

1.1 GENERAL

- .1 This section covers items common to all sections of Division 21, 22, 23 and 25 and is intended only to supplement the requirements of Division 01 and General Conditions of Contract.
- .2 The word "provide" shall mean "Supply and Install".
- .3 Provide materials, equipment and plan of specified design quality and of current models with published ratings for which replacement parts are readily available.
- .4 The codes and standards referred to in the specifications establish the minimum requirements only. The most stringent requirements of the specifications, drawings, codes and standards shall govern. Refer to the latest editions of all applicable codes and standards.

1.2 EQUIPMENT LIST

- .1 Complete list of equipment and materials to be used on this project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.
- .2 Submit for approval within 10 days after award of contract. Do not order equipment until the equipment list has been approved.

1.3 BREAKDOWN OF COSTS

- .1 Upon notice of contract award, furnish price breakdown of tendered price.

1.4 AS INDICATED

- .1 Means that the item or items specified are shown on the drawings.

1.5 STANDARD OF ACCEPTANCE

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

1.6 ENERGY CONSUMPTION

- .1 Departmental Representative may reject equipment submitted for approval on basis of performance or energy consumed or demanded.

1.7 EQUIPMENT REQUIREMENTS AND INSTALLATION

- .1 Provide unions and flanges to permit equipment maintenance and disassembly and to minimize disturbance to connecting piping and duct systems and without interference from building structure or other equipment.
- .2 Provide accessible means for lubricating equipment including permanent lubricated bearings.
- .3 Pipe all drain lines to floor drains.
- .4 Equipment, cleanouts, floor drains and like equipment shall be lined-up with the building wall wherever possible.
- .5 Provide 3-valve bypasses on all control valves and pressure reducing valves. As indicated on drawings.
- .6 All equipment such as fans, fan coils, VAV boxes, reheat coil, motorized dampers, etc. mounted in ceiling spaces shall be within 914mm of the finished ceiling to facilitate servicing and maintenance.

1.8 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation by other divisions.

1.9 TRIAL USAGE

- .1 Obtain written permission from Departmental Representative to start and test permanent equipment and systems prior to acceptance by Departmental Representative.
- .2 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing. The Departmental Representative has the right to verify the operation of the following equipment and systems:
 - .1 All air systems.
 - .2 All controls.
 - .3 Fire protection system.
 - .4 All heating systems.
 - .5 All plumbing systems.

1.10 PROTECTION OF OPENINGS

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials during trial usage until accepted by Departmental Representative.
- .2 Clean and refurbish all equipment and leave in first class operating condition including replacement of all filters as approved by Departmental Representative.

1.11 ELECTRICAL

- .1 Electrical work to conform to Division 26 including the following:
 - .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings. Starters, motor protection and manual control devices are specified and indicated in Division 26, except where otherwise indicated or specified. Wiring to packaged mechanical equipment is indicated on electrical drawings.
 - .2 All control wiring shall be by Division 23. Refer to Division 26 for quality of materials and workmanship.
 - .3 Co-ordinate with Division 21, 22 and 23 Trades to ensure that all controlled equipment is correctly connected for operation in accordance with plans and specifications, including supplying all necessary electrical inter-connection information and location to Division 26.
 - .4 Electrical equipment shall bear CSA label. Obtain special inspection labels required by Provincial Authority having jurisdiction.
 - .5 Where motors may be subject to high moisture levels such as boiler rooms use liquid tight flexible conduit.

1.12 SLEEVES

- .1 Pipe sleeves: at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated.
- .2 20 ga. metal with lock seam joints.
- .3 Use schedule 40 steel pipe sleeves with 6mm thick and 38mm larger diameter sleeve annular fin continuously welded at midpoint:
 - .1 Through foundation walls.
 - .2 Where sleeve extends above finished floor.
- .4 Sleeves to be prime coated prior to installation.

- .5 Sizes:
- .1 Provide 6mm clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.
 - .2 Where piping passes below footings, provide minimum clearance of 50mm between sleeve and pipe. Backfill up to underside of footing with concrete of same strength as footing.
- .6 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25mm above floors in mechanical rooms and service spaces.
- .7 Fill voids around pipes:
- .1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.
 - .2 Where sleeves pass through non-fire rated walls and floor slabs, tightly pack the space between the sleeve and pipe with acoustic filler material and seal both sides with acoustic sealant. Where sleeves pass through fire rated walls slabs provide space for fire stopping. Pack space between the pipe and sleeve with approved fire rated and ULC approved material and seal with approved fire rated and ULC approved sealant. Where pipes/ducts pass through fire walls, floors and partitions, maintain fire ratings integrity of surroundings.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Fill future-use sleeves with lime plaster or other easily removable filler.
 - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.
Acceptable Manufacturer:
 - Laurentide Zinc Chromatic Red Oxide Primer
- .8 Temporarily plug all openings during construction.

