjustment. Identify outstanding problems that cannot be corrected by the balancing team or that will not be corrected by the installing trades (e.g. in cases where additional balancing dampers are required).
 - .14 Submit a statutory declaration to the Consultant, certifying that the testing and balancing procedures have been completed, that complete factual reports have been distributed and that directions have been given to the Contractor to correct faults and omissions and, finally, that follow-up testing, after correction of faults and omissions, has been completed and recorded. Reports to be signed by the senior member of the balancing team.

1.04 AIR SYSTEMS - BALANCING

- .1 Adjust duct and terminal balance dampers, and adjust or change drive sheaves and fan blade pitch angles to obtain design quantities (within +/-10%) at each outlet and inlet.
- .2 Use terminal balance dampers to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. The sheet metal sub contractor shall provide additional dampers where required by the balancing agency to achieve a satisfactory balance without creating noise problems.

- .3 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross-sectional area of duct. Provide a pitot tube traverse test sheet for each major duct branch.
- .4 Measure air quantities at each air terminal.
- .5 Maintain the design relationship between the supply and exhaust air system quantities.
- .6 Check to ensure that supply and return air quantities provide reasonable building pressurization. Test building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. Exit doors and elevator shafts should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.
- .7 Air systems shall be balanced with clean filters in place, at a total of 105% to 110% of specified total airflow rates.
- .8 The Balancing Agency shall include for return visits for readjustment of systems after the owner has moved in.
- .9 Include in the air balance report:
 - .1 Date of test, Name and address of building and balancing technician's name.
 - .2 Range of outdoor air temperature during the balancing period.
 - .3 System schematics indicating damper positions, design and measured air quantities at each inlet and outlet. Show room numbers and floors.
 - .4 Record fan discharge traverse air volumes to establish system leakage.
 - .5 Main branch duct traverses. Maximum and minimum outdoor air quantities.
 - .6 Static pressure across each component in an air handling system at full flow.
 - .7 Face velocities across major components such as filter or coils.
 - .8 Static pressure across each fan.
 - .9 Fan and motor speed.
 - .10 Motor size, starting time, amps and voltage.
 - .11 Coil air entering and leaving temperatures (D.B. and W.B.).
 - .12 Maximum and minimum zone supply air temperatures under prevailing conditions at time of test.
 - .13 Provide fan performance curve for each new air handling system.

1.04 WATER SYSTEMS - BALANCING

- .1 The Contractor shall co-operate with the Balancing Contractor and provide any assistance required, including add balancing valves, provide access, etc., as requested to produce the required system balance. Upon completion of water piping system and after hydrostatic testing and cleaning, the piping system shall be balanced.
- .2 A portable differential pressure meter and/or temperature differential shall be used for determination of flow or each of the major systems.
- .3 Set valves and balance fittings to obtain uniform pressure and/or temperature differences across terminal heating coil, acknowledging the difference design pressure and/or temperature drop/rises.
- .4 Mark the final balance position on all balance valves and balance fittings.

- .5 Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings.
- .6 Report the following:
 - .1 Date of test or retest
 - .2 Name of building and address
 - .3 Tester's name
 - .4 Outdoor air temperature
 - .6 Operating performance of pump
 - .7 Entering and leaving water temperature at heating coil.
 - .8 Flow rates at measuring devices
 - .9 Suction pressure, delivery pressure and differential head across circulating pump.
- .10 Document all methods of measurements

END OF SECTION

Part 1 General**1.1 SECTION INCLUDES**

- .1 Packaged air handling units – heat recovery.

1.2 RELATED SECTIONS

- .1 Section 23 30 00 - Air Distribution.

1.3 SUBMITTALS

- .1 Section 01 33 00: Submittal Procedures.
- .2 Product Data: Indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, gages and finishes of materials.
- .3 Shop Drawings:
 - .1 Indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.
 - .2 Provide fan curves with specified operating point clearly plotted.
 - .3 Submit sound power levels for both fan outlet and casing radiation at rated capacity.
 - .4 Submit electrical requirements for power supply wiring including wire diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- .4 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Closeout Submittals.
- .2 Operation and Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.5 SOURCE QUALITY CONTROL

- .1 Fans used shall not decrease motor size, increase noise level, increase tip speed by more than 10% or increase inlet air velocity by more than 20%, from specified criteria; and capable of accommodating static pressure variations of plus or minus 10%.

