

1 General

1.1 GENERAL

- .1 This section covers items common to all sections of Divisions 20 through 23.

1.2 EXAMINATION OF SITE AND DRAWINGS

- .1 The Contractor shall examine the site and local conditions affecting the work under this Contract. No additional costs will be considered due to existing conditions.
- .2 The drawings do not show all structural or mechanical details and where accurate dimensions are required these dimensions shall be taken by the Contractor in the field. The Contractor shall confirm to their own satisfaction the accuracy of these field measurements and all necessary minor changes to piping/ducting/equipment to accommodate field conditions shall be approved by the Departmental Representative and made at no charge to the Departmental Representative.
- .3 The Departmental Representative reserves the right to alter locations of pipes, ducts or equipment without incurring additional costs provided such alterations are made before the Contractor has begun fabrication of the work in question.
- .1 The Contractor shall carefully examine the structural, civil, architectural, and electrical drawings and confirm to their own satisfaction that the work under this division can be carried out without changes to the equipment as shown on these drawings. Before commencing the work, the Contractor shall examine the work of other trades and report at once any defect or interference affecting the work of this division.
- .2 Notes on the drawings are intended to form a part of this specification and must be examined by the Contractor.

1.3 SCOPE OF WORK

- .1 This work includes, but is not limited to, the supply and installation of all supervision, labour, permits, equipment, materials, and consumables necessary to provide this facility with complete and operational systems listed below, as indicated on the drawings, and described in the specifications:
- .1 The work provided in these tender documents shall be coordinated by the General Contractor for phasing of work.
- .2 Plumbing consists of the supply and installation of pipe anchor straps, valves, aeration trough replacement.
- .3 Ventilation consists of an exhaust fan installation and general upgrades to aeration exhaust louvers.

1.4 PRODUCT SPECIFICATIONS AND STANDARDS

- .1 All equipment and materials specified to conform to an applicable code and/or standard, and shall be listed and/or labelled under the provisions of such code or standard, when available.
- .2 Product description shall take precedence over product model numbers as manufacturers may change numbers during design and tender bid periods.
- .3 Reference is made in the documents to NPS which is to be understood as Nominal Pipe Size in inches, inside or outside diameter as applicable to the piping or tubing product in question.

1.5 EQUIPMENT INSTALLATION

- .1 Unions or flanges: provide for ease of maintenance and disassembly.
- .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.
- .3 Equipment drains: pipe to floor drains.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

1.6 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates required for the work of this division for installation by other divisions.

1.7 TRIAL USAGE

- .1 The Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.8 PROTECTION OF OPENINGS

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.9 ELECTRICAL

- .1 Electrical work to conform to Division 26. Supply and installation responsibility is indicated in the mechanical and electrical specifications and on the mechanical and electrical drawings as appropriate.
- .2 Control wiring and conduit, 120V and under, shall be supplied and installed by this trade. Refer to Division 26 for quality of materials and workmanship.

1.10 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by the Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
- .3 Motors under 373 W: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .4 Motors 373 W and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, TEFC, ball bearing, maximum temperature rise 40EC, 3 phase, 208 V, unless otherwise specified or indicated.

1.11 GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives:
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm dia. holes on both shaft centres for insertion of tachometer.

- .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.

1.12 EQUIPMENT SUPPORTS

- .1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Divisions 20, 22 and 23.

1.13 SLEEVES

- .1 Pipe sleeves: provide at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated.
- .2 Schedule 40 steel pipe.
- .3 Sleeves with annular fin continuously welded at midpoint:
 - .1 Through foundation walls.
 - .2 Where sleeve extends above finished floor.
- .4 Sizes: minimum 6 mm clearance all around, between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm above other floors.
- .6 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 walls or floors, provide space for firestopping.
 - .3 Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.
 - .4 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .5 Fill future-use sleeves with lime plaster or other easily removable filler.
 - .6 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt-Mar-78.

1.14 TESTS

- .1 Give 24 h written notice of date for tests.
- .2 Insulate or conceal work only after testing and approval by the Departmental Representative.
- .3 Conduct tests in presence of the Departmental Representative when requested.