1.13 PREPARATION FOR FIRESTOPPING

- .1 Firestopping material and installation for within annular space between pipes, ducts, insulation and adjacent fire separation to be ULC listed and acceptable to the Provincial Fire Marshal's Office. Installation to be as per manufacturer's recommendations and ULC's testing procedure.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.

- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe to move without damaging firestopping material.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

1.14 ESCUTCHEONS

- .1 On pipes passing through walls, partitions, floors and ceilings in finished areas.
- .2 Use chrome or nickel plated brass or Type 302 stainless steel, split type with set screws for ceiling or wall mounting.
Acceptable Manufacturer:
 - Copper Pipe:
 - Crane No. 13-B-C
 - Grinnell Fig. 2
 - Steel Pipe:
 - Crane Fig. 13
- .3 Outside diameter to cover opening or sleeve.
- .4 Inside diameter to fit around finished pipe.
- .5 Secure to pipe or finished surface but not to insulation.
- .6 Where sleeves extend above finished floor, escutcheons or plates shall cover sleeve extension.

1.15 TESTS

- .1 Provide the following supplementary requirements to test specified in mechanical work sections.
 - .1 Give three (3) written notices of date for tests.
 - .2 Insulate or conceal work only after testing and approval by Departmental Representative.
 - .3 Conduct tests in presence of Departmental Representative.
 - .4 Bear costs including retesting and making good.
 - .5 Pipe Pressure:
 - .1 General: maintain test pressure without loss for 4h unless otherwise specified.
 - .2 Test fuel oil systems to CSA B139, latest edition and authorities having jurisdiction.
 - .3 Test drainage, waste and vent piping to piping to National Building Code and Authorities having jurisdiction.

- .1 Ensure a minimum 10' (3m) head of water is provided above the highest point of DWV system. DWV piping shall be tested for a minimum of one (1) hour with water, or two (2) hours with air. In addition, an underground piping ball test shall be conducted in the presence of the Departmental Representative and Mechanical Inspector, preferably before the piping is backfilled. Provide a minimum of four (4) working days notice of time for this test.
- .4 Test domestic hot, cold and recirculation water piping for a minimum of 1 hour at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
- .5 Test all hydronic systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
- .6 Test fire systems in accordance with authorities having jurisdiction and as specified elsewhere.
- .7 Test backflow preventer to requirements of local utility and using methods recommended by BFP manufacturer.
- .7 Equipment: test as specified in relevant sections.
- .8 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.
- .9 Conduct all other tests as specified in other Sections of Division 21, 22 and 23.
- .10 Replace defective material or equipment and repair joints using new material.

1.16 PAINTING

- .1 Apply at least one coat of corrosion resistant primer paint to ferrous supports, hangers and site fabricated equipment.
- .2 Prime and touch up marred finished paintwork to match original. Do not paint over nameplates.
- .3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.17 SPECIAL TOOLS

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers.

- .1 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.
- .2 Turn over spare parts to General Contractor and obtain signal acknowledgement from Departmental Representative and insert same in Operations and Maintenance Manual.

1.18 Dielectric Couplings

- .1 General:
 - .1 To be compatible with and to suit pressure rating of piping system.
 - .2 Where pipes of dissimilar metals are joined.
- .2 Pipes 50mm and under: isolating unions.
- .3 Pipes 63mm and over: isolating flanges.

1.19 DRAIN VALVES

- .1 Locate at low points and at section isolating valves unless otherwise specified.
- .2 Minimum 19mm unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.
- .3 Acceptable Manufacturer:
 - Dahl

1.20 OPERATION AND MAINTENANCE MANUAL

- .1 Provide operation and maintenance data for incorporation into operating and maintenance manuals.
- .2 Definition: detailed information and records of individual products provided by manufacturer or supplier as part of project requirements, and of systems, describing operation and maintenance of each item.
- .3 Operation and maintenance manual to be approved by, and final copies deposited with, Departmental Representative before final inspection.
- .4 Operation data to include:
 - .1 Control schematics for each system including environmental controls.
 - .2 Description of each system and its controls.
 - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

- .4 Operation instruction for each system and each component.
- .5 Description of actions to be taken in event of equipment failure.
- .6 Valves schedule and flow diagram.
- .7 Colour coding chart.
- .5 Maintenance data shall 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.
- .6 Performance data to include:
 - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified elsewhere.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .7 Approvals:
 - .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
 - .3 Submit three (3) hard copies and three (3) copies on CD of Operating and Maintenance Manuals to the Owner following acceptance by the Departmental Representative.
- .8 Additional data:
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.21 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with General Conditions of Contract.
- .2 Shop drawings and product data shall show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances. eg. access door swing spaces.