Part 2 Products**2.1 PREFABRICATED HEAT RECOVERY AIR UNITS**

- .1 Prefabricated Air Unit: Unit with fan and coil section plus accessories, including heat recovery coil, factory fabricated and tested for size and capacity, and draw-thru configuration, suitable for low pressure operation, vertical (floor mount) inlet and discharge.

- .1 Casing: Galvanized steel on channel base or drain pan of welded steel coated externally with zinc chromate, iron oxide, phenolic resin paint.
 - .2 Insulation: 25 mm neoprene coated, glass fibre insulation, 0.037 W/m/degree K applied to internal surfaces with adhesive and weld pins.
 - .3 Finish: Zinc chromate, iron oxide, phenolic resin paint. Seal fixed joints with flexible weather tight sealer. Seal removable joints with closed-cell foam gasket. Provide cap strips over roof flanges. Provide rain caps and gaskets on access doors.
- .2 Filters:
 - .1 Flat arrangement with 25 mm deep washable permanent panel filters.
- .3 Performance:
 - .1 113 l/s (239 CFM) at 110 Pa (0.45" WC) ESP
 - .2 Sensible heat recovery: minimum 75% at 0 deg C/65% at -25 deg C
- .4 Standard of Acceptance: Venmar AVS X30 HRV.

Part 3 Execution

3.1 INSTALLATION

- .1 Install to manufacturer's written instructions.
- .2 Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan while running.
- .3 Pipe condensate drains to nearest floor drain.
- .4 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

Part 1 General**1.1 SECTION INCLUDES**

- .1 Air cooled condensing units.
- .2 Controls and control connections.
- .3 Refrigerant piping and connections.
- .4 Refrigerant specialties.

1.2 RELATED SECTIONS

- .1 Section 23 05 00 - Mechanical Requirements.
- .2 Section 26 09 00 - Controls.

1.3 SUBMITTALS

- .1 Section 01 33 00: Submittal Procedures.
- .2 Shop Drawings:
 - .1 Indicate general assembly of specialties, rated capacities, weights, accessories, electrical requirements, wiring diagrams, dimensions, weights and loading, required clearances, and location and size of field connections. Include schematic layouts showing condenser, refrigeration compressors, cooling coils, refrigerant piping and accessories required for complete system.
 - .2 Submit design data indicating pipe sizing.
- .3 Installation Data: Manufacturer's special installation requirements.
- .4 Manufacturer's Certificate: Certify that specified Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Closeout Submittals.
- .2 Operations and Maintenance Data: Submit operation and maintenance data including start-up instructions, maintenance data, parts lists, controls and accessories.
- .3 Record Documentation: Accurately record actual locations of equipment and refrigeration accessories.

1.5 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.6 WARRANTY

- .1 Warranty Period: Five (5) years coverage for refrigerant compressors and motors.

Part 2 Products**2.1 PIPING**

- .1 Copper Tubing: Type ACR hard drawn or annealed, wrought copper fittings, 95/5 solder or silver braze joints to 22 mm OD, Type K, annealed, cast copper fittings, flared joints].

2.2 REFRIGERANT

- .1 Refrigerant: Type R-410a

2.3 AIR COOLED CONDENSING UNITS

- .1 Air Cooled Outdoor Heat Pump Unit: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, and screens.
 - .1 Heat Rejection Capacity:
13 KW (44,300 MBH) total cooling capacity, at 29°C DB/19°C WB (85 DB/67°F)
 - .2 Casing: House in galvanized steel panels, baked enamel finish. Provide removable access doors or panels with quick fasteners. Mount starters, disconnects, and controls in weatherproof panel provided with fully opening access doors.
 - .3 Condenser Coils: Aluminum fins mechanically bonded to seamless copper tubing, with sub-cooling circuits, air tested to 2900 kPa, vacuum dehydrated and sealed
 - .4 Fans:
 - .1 Vertical discharge direct driven propeller type condenser fan with fan guard on discharge.
 - .5 Motors: Suitable for outdoor use, single phase permanent split capacitor, with permanent lubricated ball bearings and built in [current and] thermal overload protection.
 - .6 Refrigerant Circuit:
 - .1 Provide each unit with one (1) refrigerant circuit factory supplied and piped with filter dryer, liquid line sight glass and moisture indicator, thermal expansion valve, insulated suction line, suction and liquid line service valves.
 - .2 For heat pump units, provide reversing valve, suction line accumulator, flow control check valve, and solid state defrost control utilizing thermistors.

2.4 AIR COOLED CONDENSING UNIT CONTROLS

- .1 Control Panel: Mount weatherproof steel control panel on unit, containing power and control wiring, disconnect switch, factory wired with single point power connection.

- .1 Control Devices: For each compressor, provide starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power, manual reset current overload protection. For condenser fan, provide across-the-line starter with starter relay.
- .2 Safety Controls: Provide safety controls arranged to shut down machine
 - .1 High discharge pressure switch
 - .2 Low suction pressure switch automatic reset.
 - .3 Oil pressure switch (manual reset).
- .3 Operating Controls: See 26 09 00 Controls
- .4 Operating Temperatures: Provide controls to permit operation down to <- 10 degrees C ambient temperature at minimum load.
 - .1 Thermostat to cycle fan motors in response to outdoor ambient temperature.
 - .2 Head pressure switch to cycle fan motors in response to refrigerant condensing pressure.
 - .3 Solid state control to vary speed of one condenser fan motor in response to refrigerant condensing pressure.
- .2 Provide pre-piped gage board with pressure gages for suction and discharge refrigerant pressures, and oil pressures.
- .3 Thermostat: Provide low voltage, adjustable thermostat to control 2 heating stages in sequence with delay between stages, and supply fan to maintain temperature setting,
 - .1 Include system selector switch [(off-heat 1-heat 2-auto-cool)] and fan control switch (auto-on).
- .4 Provide electric solid state microcomputer based room thermostat, located as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install equipment and specialties to manufacturer's written instructions.
- .2 Install piping to conserve building space and not interfere with use of space. Route piping in orderly manner, plumbing and parallel to building structure, and maintain gradient. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- .3 Provide non-conducting dielectric connections when joining dissimilar metals.
- .4 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide clearance for installation of insulation and access to valves and fittings.
- .5 Locate expansion valve sensing bulb immediately downstream of evaporator on suction line. Provide external equalizer piping on expansion valves with refrigerant distributor

3.2 APPLICATION

- .1 Provide line sized liquid indicators in main liquid line leaving condenser or in liquid line leaving receiver.
- .2 Provide line size strainer upstream of each automatic valve. Where multiple expansion valves with integral strainers are used install single main liquid line strainer.
- .3 On steel piping systems provide strainer in suction line.
- .4 Provide shut-off valve on each side of strainer.
- .5 Provide replaceable cartridge filter-driers vertically in liquid line adjacent to receivers with three valve bypass assembly to permit isolation of driers for servicing.
- .6 Utilize flexible connectors at or near compressors where within piping configuration does not absorb vibration.

3.3 FIELD QUALITY CONTROL

- .1 Field inspection and testing will be performed under provisions of Section 01 45 00.
- .2 Provide initial and cooling season start-up, and winter season shut down during first year of operation, including routine servicing and check out.
- .3 Supply service of factory trained representative for a period of 1 days to supervise testing, dehydration and charging of machine, start-up, and instruction on operation and maintenance to Owner.
- .4 Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil.

END OF SECTION

1 GENERAL

1.1 SCOPE

- .1 Fence framework, fabric, and accessories.
- .2 Excavation for post bases; concrete foundation for posts and centre drop for gates.
- .3 Manual gates and related hardware.

1.2 REFERENCE STANDARDS

- .1 ASTM A116-05 - Metallic-Coated Steel Woven Wire Fence Fabric.
- .2 ASTM A121-07 - Zinc-Coated (Galvanized) Steel Barbed Wire.
- .3 ASTM A123/A123M-08 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
- .4 ASTM A153/A153M-08 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .5 ASTM A392-07 - Zinc-Coated Steel Chain-Link Fence Fabric.
- .6 ASTM A428/A428M-06 - Weight (Mass) of Coating on Aluminum-Coated Iron or Steel Articles.
- .7 ASTM A491-07 - Aluminum-Coated Steel Chain-Link Fence Fabric.
- .8 ASTM A1011/A1011M-08 - Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy With Improved Formability.
- .9 ASTM C94/C94M-09 - Ready-mixed Concrete.
- .10 ASTM F567-07 - Installation of Chain-Link Fence.
- .11 ASTM F668-07 - Poly (Vinyl Chloride) (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
- .12 ASTM F1043-06 - Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
- .13 ASTM F1083-08 - Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- .14 CAN/CGSB-138.1-96 – Fabric for Chain Link Fence.
- .15 CAN/CGSB-138.2-96 – Steel Framework for Chain Link Fence.
- .16 CAN/CGSB-138.3-96 – Installation of Chain Link Fence.
- .17 CAN/CGSB-138.4-96 – Gates for Chain Link Fence.
- .18 CAN/CGSB-1.181-99 – Ready-Mixed Organic Zinc-Rich Coating.
- .19 CAN/CSA-A23.1-04/A23.2-04 - Concrete Materials and Methods of Concrete Construction / Methods of Test for Concrete.
- .20 CLFMI (Chain Link Fence Manufacturers Institute) - Product Manual.

1.3 SYSTEM DESCRIPTION

- .1 Fence Height: As indicated on Drawings.
- .2 Line Post Spacing: As indicated on Drawings but at intervals not exceeding 3 meters.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 00 10 – General Requirements: Shop Drawings, Product Data, Samples and Mock-ups.

1.5 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Perform Work in accordance with manufacturer's written instructions.
- .3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.
- .4 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience.

2 PRODUCTS

2.1 MATERIALS

- .1 Materials and Components: Conform to CLFMI Product Manual.
- .2 Fabric Size: CLFMI Heavy Industrial service.
- .3 Intermediate Posts: Type I round shape.
- .4 Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

2.2 ACCESSORIES

- .1 Caps: Molded rigid vinyl; sized to post diameter, set screw retainer.
- .2 Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.
- .3 Gate Hardware: Fork latch with gravity drop, Centre gate stop and drop rod; three (3) 180 degree gate hinges per leaf and hardware for padlock.

2.3 FINISHES

- .1 Components and Fabric: Vinyl coating, colour as selected by Consultant.
- .2 Vinyl Components: Colour as selected by Consultant.

- .3 Hardware: Galvanized to ASTM A153/A153M, 610 g/sq m coating.
- .4 Accessories: Same finish as fabric.
- .5 Caps: Molded rigid vinyl; sized to post diameter, set screw retainer.

3 EXECUTION

3.1 INSTALLATION

- .1 Install framework, fabric, accessories and gates to manufacturer's written instructions.
- .2 Install framework, fabric, accessories and gates in accordance with ASTM F567
- .3 Place fabric on inside of posts and rails.
- .4 Set intermediate, terminal, and gate posts plumb, in concrete footings with top of footing 150 mm below finish grade. Slope top of concrete for water runoff.
- .5 Line Post Footing Depth Below Finish Grade: ASTM F567.
- .6 Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.
- .7 Brace each gate and corner post to adjacent line post with horizontal centre brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
- .8 Provide top rail through line post tops and splice with 150 mm long rail sleeves.
- .9 Install centre brace rail on corner gate leaves.
- .10 Do not stretch fabric until concrete foundation has cured 28 days.
- .11 Stretch fabric between terminal posts or at intervals of 30 meter maximum, whichever is less.
- .12 Position bottom of fabric 50 mm above finished grade.
- .13 Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 380 mm on centres.
- .14 Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- .15 Install bottom tension wire stretched taut between terminal posts.
- .16 Do not attach the hinged side of gate from building wall; provide gate posts.
- .17 Install gate with fabric to match fence. Install three hinges per leaf, latch, catches, drop bolt.
- .18 Provide concrete centre drop to footing depth and drop rod retainers at centre of double gate openings.

3.2 ERECTION TOLERANCES

- .1 Maximum Variation From Plumb: 6 mm.
- .2 Maximum Offset From True Position: 25 mm.
- .3 Components shall not infringe adjacent property lines.

END OF SECTION