- .4 Bear costs including retesting and making good.
- .5 Piping:
 - .1 General: maintain test pressure without loss for 4 h unless otherwise specified.
- .6 Equipment: test as specified in relevant sections.
- .7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.15 PAINTING

- .1 Paint ferrous supports and site fabricated work in accordance with Section 09 91 23 - Painting.
- .2 Prime and touch up marred manufacturers' finished paintwork to match original.
- .3 Restore to new condition, manufacturers' finishes that have been extensively damaged.
- .4 Paints and coatings used must be non-toxic to fish and documentation to be provided.

1.16 SPARE PARTS

- .1 Furnish spare parts in accordance with Section 01 10 01 – General Requirements.
 - .1 One (1) set of belts for each piece of machinery.
 - .2 One (1) filter cartridge or set of filter media for each filter or filter bank in addition to final operating set, for each applicable piece of equipment.
 - .3 One (1) set of mechanical seals for each pump.
 - .4 One (1) casing joint gasket for each pump.
 - .5 As indicated.

1.17 ACCESS DOORS

- .1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600 mm x 600 mm for body entry and 300 mm x 300 mm for hand entry unless otherwise noted. Doors to open 180 degrees, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Material:
 - .1 Special areas such as tiled surfaces: use stainless steel with brushed satin or polished finish as directed by the Departmental Representative.
 - .2 Remaining areas: use prime coated steel.
- .4 Installation:
 - .1 Locate so that concealed items are accessible.
 - .2 Locate so that hand or body entry (as applicable) is achieved.
 - .3 Installation is specified in applicable sections.
- .5 Standard of Acceptance: Zurn, Ancon-Lehage, Jay R. Smith.

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 NPS 2 and under: isolating unions.

- .3 Pipes NPS 2-1/2 and over: isolating flanges.
- 1.19 DRAIN VALVES
- .1 Locate at low points and at section isolating valves unless otherwise specified.
 - .2 Minimum NPS 3/4 unless otherwise specified: bronze, with hose end male thread and complete with cap and chain.
- 1.20 THERMOWELLS
- .1 Thermowells for controls instrumentation shall be supplied by Controls Contractor for installation by Mechanical Contractor in locations as directed by Controls Contractor.
- 1.21 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS
- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
 - .2 Where specified elsewhere in Divisions 22 and 23, manufacturers to provide demonstrations and instructions.
 - .3 Use operation and maintenance manual, record drawings, audio visual aids, etc. as part of instruction materials.
 - .4 Instruction duration time requirements as specified in appropriate sections, and minimum as follows:
 - .1 Plumbing Systems: 1 day (site time).
 - .2 Heating, ventilation, and air conditioning systems: 1 day (site time).
 - .5 Where deemed necessary, the Departmental Representative may record these demonstrations on video tape for future reference.
- 1.22 OPERATION AND MAINTENANCE MANUAL
- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 10 01 – General Requirements.
 - .2 Operation and maintenance manual to be reviewed by, and final copies deposited with, the Departmental Representative before final inspection.
 - .3 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.
 - .4 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.

- .5 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.
- .6 Reviews.
 - .1 Submit three (3) copies of draft Operation and Maintenance Manual and one (1) electronic copy to the Departmental Representative for review.
 - .2 Submission of individual data will not be accepted unless so directed by the Departmental Representative.
 - .3 Make changes as required and re-submit as directed by the Departmental Representative.
- .7 Additional data.
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.23 SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings and product data shall show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances, e.g. 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.
 - .6 Electrical requirements.
 - .7 Accessories.

1.24 CLEANING

- .1 Clean mechanical (building) systems in accordance with Section 01 74 11 - Cleaning.
- .2 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and ventilating 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.

1.25 RECORD DRAWINGS

- .1 Site records:
 - .1 Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 On a weekly basis, transfer information to prints, 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.

- .2 Record 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 12 mm high as follows: - "RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
 - .3 Submit to the Departmental Representative for approval and make corrections as directed.
 - .4 TAB to be performed using record drawings.
 - .5 Submit completed reproducible record drawings with Operating and Maintenance Manuals.
- .3 Submit copies of record drawings for inclusion in final TAB report.

1.26 COMMISSIONING

- .1 Installing trades shall provide site attendance by qualified technicians to assist with the commissioning process, verify in writing that tests and adjustments have been made for each item requiring commissioning, and submit verification to the Departmental Representative for review. Commissioning and verification requirements are indicated in detail in the specifications that follow for some equipment/systems, however, as a minimum, verification shall be a list of each piece of equipment showing the tag # for the equipment, room numbers, date commissioned, personnel's name performing the work and comments indicating the work performed. Report may be hand printed in ink and must be legible. Submit proposed method of commissioning to the Departmental Representative prior to performing the work, showing all equipment to be commissioned.

END OF SECTION

1 General

1.1 GENERAL

- .1 Provide all labour, materials, products, equipment and services to supply and install the basic mechanical materials indicated on the Drawings and specified in Division 20 through 23 of these Specifications.

1.2 IDENTIFICATION OF MECHANICAL SERVICES

- .1 Identify all mechanical services after finish painting is complete.
- .2 Use consistent terminology:
 - .1 With the Drawings and Specifications.
 - .2 With the departmental representative's requirements and standards.
- .3 Mark valve and equipment identification on Record Drawings.
- .4 Provide typewritten master lists for each Equipment Room. Frame under glass. Insert copies in Operating and Maintenance Instruction Manuals.

1.3 PIPE IDENTIFICATION

- .1 Provide SMS Wrap-Mark on all pipe coverings, using Wrap-Mark pipe markers with alternating flow arrow wording. For outside diameters up to 150 mm, allow marker to completely wrap pipe. For larger outside diameters, secure markers with stainless steel springs. Secure markers on vertical piping and elsewhere where markers could be inadvertently moved.
- .2 Locate identification and flow arrows so they can be seen clearly from floor and service platforms.
 - .1 At least once in each room.
 - .2 At each piece of equipment.
 - .3 At each branch close to connection point to main piping and ductwork.
 - .4 At not greater than intervals of 15 metres on straight runs of exposed piping and ductwork.
 - .5 At entry and leaving point to pipe and duct chases, or other concealed spaces.
 - .6 Both sides where piping and ductwork passes through walls, partitions and floors.
 - .7 On vertical pipes and ducts approximately 1800 mm above floor.
 - .8 Behind each access door and panel.
 - .9 At valves, identify piping upstream of valves and identify branch, equipment, building part or building serviced downstream of valve.
- .3 Colour code pipes to meet code and the departmental representative's requirements. At minimum, colour code pipes with 50 mm wide bands in accordance with the detail shown on the drawings.
- .4 Identify electrical tracing of pipes on pipe insulation.

1.4 VALVE TAGS

- .1 Provide 40 mm dia., 1 mm thick brass tags with 10 mm high die-stamped black letters.
- .2 Attach to valve handles with 100 mm long brass chains through a hole in the handle.

- .3 Tag all valves except for small valves isolating a single piece of equipment such as a unit heater, fan coil unit, terminal reheat coil and radiation section.

1.5 EQUIPMENT NAMEPLATES

- .1 Identify equipment, starters, and, remote control devices in a manner consistent with the Drawings.
- .2 Use solid black capitalized lettering 100 mm high.
- .3 Where equipment size does not permit stencil identification, use lamacoid labels, engraved white on black, mechanically fastened to the equipment. Minimum lettering size 10 mm.

1.6 COMMISSIONING

- .1 Perform commissioning activities in accordance with Section 20 04 00 - Mechanical General Requirements.

2 Products

2.1 INSERTS

- .1 Submit proposed materials and methods for cast-in-place inserts.
- .2 Where inserts must be placed after concrete is poured, use Phillips Red Head Multiset II Anchor system or equivalent Hilti System.

2.2 PIPE HANGERS

- .1 Provide pipe hangers and supports for all piping. Provide hangers in accordance with the following requirements. Provide steel supports in accordance with the subsequent article in this specification section. Provide galvanized steel hangers and supports with galvanized fittings and accessories where exposed to direct contact with water or to possible high humidity conditions where condensation can occur.
- .2 Provide manufactured hangers, accessories and supports in accordance with ANSI B31.1 and MSS SP58, SP69, SP89 and SP90 similar to the Grinnell or Myatt figures numbers below.
- .3 Select products to ensure adequate safety factors under anticipated loads.
- .4 Provide upper attachments as follows:
 - .1 Standard beam clamp for normal service - Grinnell Fig 133 with Fig 290 or Fig 278 or Myatt Fig 500 with Fig 480 or Fig 440.
 - .2 Standard side beam clamp for normal service - Grinnell Fig 225 or Myatt Fig 505.
 - .3 Top beam clamp - Grinnell Fig 92 or Myatt Fig 406.
 - .4 C clamp - Grinnell Fig 86 or Myatt Fig 586.
 - .5 Angle clip for light duty side mounting - Grinnell Fig 202 or Myatt Fig 542.
- .5 For vertical adjustment of hanger rods, provide forged steel turnbuckle - Grinnell Fig 230 or Myatt Fig 475.
- .6 Provide pipe attachments as follows:
 - .1 Adjustable swivel rings for uninsulated fire service piping - ULC approved - Grinnell Fig 69 or Myatt Fig 41.
 - .2 Clevis hanger for copper piping up to and including 100 mm diameter - Grinnell Fig CT-65 plastic coated or Myatt Fig 56 epoxy coated.
 - .3 Swivel ring hanger for copper tubing up to and including 25 mm diameter - Myatt Fig 43 epoxy coated.

.4 Standard duty clevis hanger for steel piping - Grinnell Fig 260 or Myatt Fig 124.

- .5 Standard duty long clevis hanger for steel piping - Grinnell Fig 300 or Myatt Fig 124L.
- .7 Provide vertical pipe supports as follows:
 - .1 Riser clamp for copper pipe - Grinnell Fig CT121C plastic coated or Myatt Fig 186 epoxy coated.
 - .2 Riser clamp for steel or cast iron pipe - Grinnell Fig 261 or Myatt Fig 182 or Fig 183.
- .8 Provide supports for other piping types such as plastic, mechanically fused or packed joint pipe according to the pipe manufacturer's published recommendations. Support piping continuously where required to prevent sagging.
- .9 Provide protection saddles where insulated piping is supported from below.
 - .1 For high temperature insulated pipe - Grinnell Fig 160 or Fig 165 or Myatt Fig 210 or Fig 240.
 - .2 For insulated pipe with vapour barrier for low temperature service, insulate pipe with calcium silicate at hangers and provide Grinnell Fig 167 or Myatt Fig 251.
- .10 Provide roll type supports where shown on the drawings and where longitudinal movement may occur. Provide single pipe rolls - Grinnell Fig 177 or Myatt Fig 262 where supported from below and Grinnell Fig 171 or Myatt Fig 261 where suspended. Provide spring cushions where slight vertical movement is likely and cushioning required - Grinnell Fig 178 or Myatt Fig 880.
- .11 Provide Grinnell or Myatt engineered constant support hangers on piping subject to vertical movement exceeding 40 mm due to vertical pipe expansion.

2.3 EQUIPMENT RIGGING SUPPORTS

- .1 Provide eyebolts suitable for block and tackle connection, adequately supported by the structure above for:
 - .1 Heat recovery equipment wheel and fans.
 - .2 Motors.
 - .3 Other equipment which will require block and tackle handling.

2.4 SLEEVES, WALL AND FLOOR PLATES

- .1 For pipe sleeves, use machine cut and reamed standard weight steel piping.
- .2 Concealed perimeter risers and runouts may have sleeves of 1.31 mm galvanized steel set around section of insulation to provide freedom of movement of piping. Extend 50 mm above finished floor level.
- .3 For piping through exterior walls, cooperate with the waterproofing trade at all times, and do not break any waterproofing seal without consent of the waterproofing trade. Provide waterproof link seals as detailed on Drawings.
- .4 Provide leak plates where pipe sleeves pass through exterior building walls. Each leak plate shall be a 3.42 mm steel plate, welded to the sleeve, 100 mm diameter greater than sleeve outside diameter.
- .5 Provide 1.31 mm galvanized steel duct sleeves. Provide adequate bracing for support of sleeves during concrete and masonry work. For fire rated floors and walls, build fire damper assemblies into structure to attain fire rated construction, in a manner acceptable to the Departmental Representative.

- .6 Cover pipe sleeves in walls and ceilings of finished areas, other than Equipment Rooms, with satin finish stainless steel, or satin finish chrome or nickel plated brass escutcheons, with non-ferrous set screws. Do not use stamped steel split plates. Split cast plates with screw locks, however, may be used.
- .7 Cover exposed duct sleeves in finished areas with 1.31 mm galvanized steel plates in the form of duct collars. Fix in position with non-ferrous metal screws.

2.5 PROVISION FOR PIPE EXPANSION, CONTRACTION AND BUILDING SHRINKAGE

- .1 Where space limitations do not permit the use of expansion loops or offsets, provide Flexonics Expansion Joints properly selected for system operating pressures according to the following:
 - .1 For piping up to and including 65 mm, select ends to suit specified pipe fittings. Pressure shall be external to the bellows. Pressure ratings for Model H and HB expansion compensated as 1400 kPa and 1050 kPa.
 - .2 Copper Piping - Flexonics Model HB expansion compensator with two-ply bellow, all bronze construction.
 - .3 For piping 75 mm and above, use flanged ends.
 - .4 Copper Piping - Flexonics controlled, flexing expansion joint with monel pressure carrier, and brass flanged ends.
 - .5 Submit for Departmental Representative review prior to installation, drawings showing the location of expansion joints, anchors and guides. Show details of proposed connection to structure and loads to be imposed. All Drawings must be signed by a Professional Engineer registered in the Province of New Brunswick.
- .2 Provide steel required for mechanical work including supports, framing of openings and lintels over openings that are not shown on Structural or Architectural Drawings.
- .3 Provide steel of adequate strength to support equipment and materials during all operating and test conditions.

3 Execution

3.1 PIPE AND EQUIPMENT INSTALLATION

- .1 Locate distribution systems, equipment and materials for maximum usable space, optimum service clearances and to accommodate current requirements and identified future expansion.
- .2 Coordinate mechanical services installation above typical floor modular ceilings to allow installation and future relocation of lights and air troffers without interfering with or requiring relocation of mechanical, electrical or other services, or removal of ceiling grid.
- .3 Include all pipe offsets required to eliminate interference with the work of other trades.
- .4 Install equipment and materials to present a neat appearance. Run piping parallel to or perpendicular to building planes. Conceal piping in finished areas. Install so as to require a minimum amount of furring.
- .5 Install pipe straight, parallel and close to walls and slab or deck underside, with specified pitch.
- .6 Use standard fittings for all direction changes. Do not use drilled tees and other field fabricated fittings.

- .7 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.
- .8 Where pipe sizes differ from connection sizes of equipment, provide reducing fittings between inline components such as valves, strainers and fittings, and equipment. Reducing bushings are not permitted.
- .9 Cap open ends of piping during installation.
- .10 Lay copper tubing so that it is not in contact with dissimilar metal and will not kink or collapse.
- .11 Use non-corrosive lubricant or teflon tape and apply on male thread.
- .12 Provide brass adaptors or dielectric couplings wherever dissimilar metals are joined.
- .13 No pipe to be laid in water or when, in opinion of Departmental Representative conditions are unsuitable.
- .14 Ensure that pipe installation does not transmit vibration to the walls and floors through which they pass.
- .15 Make provisions for neat insulation finish around equipment and materials. Do not mount equipment within insulation depth.
- .16 In electrical rooms and elevator machine rooms, provide drip trays under the entire length of all pipe within the confines of the room. Pipe drip tray to nearest floor drain.
- .17 Perform pipe welding to meet ANSI B31.9.

3.2 CONNECTIONS TO EQUIPMENT

- .1 Provide unions or flanges at all connections to equipment. Ensure that piping adjacent to equipment is readily removable for servicing and/or removal of equipment without shutting down entire system.
- .2 Install unions in piping up to and including 50 mm pipe size. Install flanges in piping 65 mm pipe size and larger.
- .3 Control valves with threaded connections are to have unions at both inlet and outlet.
- .4 Prevent galvanic corrosion by isolating copper and steel. Use red brass adapters, or completely isolate flanges using full-face gaskets with bolts installed through phenolic sleeves with insulating fibre washers. Where the Plumbing Code prohibits the use of red brass adapters, use insulating couplings. Where system valves are required, solid brass isolating valves may be used in lieu of adapters or couplings.
- .5 Provide metallic code rated continuity link between flanges or unions, where pipe mains carry flammable fluids or gases.
- .6 Make all plumbing and sheet metal connections to equipment provided by the departmental representative.

3.3 INSERTS

- .1 Size and space for the loads to be supported.
- .2 Properly locate and firmly secure inserts to forms before concrete is poured.
- .3 Place inserts only within main structure and not in any finishing materials.

- .4 When inserts are required in precast concrete, supply inserts and location drawings to the precast concrete supplier for casting into material. Otherwise, include the cost of having the precast concrete supplier install inserts at the site.
- .5 Do not use powder actuated tools.

3.4 HANGERS

- .1 Suspend piping and equipment with all necessary hangers and supports required for a safe and neat installation. Ensure that pipes are free to expand and contract and are graded properly. Adjust each hanger to take its full share of the weight.
- .2 Suspend hanger rods directly from the structure. Do not suspend pipes or equipment from other pipes, equipment, metal work, steel deck or ceilings. Fasten to the bottom rib of structural members only.
- .3 Provide auxiliary structural steel angles, channels and beams where piping and equipment must be suspended between joists or beams.
- .4 Use galvanized rods, steel support angles, channels and beams where exposed to direct contact with water or to possible high humidity conditions where condensation can occur.
- .5 Use space hangers to ensure that structural steel members are not over stressed. In no case shall pipe hangers be further apart than indicated in the tables. When requested, submit detailed drawings showing locations and magnitude of ductwork, piping and equipment loads on the structure. Provide calculations when requested by Departmental Representative. Space hangers so that point load on each hanger is no greater than 45kg. Minimum spacing of hangers to be 1220 mm on center.
- .6 Do not use trapeze type hangers for support of piping, without prior review by Departmental Representative. Where permitted, fabricate from angle or channel frames, and space hangers to suit the smallest pipe size.
- .7 Do not use hooks, chains or straps to support equipment and materials.
- .8 For precast concrete work, pass hanger rods between the members and weld to steel plates resting on the upper surface of the precast material. To prevent raising of the hanger rod, apply a lock nut and 50 mm minimum dia. flat washer tight against the under surface of the precast material.
- .9 Ensure that copper materials are completely isolated from ferrous materials. Use plastic or epoxy coated hangers and clamps. Use lead inserts between copper piping and other ferrous materials.
- .10 If individual point loads are greater than 45kg, provide a signed letter from the steel deck manufacturer confirming the deck is capable of supporting the load.
- .11 Provide round steel threaded rods meeting ASTM A-36. Provide cadmium plated rod and accessories where exposed to direct contact with water or to possible high humidity conditions where condensation can occur.

- .12 The following table establishes minimum standards of rod sizes and hanger spacing for steel and copper piping.

Maximum Horizontal Spacing of Supports			
Pipe Size mm	Rod Size mm	Steel m	Copper m
12	10	1.5	1.5
20	10	1.8	1.8
25	10	1.8	1.8
32	10	2.4	2.1
40	10	2.7	2.4
50	10	2.7	2.7
65	12	3.0	3.0
75	12	3.0	3.0
90	12	3.0	3.3
100	16	3.0	3.7
125	16	3.7	3.7
150	20	3.7	3.7
200	22	3.7	
250	22	3.7	
300	22	3.7	
350	25	3.7	
400	25	3.7	
450	29	3.7	
500	32	3.7	
600	32	3.7	

- .13 In addition to these basic requirements, provide hangers in the following location:
- .1 To eliminate vibration.
 - .2 At points of vertical and horizontal change of direction of pipe.
 - .3 At inline centrifugal pumps.
 - .4 At valves and strainers.
 - .5 On mains at branch takeoffs.
 - .6 To avoid stress on equipment connections.
- .14 Support horizontal cast iron soil pipe at each hub. Where groups of fittings occur, not more than three joints shall be between hangers.
- .15 Refer to applicable articles of the Specification regarding thermal insulation requirements. Unless shown specifically on Drawings, provide the following support methods.
- .1 For insulated domestic hot water piping, for condensate piping and for steam piping up to 65 mm diameter, support with hangers directly on piping.

- .2 For refrigerant and domestic cold water piping, hangers shall be large enough to fit over specified pipe covering. At each point of support, install specified protection saddles with sufficient length to prevent crushing of insulation.
- .16 Generally, support ducts with 2.7 mm by 25 mm wide galvanized hangers or with 12 mm diameter rods and 40 mm rolled angle saddles to meet SMACNA or ASHRAE Standards.
- .17 Support vertical duct risers at each floor with rolled angle collars bearing on building structure.

3.5 SLEEVES, WALL PLATES, FLOOR PLATES

- .1 Set sleeves for piping and ductwork in conjunction with erection of floors and walls. Locate sleeves accurately in accordance with submittal drawings, and as follows:
 - .1 Through interior walls, set sleeves flush with finished surfaces on both sides.
 - .2 Through exterior walls above grade, set sleeves flush with finished surfaces on inside and to suit flashing on outside.
 - .3 For floors in Mechanical Equipment Rooms, Janitors Closets, Kitchens and similar areas where a water dam is required, set sleeves flush to underside of structure and extending 50 mm above finished floor.
 - .4 For other floors, set sleeves flush to both finished surfaces. Refer to Room Finish Schedule.
- .2 Size sleeves to provide 25 mm clearance around insulated piping and ductwork.
- .3 Provide continuous insulation runs through fire separations. Ensure that piping does not touch sleeves or for domestic hot water piping terminate insulation cover on each side of sleeve. For domestic cold water piping, provide same thickness high density insulation with all purpose vapour barrier jacket through fire separation to a point 100 mm on each side of fire separation.
- .4 Install leak tight seals to meet the manufacturer's requirements. Select the inside diameter of each wall sleeve opening to fit the pipe and leak tight seal, all to ensure watertight joint.
- .5 Additional sleeving requirements:
 - .1 Provide sleeves for systems not part of Contract, but identified to be required on Drawings.
 - .2 Provide sleeves to accommodate wiring conduits required for Division 23 work.
 - .3 Provide additional sleeves as required by Drawings to accommodate service requirements. Include for the cost of drilling and setting sleeves.
 - .4 Fill unused sleeves through fire separations with firestop material (see Firestopping article 3.7). Fill other unused sleeves with suitable noncombustible materials.

3.6 PIPE GUIDES AND ANCHORS

- .1 Install pipe guides for expansion joints according to expansion joint manufacturer's published recommendations. Use at least two (2) guides on each side of expansion joint.
- .2 Install manufactured or field fabricated alignment guides to allow movement in axial direction only.
- .3 Install vertical risers properly anchored and guided to maintain accurate vertical position of piping. At time of startup, clean and lubricate guides, and adjust to allow free sliding at operating conditions.

- .4 For piping up to and including 75 mm, guide pipes at every floor or every 3900 mm. Guide larger pipes at every second floor or every 7500 mm .
- .5 Fabricate anchors from structural steel channels, plates or angles.
- .6 Secure anchors to the structure. Avoid introduction of excessive reactive forces and operating weights into the structure and onto equipment and piping.
- .7 Where guides are provided on cold piping, provide thermal break to prevent sweating.

3.7 PAINTING

- .1 Supply ferrous metal work except piping and galvanized and stainless steel ductwork, with at least one (1) factory prime coat, or paint one (1) prime coat on job.
- .2 Clean and steel brush surfaces with welds. Then prime coat all steel supports and brackets.
- .3 On uninsulated piping, steel brush and prime coat welds.
- .4 Touch-up or repaint all surfaces damaged during shipment or installation and leave ready for finish painting.
- .5 Prime coat material shall conform to Canadian General Standards Board Standard No. 1-GP-48.

END OF SECTION