- .3 Shop drawings and product data shall be accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify as to current model production.
 - .5 Certification of compliance to applicable codes.
- .4 When submitting shop drawings use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .5 Keep one (1) copy of shop drawings and product data on site, available for reference purposes at all times.

1.22 CLEANING

- .1 Clean mechanical (building) systems daily.
- .2 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.
- .3 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.
- .4 Balance and adjust all systems and each piece of equipment to operate efficiently.

1.23 AS-BUILT DRAWINGS

- .1 To be read in conjunction with General Conditions of Contract and Section 01 78 00 Closeout Submittals.
- .2 Site records:
 - .1 Provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur.
 - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection at all times.
- .3 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.

- .2 Identify each drawing in lower right hand corner in letters at least 12mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 TAB to be performed using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .4 Submit copies of as-built drawings for inclusion in final TAB report.

1.24 DRAWINGS

- .1 Mechanical drawings are not intended to show structural details or architectural features.
- .2 The Mechanical drawings are not to be scaled.
- .3 Except where dimensioned, indicate general Mechanical layouts only. Because of the small scale of Mechanical drawings, it is not possible to show all offsets, fittings and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves and accessories which are required to meet the conditions.

1.25 EXISTING SITE CONDITIONS

- .1 The contractor shall visit the site of the building in order to examine first hand the existing conditions which may affect his contract. No compensation shall be considered for additional expenditures incurred later through failure to do so.

1.26 EXISTING SYSTEMS AND SERVICES

- .1 The location of existing systems and services as shown on the drawings are approximate only. Ascertain the exact location of these services before commencing with installation. No compensation shall be considered for additional expenses incurred later through his failure to do so.
- .2 Any connection to the existing systems shall be made at a time approved by the Owner. The contractor shall request for written approval of time when these connections could be made. This contractor shall be responsible for any damage caused to the existing systems by his crew.

- .3 Should existing services be accidentally uncovered and disrupted, make complete restoration immediately and ensure adequate protection to avoid further disruption.
- .4 Unless otherwise specified, restore services on which work is performed to original condition.

1.27 COMMISSIONING OF MECHANICAL

- .1 In addition to commissioning outlined in Section 01 91 13, the following commissioning is to take place:
 - .1 Upon receipt of written verification from the Departmental Representative that:
 - .1 All systems are complete and operational in all respects.
 - .2 All specified reports and certificates of verification have been submitted and approved.
 - .3 All demonstrations have been completed and documented, the Departmental Representative will commence a systems' commissioning period.
 - .2 During this period of not more than ten working days, Departmental Representative will verify the operation of all systems. The commissioning process may involve real or simulated conditions to determine the systems full operational capabilities. Copies of all specified reports and documents are to be available on site during the commissioning period.
 - .3 During the commissioning process, the on-site foreman of the mechanical sub-trade involved in the supervision of the work plus one mechanical contractor are to be on site, providing full time assistance to the commissioning team. In addition, systems suppliers' representatives are to be available to be on site, providing full-time assistance to the Departmental Representative within forty-eight hours notice to assist in the verification of their respective systems.
 - .4 All necessary equipment such as meters, tools, etc. required to fully commission the systems are to be made available to the commissioning team by the Contractor.
 - .5 Deficiencies or discrepancies discovered during the commissioning process are to be immediately rectified. Acceptable arrangements for labour and materials will be required to correct deficiencies which prevent the satisfactory completion of the commissioning process.

1.28 TEMPORARY USAGE OF SYSTEM

- .1 Permanent HVAC systems shall not be used for temporary heating and ventilation of the building until the Departmental Representative declares the building complete and "Dust Free".

1.29 COMMISSIONING

- .1 Provide commissioning services as called for in the commissioning specification.

1.30 CONTRACT CLOSE-OUT

- .1 Our completion of contract provide the following materials for contract close-out.
 - .1 All spare parts (signed off list).
 - .2 Signed off list that contractor's demonstration's have been
 - .3 TAB reports submitted.
 - .4 Contractors O & M manuals submitted.
 - .5 As built drawings submitted.
 - .6 Final Deficiency list-signed off.
 - .7 Equipment start up reports.
 - .8 Combustion efficiency tests completed.
 - .9 All test reports carried out during installation.
 - .10 Fire Marshal's Review Report (sprinkler).
 - .11 Copies of all warranties.
 - .12 Commissioning completed to requirements of Cx Agent.

1.31 PACKAGED EQUIPMENT

- .1 The Mechanical Trade Contractor shall note that whenever packaged Environment is specified it is intended that this equipment shall be a complete package with all necessary accessories for safe operation.
- .2 These accessories shall include all necessary starter, disconnects, relays, transformers, pressure switches, sensors, timers etc. Where subject to the weather, the device shall be enclosed in a "weatherproof" enclosure.
- .3 The Mechanical Trade Contractor shall be responsible for checking with the supplier of all equipment to ensure that the packaged equipment is complete with all necessary accessories. He shall also determine which accessories are factory mounted and which ones are shipped loose with equipment. The Mechanical Trade Contractor shall included in his Tender an amount for all necessary wiring and piping etc. necessary to incorporate any pieces of equipment, which are shipped separately into the job, at no cost to the Departmental Representative.

