1 RELATED SECTIONS

.1 Primary Process Instrumentation Devices and Cabling: Section 26 90 00.

.2 Process Pipe Hangers and Equipment Supports: Section 26 90 00.

.3 Process Valves and Miscellaneous Equipment: Section 40 05 23

.4 Process Mechanical Piping, And Appurtenances: Section 40 20 00

2 REFERENCES

.1 ASME B31.3-04, Process Piping.

3 GENERAL

.1 This section covers items common to all sections of Division 40 and is intended to supplement the requirements of Section 01 10 10.

4 WORK INCLUDED

.1 Finish all materials, labour, tools and equipment and perform all operations necessary to complete all process systems specified under Division 40.

.2 The work shall include inspection, testing, start-up and commissioning of process systems and equipment. Coordinate commissioning in accordance with Section 01 10 10.

5 DRAWINGS

.1 The Drawings indicate the extent and general arrangement of the various systems and must be read in conjunction with these specifications. The Drawings are not to be considered as detail as shop drawings but as a guide to the general intent based on the materials specified.

.2 Where field conditions necessitate departures from the Drawings, working drawings for the proposed departures shall be submitted to the Departmental Representative for review prior to installation.

.3 Because of the small scale of the Drawings, it is not possible to indicate all offsets and accessories that may be required for the installation.

5 DRAWINGS (Cont'd)

.4 Investigate carefully the, architectural, electrical, structural and finish conditions affecting this work and arrange details accordingly. Furnish and install items required to meet such conditions.

6 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperature and conditions required by manufacturer at no additional cost to the Contract.

7 REFERENCE STANDARDS

.1 The work under this Section shall conform to the applicable requirements of the National Building Code and National Plumbing Code of Canada, National Fire Protection Association, Underwriters Laboratories of Canada (ULC), and referenced standards throughout these Specifications of the American National Standards Institute (ANSI), American Society of Mechanical Engineers (ASME), American Society of Testing and Materials (ASTM), Canadian Standards Association (CSA), the Canadian General Standards Board (CGSB), Canadian Gas Association (CGA), American Water Works Association (AWWA), Hydraulic Institute Standards, National Electrical Manufacturers' Association (NEMA), Institute of Electrical and Electronics Engineers (IEEE), Electrical Manufacturers' Association of Canada (EEMAC).

.2 Equipment assemblies comprised of electro-mechanical components will be certified by an agency (preferably CSA) recognized by the applicable provincial Electrical Inspection Department. Where there is no alternative to supplying equipment that is not appropriately certified, special approval from the applicable provincial Electrical Inspection Department will be required. Costs associated with obtaining such approval will be the responsibility of the Contractor.

8 INSPECTION

.1 All manufacturing operations and finished pipes, fittings and appurtenances shall be subject to inspection by the Departmental Representative. Furnish all labour necessary to assist the Owner or his inspectors in inspecting the materials.

9 EQUIPMENT INSTALLATION

.1 Provide unions and flanges to permit equipment maintenance and disassembly and to minimize disturbance to piping and duct systems without interfering with other equipment.

.2 Provide means of access for servicing equipment including permanently lubricated lifetime bearings.

.3 Pipe equipment drains as indicated.

.4 Install equipment, piping, conduit and similar items parallel to or perpendicular to building lines.

10 CUTTING AND PATCHING

.1 Provide equipment and inserts in time to prevent cutting of new work.

.2 Coordinate and provide sizes of openings and locations (prior to work).

11 ANCHOR BOLTS AND TEMPLATES

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

12 TRIAL USAGE

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

.2 Trial usage to apply to following equipment and systems:
.1 Process pipe systems.
.2 Process equipment.
.3 Pumps.
.4 Process valves and gates.
.5 Process controls.

13 PROTECTION OF OPENINGS

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

14 ELECTRICAL

.1 Electrical work to conform to Division 26.

.2 Refer to Section 26 90 00 for instrumentation and controls wiring requirements.

15 GUARDS

.1 Provide guards for all unprotected drives.

.2 Guard for flexible pump coupling, unless otherwise specified:
.1 "U" shaped, minimum 1.6mm thick galvanized mild steel.
.2 Securely fasten in place.
.3 Removable for servicing.

16 EQUIPMENT SUPPORTS

.1 Equipment supports and equipment as specified in Section 40 05 29 or as shown on drawings.

17 ESCUTCHEONS

.1 On pipes passing through walls, partitions, floors and ceilings in finished areas.

.2 Chrome or nickel plated brass or Type 302 stainless steel, split type with set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

.5 Secure only to bare pipe or flat surface.

18 TESTS

.1 Give 24 h written notice 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 or local authority having jurisdiction.

.4 Bear costs including retesting and making good.

18 TESTS (Cont'd)

.5 Piping systems:
.1 Record all data and provide five (5) copies of written report upon completion of work.
.2 Where applicable, test drainage, waste and vent piping to the National Plumbing Code and/or the local authorities having jurisdiction.
.3 Test all liquid service process piping in accordance with ASME B31.3 at 1½ times system operating pressure or minimum 1035 kPa, whichever is greater. Maintain test pressure without loss for 4 h unless otherwise specified.

.6 Process equipment: provide supplemental tests as specified in relevant sections.

.7 Prior to tests, remove or isolate all equipment or other parts which are not designed to withstand test pressures or test medium. Re-install after test is completed.

19 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work, including pipe hangers. Use zinc rich primer on galvanized materials.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

20 SPARE PARTS

.1 Furnish spare parts where specified or indicated on the Drawings.

21 SPECIAL TOOLS

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

22 DIELECTRIC COUPLINGS

.1 General:
.1 To be compatible with and to suit pressure and temperature 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.

22 DIELECTRIC COUPLINGS (Cont'd)

.4 Acceptable material: EBCO, Walter Valiet Co.

23 DRAIN VALVES

.1 Locate at low points and at section isolating valves unless otherwise specified.

24 CO-OPERATION WITH OTHER TRADES

.1 In areas where piping, and electrical fixtures are in close proximity to each other, cooperate fully with the other trade in laying out the location of same.

.2 Report immediately to the Departmental Representative for his comments areas of conflict. Do not install work until corrective measures are approved.

.3 Take special care with structural coordination.

.4 If required, prepare interference layout drawings prior to construction and submit these to the Departmental Representative for his review. These drawings shall clearly indicate all necessary associated trade work such as light fixtures, etc.

25 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into Operations and Maintenance Manuals in accordance with Section 01 10 10.

.2 Instructions to include step-by-step directions for starting up and shutting down process equipment and step-by-step directions for minor troubleshooting, and periodic maintenance instructions such as cleaning, oiling, etc., for all equipment provided under this Contract, including type of lubricant.

.3 All bulletins shall pertain to equipment installed on this job only. General bulletins describing any items of equipment not installed on this job will be rejected.

.4 Include preparation of such instructions and schematic diagrams as part of the work under this Section.

.5 Each manufacturer to submit recommended list of spare parts with maintenance manuals.

25 OPERATION AND MAINTENANCE DATA (Cont'd)

.6 Approvals:
.1 Submit copies of draft Operating and Maintenance Manual to Departmental Representative for approval in accordance with Section 01 10 10. Submission of individual data will not be accepted unless so directed by Departmental Representative.
.2 Make changes as required and resubmit data in accordance with Section 01 10 10.
.3 Submit two (2) additional complete sets of Operations and Maintenance Manuals for all process equipment systems and equipment to the Departmental Representative six (6) weeks prior to commissioning. These sets of Manuals will not be returned to the Contractor.

.7 Additional data: prepare and insert into operation and maintenance manual when need for same becomes apparent during commissioning.

26 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 10 10.

.2 Shop drawings and product data shall show:
.1 Mounting arrangements.
.2 Operating and maintenance clearances. eg. access door swing spaces.
.3 Roughing-in dimensions and all other physical characteristics pertinent to installation.
.4 Detailed drawings of bases, supports, and anchor bolts.
.5 Acoustical sound power data, where applicable.
.6 Points of operation on performance curves.
.7 Certification as to current model production.
.8 Certification of compliance to applicable codes.

27 CLEANING

.1 Clean interior and exterior of all systems including strainers, supports, ducting and piping distribution systems, tanks, pumps, process equipment, compressors, etc.

.2 Upon completion of testing, remove all test equipment and cap holes to satisfaction of the Departmental Representative.

.3 In preparation for final acceptance, clean and refurbish all equipment, fixtures and trim and leave in operating condition including replacement of all filters in all air and piping systems in preparation for final acceptance.

27 CLEANING (Cont'd)	.4	Leave all areas cleaned of debris and unused materials.
28 RECORD DRAWINGS	.1	Maintain record drawings on site for process mechanical work in accordance with Section 01 10 10.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 The work to be done under this Section shall include, but shall not be limited to the supply and installation of valves, actuators, and all other appurtenances, and carrying out of all related start-up and testing.

1.2 RELATED SECTIONS

.1 Painting: Section 09 91 23

.2 Electrical: Division 26

.3 Process Mechanical General Requirements: Section 40 05 10.

.4 Process Piping Hangers and Equipment Supports: Section 40 05 29

1.3 REFERENCES

.1 Refer to Section 40 05 10.

.2 Equipment assemblies comprised of electro-mechanical components will be certified by an agency (preferably CSA) recognized by the applicable provincial Electrical Inspection Department. Where there is no alternative to supplying equipment that is not appropriately certified, special approval from the applicable provincial Electrical Inspection Department will be required. Costs associated with obtaining such approval will be the responsibility of the Contractor.

.3 ANSI B16.1-00, Cast Iron Pipe Flanges and Flanged Fittings.

.4 ASTM A126-04(2014), Standard Specification for Gray-Iron Castings for Valves, Flanges and Pipe Fittings.

.5 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

.6 AWWA C500-02, Metal-Seated Gate Valves for Water Supply Service.

.7 AWWA C509-01, Resilient-Seated Gate Valves for Water Supply Service.

1.3 REFERENCES (Cont'd)

.8 Underwriters Laboratory of Canada (ULC).

.9 Factory Mutual Approved (FM).

1.4 INTENT

.1 The intent of these specifications is to provide the works fully complete in every detail for the purpose designated. Any apparatus, appliance, material or labour not herein specifically mentioned or included but requisite to the operation of the apparatus and equipment specified shall be furnished without additional expense to the Contract.

1.5 SHOP DRAWINGS

.1 Provide shop drawings for all valves, gauges and tanks.

1.6 IDENTIFICATION OF EQUIPMENT

.1 All equipment shall be fitted with manufacturer's identification nameplates indicating size, equipment model, manufacturer's name and serial number.

PART 2 - PRODUCTS

2.1 PLUG VALVES

.1 Non-lubricated eccentric plug type, cast iron body to ASTM A126-04(2014), Class B, with exterior epoxy finish and BUNA-N interor coating; full round port, wrench operated, with 125 lb. flanges.
.1 Acdeptable products: Keystone Ballcentric, or approved equal.

2.2 BALL VALVES

.1 Bronze, 2 piece body, 1035 kPa rated, full port ball valve with threaded end connections. Acceptable products: Watts, Crane, Nibco, Velan, or approved equivalent.

.2 Stainless steel, 2 piece body, 5500 kPa rated, full part ball valve with threaded end connections. Acceptable products: Watts, Crane, Nibco, Velan, or approved equivalent.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install valves in the locations indicated, and to the elevations as shown on the Drawings.

.2 The loading, hauling, unloading, storage of valves and appurtenances shall be accomplished without damage to the same. The Contractor shall be liable for any damage to the valves or appurtenances until they are accepted in the completed work.

.3 Where flanged pipe and fittings are used, make joints with 3 mm Buna N or neoprene gaskets and bolts and nuts conforming to ASTM A307-14 for Grade B steel machine bolts and nuts. Tighten nuts alternately to a uniform torque to achieve even distribution of pressure on joint gasket and to avoid unequal stresses in flanges. Provide flanged adapter or vic-flange couple where shown on the Drawings or where required to install valves or to permit future equipment removal for maintenance purposes.
.1 Provide 304 stainless steel machine nuts and bolts for joints involving stainless steel pipe or in areas where nuts and bolts will not be painted.

.4 Orient valves for ease of operation. Obtain Departmental Representative's approval of a particular orientation before completing joints.

.5 Install specialties and other like items in accordance with the manufacturer's instructions. Provide small piping, or tubing, with fittings where required for their proper operation and servicing whether shown on the Drawings or not.

.6 Install valves and appurtenances in strict accordance with the manufacturer's instructions and as directed by the Departmental Representative.

.7 Remove internal parts before soldering where applicable.

3.2 PIPE SUPPORT

.1 Provide permanent support in accordance with Section 40 05 29.

.2 All valves and fittings shall be restrained so that all thrusts shall be supported independent of the piping system.

3.2 PIPE SUPPORT (Cont'd)

.3 Coordinate support work. Ensure permanent supports are complete before any temporary support is removed.

3.3 IDENTIFICATION

.1 Equipment to be identified includes all equipment specified herein.

.2 Coordinate identification work.

3.4 PAINTING

.1 Paint piping, valves, fittings, fasteners and supports, etc., as specified in Section 09 91 23.

.2 Follow painting schedule as described in Section 09 91 23.

.3 Coordinate painting and pipe identification work to avoid conflicts. Do not paint over valve name plates.

3.5 CLEANUP

.1 Upon completion of testing, remove all test equipment and demonstrate proper operation of the installation to the Departmental Representative.

.2 Clean and refurbish all equipment and fixtures and leave in operating condition in preparation for final acceptance.

3.6 EXISTING VALVES

.1 Relocate or reinstall existing valves as required or where indicated. Inspect valves visually and report any noticeable damage to the Departmental Representative prior to storage or reinstallation.

.2 Clean relocated valves and replace gaskets and fasteners as required.

.3 Provide temporary bulkheads or blind flanges as required to allow existing valves and equipment to be removed.

.4 Seek approval by the Departmental Representative prior to manipulation or operation of existing valves.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 The work shall include, but shall not be limited to the supply and installation of hangers and supports, equipment supports and all other appurtenances. Pipe supports and appurtenances shall be in accordance with details shown on the Drawings and shall be suitable for the purpose for which they are specified.

1.2 RELATED WORK

.1 Painting: Section 09 91 23

.2 Process Mechanical General Requirements: Section 40 05 10

.3 Process Valves and Miscellaneous Equipment: Section 40 05 23

.4 Process Mechanical Piping, and Appurtenances: Section 40 20 00

.4 Electrical: Division 26

1.3 REFERENCES

.1 ANSI/ASME B31.3-20144, Process Piping.

.2 MSS-SP-58-02, Pipe Hangers and Supports - Materials, Design and Manufacture.

.3 MSS-SP-69-03, Pipe Hangers and Supports - Selection and Application.

1.4 INTENT

.1 The intent of these specifications is to provide the works fully complete in every detail for the purpose designated. Any apparatus, appliance, material or labour not herein specifically mentioned or included but requisite to the operation of the apparatus and equipment specified shall be furnished without additional expense to the Contract.

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 40 05 10.

1.5 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.2 Submit shop drawings and product data for the following items:
- .1 Upper attachment.
- .2 Middle attachment.
- .3 Pipe attachment.
- .4 Riser clamps.
- .5 Shields and saddles.
- .6 Sway braces.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Where pipe hangers are detailed on the drawings, these details shall govern. For small piping where supports are not detailed, this section shall govern.

.2 Fabricate hangers and supports in accordance with ANSI/ASME B31.3-2014 and MSS-SP58.

.3 Support only from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members. Provide supplementary members suitable for use of the products specified in this section.

.4 Unless otherwise specified, all metal supports shall be galvanized prior to installation.

2.2 PIPE SUPPORTS

.1 Finishes:
- .1 All pipe hangers and supports shall be hot dipped galvanized after fabrication.
- .2 All inserts and fasteners shall be galvanized or stainless steel.
- .3 Provide other materials where indicated on the Drawings for areas of higher corrosion potential.

2.3 U-BOLTS

.1 Material to MSS SP-69.
- .1 Acceptable product:
  - .1 Anvil (Grinnell) Fig. 137
  - .2 Hunt
  - .3 Carpenter and Paterson

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP58, type 42.
  .1 Acceptable product:
    .1 Anvil (Grinnell) Fig. 261
    .2 Hunt
    .3 Carpenter and Paterson

2.5 PIPE HANGERS

.1 Upper attachment:
  .1 Ceiling flange plate with rod and clevis, for surface mount: galvanized, with two anchors for each hanger.
    .1 Acceptable material:
      .1 Anvil (Grinnell), Plate Fig. 128R.
      .2 Myatt.
      .3 Carpenter and Paterson.

.2 Adjustable clevis:
  .1 Material to MSS SP69.
  .2 Clevis bolts with nipple spacer and vertical adjustment nuts above and below clevis.
  .3 All components to be galvanized.
  .4 Acceptable material:
    .1 Anvil (Grinnell) Fig 260.
    .2 Myatt.
    .3 Carpenter and Paterson.

2.6 FABRICATED SUPPORTS

.1 Fabricate supports from structural grade steel. All fabricated supports shall be hot-dip galvanized after fabrication.
  .1 Provide other materials where indicated on the Drawings.

2.7 SUPPLEMENTARY STRUCTURAL STEEL MEMBERS

.1 As required by hanger location and design loads.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install pipe in accordance with the Canadian Plumbing Code and the local authority having jurisdiction.

.2 Drawings do not show all required pipe. Drawings show type of support to be used. Refer to Section 3.2 for support spacing.

.3 Provide permanent support in accordance with this Section.

.4 All valves, fittings and equipment shall be restrained so that all thrusts shall be supported independent of the piping system.

.5 Support hangers from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.6 Coordinate support work. Ensure permanent supports are complete before any temporary support is removed.

.7 Provide concrete pipe supports in areas as shown on the Drawings. All support locations are not shown on the Drawings.

.8 Provide all supports unless otherwise provided by equipment manufacturers.

3.2 SUPPORT SPACING

.1 Install pipe supports such as hangers, concrete supports or support legs with maximum support spacing as follows:

3.2 SUPPORT SPACING .1 (Cont'd)
(Cont'd)

Pipe Size	SS Stainless Steel (ID)	SSS Stainless Steel (Sch. 10)	PVC Schedule 80	Ductile Iron
Up to 19 mm	1980 mm	1980 mm	1000 mm	
25 mm	2100 mm	2100 mm	1200 mm	
50 mm	3000 mm	3000 mm	1500 mm	1800 mm
75 mm	3400 mm	3600 mm	2000 mm	1980 mm
100 mm	4000 mm	4270 mm	2500 mm	2585 mm
150 mm	4300 mm	4500 mm	3000 mm	2743 mm
200 mm	4900 mm	5000 mm		3200 mm
250 mm	4900 mm	5000 mm		4000 mm
300 mm	5200 mm	5500 mm		4000 mm

.2 The above spacing does not apply where there are concentrated loads between supports, such as flanges, valves, specialties. These shall be supported separately. Provide additional pipe supports where pipes connect to equipment or machinery, so that no load shall be exerted from piping to such equipment or machinery.

.3 Critical or specific piping support locations are shown on the drawings for clarity. Where locations of miscellaneous piping supports are not detailed or are not located by dimensions, locate supports in accordance with clause .1 above.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for providing all labour, tools, equipment and materials to complete all identification for Division 40 and Divisions 41 through 46.

1.2 REFERENCES

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

.3 Provide ULC and CSA registration plates as required by respective agency and inspection authority.

1.3 RELATED WORK

.1 Process Mechanical General Requirements: Section 40 05 10

.2 Process Integration: Division 40

1.4 SAMPLES

.1 Submit samples and lists of proposed wording for approval before engraving in accordance with Section 01 10 10.

PART 2 - PRODUCTS

2.1 MANUFACTURERS NAMEPLATES

.1 Provide metal nameplate on each piece of equipment, mechanically fastened complete with raised or recessed letters.

.2 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and HP of motors.

2.2 SYSTEM NAMEPLATES AND PROCESS EQUIPMENT

.1 Colour:
.1 White letters, black background except where required otherwise by applicable codes.

.2 Construction:
.1 3 mm thick, lamicoid plastic, square corners, letters accurately aligned and machine engraved into core.

2.2 SYSTEM NAMEPLATES AND PROCESS EQUIPMENT (Cont'd)

.2 Construction:(Cont'd)
.2 Use size 17 mm x 100 mm for terminal cabinets and control panels with 5 mm letters.
.3 Use size 35 mm x 150 mm with 17 mm letters for process equipment as specified under Division 46.

2.3 PIPING

.1 General:
.1 To CAN/CGSB-24.3.
.2 Identify medium by lettered legend, classification by primary and secondary colours, direction of flow by arrows.

.2 Material:
.1 Paint: to CAN/CGSB-1.60 for stencils.
.2 Legend markers (labels), arrow and colour bands: plastic coated cloth material with protective overcoating and waterproof contact adhesive undercoating, suitable for 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C. Apply to prepared surfaces. Wrap tape around pipe or pipe covering with ends overlapping one (1) pipe diameter.
.3 Waterproof and heat resistant plastic marker tags: for pipes and tubing 19 mm nominal and smaller.
.4 Acceptable material: W.H. Brady Inc., Seton Name Plate Corp., Setmark Pipe Markers, S.M.S. Construction Specialties.

2.3 PIPING (Cont'd)

.3 Provide identification as per the following schedule at intervals not exceeding 5 m and after valves and fittings. Note that identification on digester waste gas systems (if applicable) shall be at intervals not exceeding 3 m.

(Cont'd)

Contents	L-Label S-Stencil	Stencilled Colour Primary	Stencilled Colour Secondary	Direction Arrows
Wastewater	L	White	Black	Yes
Grit	L	White	Black	Yes
Scum	L	White	Black	Yes
Mixed Liquor	L	White	Brown	Yes
WAS	L	White	Brown	Yes
Decant (Effluent)	L	White	Light Green	Yes
Air	L	White	Black	Yes
Drain	L	White	Black	Yes
Service Water (Non Potable)	L	White	Black	Yes
Vent	L	White	Black	No
Sample	L	White	Black	Yes
Overflow	L	White	Black	No
Low Pressure Air	L	White	Black	Yes

.4 Sizes:

.1 Legend and stencilled letters shall be block capitals sized as follows:

Outside Pipe Dia (mm)	Letter Size (mm)
Up to 30	13
50	19
150	32
250	63
Above 250	88

.2 Arrows shall be 150 mm long x 37 mm for pipes/insulation 40 mm diameter, and greater; and 100 mm long x 19 mm high for pipes/insulation under 40 mm diameter.

2.4 VALVES AND CONTROLLERS

.1 3 mm thick, lamicoid plastic, black face, white core, square corners with letters accurately aligned and machine engraved into core.

.2 Hang identification plates with either chrome or brass chains. Chrome-plated or brass plated chains are not acceptable. Do not hang on valve handles.

2.4 VALVES AND CONTROLLERS (Cont'd)

.3 Size as follows:
.1 18 mm x 82 mm: 9.5 mm letters (one line).
.2 18 mm x 82 mm: 5 mm letters (two lines).

.4 Process valves and controllers shall include:
.1 All process valves but not including check valves.

2.5 CONTROLS IDENTIFICATION

.1 Identify all systems, equipment, components, controls and sensors.

.2 Inscription to identify function and, where applicable fail-safe position.

PART 3 - EXECUTION

3.1 GENERAL

.1 Do identification work in accordance with CAN/CGSB-24.3 except where specified otherwise.

.2 Secure nameplates with aluminum or stainless steel pop-rivets or other mechanical fasteners. Do not use adhesives.

.3 Provide identification only after painting has been completed.

3.2 LOCATION OF NAMEPLATES

.1 In conspicuous location to facilitate easy reading from operating floor and to properly identify equipment and/or system.

.2 Provide stand-offs for nameplates on hot surfaces and insulated surfaces.

.3 Do not insulate or paint over plates.

3.3 PIPING

.1 Locations:
.1 In open areas, equipment rooms, and above removable suspended ceilings.
.2 At least once in each room through which piping passes.
.3 On both sides of visual obstructions or separations.
.4 At not more than 17m intervals and more frequently if required to ensure at least one is visable from any view point in operating areas.

3.4 VALVES AND CONTROLLERS

.1 Secure tags with non-ferrous chains(as noted in Clause 2.4) or closed "S" hooks for valves and operating controllers.

.2 Consecutively number valves in system or as indicated on the drawings.

END

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 The work to be done under this Section consists of furnishing all materials, labour, tools and equipment and performing all operations necessary to complete water, piping and connection to equipment.

1.2 RELATED WORK

.1 Painting: Section 09 91 23

.2 Process Mechanical General Requirements: Section 40 05 10

.3 Process Pipe Hangers and Supports: Section 40 05 29

1.3 REFERENCES

.1 ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ASTM D2564-12, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

.3 AWWA C104/A21.3-03, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

.4 AWWA C110, American National Standard for Ductile-Iron and Gray Iron Fittings, 72 mm Through 1200 mm for Water and Other Liquids.

.5 AWWA C151/A21.51-02, American National Standard for Ductile-Iron Pipe, Centrifugally Cast for Water.

.6 AWWA C606-04, Grooved and Shouldered Joints.

.7 AWWA C900-97, Polyvinyl Chloride (PVC) Pressure Pipe, 4" Through 12" for Water Distribution.

.8 ANSI A21.10-00, Cast Iron & Ductile Iron FTGS, 2 Thru 48 in./Water

.9 ASME B31.3-2004, Process Piping.

.10 ASTM A181/A181M-14, Standard Specification for Carbon Steel Forgings for General Purpose Piping.

.11 ASTM A240/A240M-15a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

1.3 REFERENCES (Cont'd)

.12 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.13 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat-Treated, 120/105 Ksi Minimum Tensile Strength.

.14 ASTM A 536-84(2014), Standard Specification for Ductile-Iron Castings.

.15 ASTM A778-01(2009)e1, Standard Specification for Welded, Unannealed Austenitic Stainless Steel tubular Products.

.16 AWWA C111-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.17 AWWA C115/A21.15-05, Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges.

.18 CSA B137 Series-02 Series 05, Thermoplastic Pressure Piping Compendium.

1.4 INTENT

.1 The intent of these specifications is to provide the works fully complete in every detail for the purpose designated. Any apparatus, appliance, material or labour not herein specifically mentioned or included but requisite to the operation of the apparatus and equipment specified shall be furnished without additional expense to the Contract.

.2 Pipes and appurtenances shall be in accordance with details shown on the Drawings and shall be suitable for the purpose for which they are specified.

1.5 SHOP DRAWINGS

.1 Provide shop drawings for:
.1 Pipe and fittings.
.2 Piping layouts (piping 100 mm and larger).

.2 Piping arrangements shall be detailed so as to relate specifically to the type of equipment and fittings to be installed. Any changes in the layout of piping or equipment due to the acceptance of alternates must be submitted with dimensioned scale drawings for approval by the Departmental Representative.

PART 2 - PRODUCTS

2.1 DUCTILE IRON (DI)

.1 Pipe material: ductile iron to AWWA C151, special class 52, cement mortar lined to AWWA C104, maximum working pressure 2400 kPa. Special Class 54 where grooved ends are employed.

.2 Pipe joints: flanged to AWWA C115 with 125 lb. flange dimensions to ASME B16.1-1998.

.3 Fittings: ductile iron or grey iron to AWWA C110/A21.10-12 with 125 lbs. flange connections to ASME B16.1-1998 and cement mortar lined to AWWA C104.

.4 Gaskets: neoprene rubber.

.5 Couplings: Victaulic style 31 (or equivalent) and Dresser style 138 where shown on the Drawings.

.6 Coatings: all pipe and fittings to be coated with manufacturer's standard coating.

.7 Bolt assemblies shall conform to ASTM A307-14 for Grade B steel machine bolts and nuts.

.8 Grooved end couplings are acceptable alternates to flanged coupling as described in clause 2.1.2.3.
.1 Groove end couplings shall be ductile iron to ASTM A-536, Victaulic Style 31 (or equivalent), complete with flush seal "M" gasket.
.2 Groove end fittings shall have rigid radius in accordance with AWWA C606. Fittings shall conform to ANSI A21.10/AWWA C-110. Acceptable product: Victaulic, Shurjoint, or approved equivalent.

.9 Provide additional grounding rings as required for magnetic flow meters specified under Division 26.

2.2 STAINLESS STEEL

.1 Pipe material: 304 stainless steel.

.2 All pipe and fittings shall be manufactured to ASTM A778 or ASTM A774 from sheet and plate of domestic origin confirming to ASTM A240, A-304L. Sheet finish shall be plate finish No. 1.

.3 Pipe and fittings for service up to 1350 kPa operating pressure and maximum 95°C and shall be supplied in the following nominal wall thicknesses:
.1 Schedule 10.

2.2 STAINLESS STEEL (Cont'd)

.4 Fittings: elbows to 600 mm shall be smooth flow Schedule 10 design.

.5 Stub-ends Type A: shall be 316L stainless steel confirming to ASTM A240 and shall be pressed type Schedule 10S, supplied with bevelled ends to ASME B16.9.

.6 Vanstone Rings: shall be 316L stainless steel conforming to ASTM A240 and shall be pressed type with minimum 11 USS gauge thickness.

.7 Backing flanges shall be carbon steel, hot dipped galvanized to ASME B16.1, class 150 suitable for 1040 kPa working pressure.

.8 Grooved end couplings are an acceptable alternative and shall be rigid style Victaulic Model No. 489 or approved equivalent.

.9 Gaskets: 3.2 mm thick Buna N composition or Neoprene suitably reinforced.

.10 Minimize field welding of pipe.

.11 Bolt assemblies shall be stainless steel.

.12 Welding in fabricator's shop and in the field shall be performed by qualified welders to approved procedures. Welding rod or wire shall be of the same composition or superior to the pipe and fitting material. The weld deposit at the seam shall have a slight crown on both sides of the weld and no cracks or crevices shall be allowed. Excessive weld deposits, slag, weld splatter and projections into interior of the pipe shall be removed by grinding.

2.3 COPPER

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

2.4 BRASS PIPE AND FITTINGS

.1 Pipe to ASTM B135, seamless brass tube.

.2 Fittings to be forged brass with threaded connections.

PART 3 - EXECUTION

3.1 GENERAL

.1 Pipe installation shall be in accordance with ASME B31.3.

.2 Install piping in the locations indicated, and to the elevations and lines as shown on the Drawings.

.3 Pipes entering concrete tanks, or structures shall be done by one of the methods shown on the Drawings.

.4 Co-ordinate location and furnish embedded items to Contractor for installation in poured-in-place concrete.

.5 Cut pipes where necessary to obtain the exact location of fittings or valves.

.6 Run piping as directly as practical and make provisions for expansion, jarring, vibrations and settling.

.7 In the installation of piping, do not cut girders, beams or other members of building in such a manner as to reduce strength of the girder, beam, or other member of the building below that required for the purpose for which it was intended.

.8 Run pipes to avoid conflicts between pipes of different functions. Where conflicts between pipe locations occur, process pipe shall have precedence over plumbing and heating pressure pipes, gravity pipes will have precedence over pressure pipes and large diameter pressure pipes will have precedence over smaller diameter pipes. Notify the Departmental Representative of conflicts. The Departmental Representative will provide the resolution.

.9 The loading, hauling, unloading of pipes and appurtenances shall be accomplished without damage to the same. Dropping of pipe and appurtenances on the ground will not be permitted. The Contractor shall be liable for any damage to the pipe or appurtenances until they are accepted in the completed work.

.10 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.11 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as

3.1 GENERAL (Cont'd)

.11 (Cont'd)
indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.2 JOINTING OF PIPE AND FITTINGS

.1 Where pipe is to be connected to equipment, fit pipe so that neither pipe nor equipment is strained during the joining procedure.

.2 Where flanged pipe and fittings are used, make joints with 3 mm Buna N or neoprene gaskets and bolts and nuts conforming to ASTM A307-14 for Grade B steel machine bolts and nuts. Tighten nuts alternately to a uniform torque to achieve even distribution of pressure on joint gasket and to avoid unequal stresses in flanges. Provide sleeve coupling, flanged adapter, victaulic coupling or vic-flange couple where shown on the Drawings or where required to install pipe or to permit future equipment or pipe removal for maintenance purposes.
.1 Provide 304 stainless steel machine nuts and bolts for joints involving stainless steel pipe or in areas where nuts and bolts will not be painted.

.3 Where victaulic grooved pipe and fittings are used, jointing procedures shall be in strict compliance with the manufacturer's instructions.

.4 Screwed pipes shall be NPT. Make joints with graphite and oil filler and adequate unions provided for ease of future uncoupling. Ream cut ends of pipe to remove burrs.

.5 Install specialties and other like items in accordance with the manufacturer's instructions. Provide small piping, or tubing, with fittings where required for their proper operation and servicing whether shown on the Drawings or not.

3.3 AIR VENTS

.1 Install air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

.4 Manual air vents shall be NPS 13 mm ball valves unless indicated otherwise.

3.4 PIPE SUPPORT

.1 Provide permanent support in accordance with Section 40 05 29.

.2 All pipe and fittings shall be restrained so that all thrusts shall be supported independent of the piping system.

.3 Coordinate support work. Ensure permanent supports are complete before any temporary support is removed.

.4 Provide pipe pads on piping as required for permanent supports.

3.5 PIPE CLEANING, TESTING & START-UP

.1 Flush and clean pipes upon completion and prior to testing.

.2 Pressure test piping as specified in Section 40 05 10.

.3 Remove air from system. Check air vents and drains for proper operation.

.4 Bring system up to pressure or temperature slowly. Monitor pipe movement. Adjust pipe supports, hangers, expansion joints as required. Re-tighten bolts or replace gaskets where necessary.

.5 Continue to monitor piping throughout start-up and plant commissioning.

3.6 PIPING FOR GAUGES AND INSTRUMENTS

.1 Fabricate and install piping, accessories and valve assemblies for pressure sensing gauges and transducers as indicated on the drawings.

.2 Provide isolation valves for all devices and run piping to prevent air pockets or sediment from accumulating in sensing lines.

.3 Coordinate locations for gauges and instruments on piping layouts.

3.7 PAINTING

.1 Paint piping, valves, fittings, fasteners and supports, etc., as specified in Section 09 91 23.

.2 Stainless steel pipe to be cleaned.

.3 Follow painting schedule as described in Section 09 91 23.

3.7 PAINTING (Cont'd)

.4 Coordinate painting and pipe identification work to avoid conflicts.

3.8 CLEANUP

.1 Upon completion of testing, remove all test equipment and cap holes to satisfaction of the Departmental Representative.

.2 Clean and refurbish all equipment and fixtures and leave in operating condition in preparation for final acceptance.

3.9 NON-DESTRUCTIVE WELD EXAMINATION

.1 Visually examine all welds for compliance with applicable codes.

.2 Random examination of welds using radiographic examination procedures as specified in ASME B31.3 will be performed by a qualified independent testing agency at the discretion of the Departmental Representative.

.3 All such costs of non-destructive radiographic weld examinations to be borne by the Departmental Representative.

END