- .4 Disconnect switches shall not obscure manufacturers nameplate data.

- .5 The Mechanical Trade Contractor shall note that this refers to all packaged Equipment including boilers, pump sets, etc. and shall be the responsibility to coordinate this with the supplier of the equipment and to either have the supplier include an amount to ensure the supply and installation of any accessories for the operation of this equipment.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 22 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
 - .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
 - .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
 - .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB):
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .4 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

- .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations:
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

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 specified.
- .2 TIAC SS:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

- .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12mm plywood board. Affix label beneath sample indicating service.
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards member of TIAC.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 10 10 - General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:

- .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 22 - Construction /Demolition Waste Management and Disposal.
- .2 Place excess or unused insulation and insulation accessory materials in designated containers.
- .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
- .4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

1.7 LOW EMITTING

- .1 All site-applied interior adhesives, sealant primers, paints and coatings must conform to Division 09 - Finishes.

PART 2 - PRODUCTS

2.1 SUSTAINABLE

- .1 Materials and products in accordance with Section 01 10 10 General Instructions.

2.2 FIRE AND SMOKE RATING

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

2.3 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 without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
 - .2 Maximum "K" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "K" factor: to CAN/ULC-S702 ASTM C547.

- .5 TIAC Code C-2: mineral fibre blanket faced with without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "K" factor: to CAN/ULC-S702 ASTM C547.

- .6 TIAC Code A-6: flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "K" factor.
 - .4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

- .7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
 - .1 Insulation: to ASTM C533.
 - .2 Maximum "K" factor.
 - .3 Design to permit periodic removal and re-installation.

2.4 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, plain reinforced, 50mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5mm diameter stainless steel.
- .5 Bands: stainless steel, 19mm wide, 0.5mm thick.

2.5 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

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.

2.8 OUTDOOR VAPOUR RETARDER FINISH

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

- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.9 JACKETS

- .1 ABS Plastic:
 - .1 One-piece moulded type and sheet with pre-formed shapes as required.
 - .2 Colours: selected by Engineer.
 - .3 Minimum service temperatures:-40°C.
 - .4 Maximum service temperature: 82°C.
 - .5 Moisture vapour transmission: 0.012 perm.
 - .6 Thickness: 0.75mm.
 - .7 Fastenings:
 - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Locations:
 - .1 For outdoor use ONLY.
- .2 Canvas:
 - .1 220gm/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: 0.50mm sheet.
 - .3 Finish: smooth stucco embossed corrugated.
 - .4 Joining: longitudinal and circumferential slip joints with 50mm laps.
 - .5 Fittings: 0.5mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19mm wide, 0.5mm thick at 300mm spacing.
- .4 Stainless steel:
 - .1 Type: 304 316.
 - .2 Thickness: 0.25mm.
 - .3 Finish: smooth corrugated stucco embossed.
 - .4 Joining: longitudinal and circumferential slip joints with 50mm laps.
 - .5 Fittings: 0.5mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19mm wide, 0.5mm thick at 300mm spacing.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

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

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports 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.

3.4 REMOVABLES, PRE- FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.
- .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: aluminum SS PVC ABS high temperature fabric.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

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

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code A-1:
 - .1 Securements: SS wire bands Tape at 300mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code A-3:
 - .1 Securements: SS wire bands Tape at 300mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code A-6:
 - .1 Insulation securements.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code.
- .5 TIAC Code C-2 with without vapour retarder jacket:
 - .1 Insulation securements.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .6 TIAC Code A-2:
 - .1 Insulation securements.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-H.
- .7 Thickness of insulation as listed in following table:
 - .1 Run-outs to individual units and equipment not exceeding 4m long.
 - .2 Do not insulate exposed runouts 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
Hot Water Heating	Up to 140	A-1	1	1	1	1-1/2	1-1/2	
Domestic HWS		A-1	1	1	1	1-1/2	1-1/2	1-1/2
Domestic CWS		A-3	1	1	1	1	1	1

.8 Finishes:

- .1 Exposed indoors: canvas jacket.
- .2 Exposed in mechanical rooms: PVC jacket.
- .3 Underslab: PE Jacket.
- .4 Concealed, indoors: canvas on valves, fittings. No further finish.
- .5 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .6 Outdoors: water-proof aluminum.
- .7 Finish attachments: SS screws bands, at 150mm on centre. Seals: wing closed.
- .8 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Section 01 33 00 - Submittal Procedures include low-emitting materials.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION