.10 Tape Wrap: shop applied tape wrap may be used as an alternative to Yellow Jacket. Two or three layer methods can be used, meeting or exceeding the application and performance requirements of AWWA C214.

.3 Epoxy, E2a, E2b or E2c

.1 Apply epoxy (E2a, E2b or E2c) to the exterior of piping in accordance with AWWA C210. Refer to Section 09905 for details.

2.12 Exterior Finishes - (Coatings) Field Applied

.1 General

.1 Use field applied finishes only for: short lengths of metal pipe in a piping system where the length of pipe which requires coating is less than 3.0 m unless otherwise specified; to repair shop-applied exterior finishes; to make up cutback distances at joints; and for fittings, couplings, valves and other appurtenances.

.2 Refer to Section 09905 for painting requirements for aboveground piping and piping located in tunnels, buildings, pump houses, and other structures. Also refer to Section 09905 for painting requirements for exposed piping within insulated systems.

.2 Tape Wrap

.1 For welded joints on Yellow jacketed pipe and as other indicated locations apply tape to buried pipe and fittings. Use Polyken, Tec-Tape or Denso tape, consisting of primer and tape applied to minimum thickness of 0.90 mm in accordance with AWWA C209.

.2 For flanged or coupled joints and for fittings use petrolatum primer, mastic and tape; Polyken, Tec-Wrap or Denso, in accordance with AWWA C217.

.3 Shrink Sleeve

.1 As an alternative to tape wrap, shrink sleeves are acceptable if material and method of installation is reviewed and accepted by the Engineer prior to use.

.4 Epoxy, E2a, E2b or E2c

.1 Apply epoxy, E2a, E2b or E2c, to the exterior of piping in accordance with AWWA C210. Refer to Section 09905.

2.13 Galvanizing

.1 Where piping is to be galvanized, hot dip zinc coat to CSA G164 with a minimum coating of 550 g/m^2.

.2 All carbon steel parts, such as elements of flanges, anchors, guides and supports shall be galvanized, hot dip zinc coat to CSA G164 with a minimum coating of 550 g/m^2. Elements welded to components that do not lead themselves to hot dip galvanizing shall be thoroughly

cleaned and cold zinc galvanized to similar coat thickness. Surface preparation for cold galvanizing shall meet specifications of the manufacturer of the cold galvanizing product. Product shall meet 2000 hours resistance test to salt spray (ASTM B-117).

2.14 Grout

.1 Non-shrink grout: conform to Section 03300.

2.15 Concrete

.1 Provide concrete for concrete surround placed around buried pipe, and fill placed over buried pipe, in accordance with Section 03300 and as shown.

3. EXECUTION

3.1 Preparation

.1 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.

.2 Make all minor modifications to suit installed equipment and structural element locations and elevations.

.3 Piping arrangements indicated on the drawings have been established on the basis of the "Design Standard" listed in the specific process equipment sections. If the equipment to be provided is not the Design Standard, at no additional expense to the Owner, modify the piping arrangement as necessary.

.4 Advise the Engineer of all modifications. Do not commence work on the related piping until all modifications have been reviewed by the Engineer.

.5 Include any piping modifications in the shop drawings submitted prior to fabrication or installation.

3.2 Pipe Handling

.1 Inspect each pipe and fitting prior to installation. Do not install damaged pipe or pipe with damaged protective coatings. Do not use sections of large diameter, thin walled stainless steel piping that may have been deformed out of roundness or dimpled. Such damaged sections shall be discarded.

.2 Remove all foreign matter from inside of pipe prior to installation.

.3 Repair pipe with damaged protective coatings with material similar to the original in accordance with the manufacturer's directions and to the satisfaction of the Engineer.

.4 Damaged glass lining cannot be repaired. Damaged pipe must be replaced.

.5 Use proper implements, tools, and facilities for the proper protection of the pipe. Exercise care in the installation so as to avoid damage to pipe or coatings.

.6 When lifting sections of large diameter, thin wall piping onto the supports use methods that will prevent damage or deformation. Lift evenly at several places to ensure that the piping deflection between lifting points does not exceed 6.3 mm (1/4").

3.3 Sleeves

.1 Unless otherwise noted or approved by the Engineer, provide sleeves where piping passes through a wall, floor or ceiling.

.2 Locate and place sleeves prior to construction of cast-in-place elements and prior to the construction of concrete and masonry building elements.

3.4 Installation of Pipe Underground/Buried and Below Structures

.1 Trenching and backfill for buried pipe: conform to Division 2.

.2 Pipe laying and bedding: conform to Division 2.

.3 Unless otherwise shown, protect pipe laid below structures with a concrete surround having a minimum coverage of 100 mm all around the pipe; extend concrete surround to undisturbed ground.

.4 For concrete surround, comply with the following:

.1 Install pipe in straight alignment. Do not exceed 10 mm variance from the true alignment in any direction.

.2 Ensure the pipe alignment stays true during and after placement of concrete surround.

.3 Ensure that the method used to prevent pipe uplift during placement of concrete surround results in a level invert and crown.

.4 Maintain pipe circular cross section.

.5 Provide lean concrete to within 150 mm of the underside of the slab or footing for backfill over pipe laid below structures, except as detailed otherwise.

.6 Place concrete in accordance with Section 03300.

.7 Provide yellow jacket or tapewrap on all fittings and flanged, grooved, plain end and welded joints underground and below structures.

.8 Unless otherwise specified or shown, for underground piping provide groove joints or flex coupled joints at 6 m on centre.

.9 Use anti-seize compound with all stainless steel nuts and bolts.

.10 Prior to installation provide a manufacturer's representative, from the HDPE pipe manufacturer, for a minimum of one day to instruct personnel on installation procedures of HDPE pipe.

3.5 Installation

.1 Fabricate and install process and pressure piping in accordance with the Process Piping Code B31.3 and ACI Central. Fabricate and install domestic hot and cold water piping, sanitary piping and storm drainage piping in accordance with the National Plumbing Code.

.2 Make adequate provision in piping and pipe support systems for expansion, contraction, slope, and anchorage. Supports, bracing, and expansion joints shown in the drawings are schematic only. The Contractor is responsible for the design, supply, and installation of the piping system in general accordance with the indicated requirements.

.3 Install pipe support system to adequately secure the pipe and to prevent undue vibration, sag or stress.

.4 Install expansion joints where shown and at other locations as necessary to allow for piping expansion and contraction.

.5 Provide temporary supports as necessary during construction to prevent overstressing of equipment, valves or pipe.

.6 Accurately cut all piping for fabrication to field measurements. Process air piping sections shall be measured and cut at 15 to 20°C. If the installation in the field takes place at lower outdoor temperatures, provide circulation of hot air inside the piping to expand the material such that flanges can be bolted. Expansion joints for process air piping shall be blocked at their natural length at 15 to 20°C and such that they will not deflect excessively during handling and installation. These blocks shall be removed prior to pressure testing.

.7 Install pipes in straight alignment. For large diameter (500 ND and greater), thin walled (6.4 mm and less) stainless steel piping provide laser alignment of all pipe supports. Lateral and vertical misalignment between any three consecutive supports shall not exceed the pipe wall thickness.

.8 For piping other than large diameter, thin walled stainless steel, do not exceed 10 mm in 10 m variance from the true alignment, in any direction.

.9 Fabricate and assemble pipe runs so that the pipework is not stressed to achieve the desired alignment and that no stresses are transferred to equipment or equipment flanges. The "springing" of pipework to ensure alignment is not permitted. Undo and subsequently remake all pipework connections to ensure that springing does not occur. Take care not to damage equipment, valves or flanges.

.10 Slope instrument air piping to condensate traps. Provide condensate traps as recommended by the manufacturer of the instrument air compressor.

.11 Do not cut or weaken the building structure to facilitate installation.

.12 In parallel pipe runs, offset flanges and/or grooved joint fittings by a minimum of 200 mm.

.13 In vertical pipe runs of diameter greater than 250 mm, provide 200 mm long spool piece on lower side of each valve.

.14 Provide aluminum watertight drip trays under pipe carrying corrosive commodities crossing over cable trays. The drip trays will be 300 mm wider and 600 mm longer than the piping area over the cable tray.

3.6 Mild Steel Welding

.1 Use manual shielded metallic arc (SMAW), submerged arc (SAW), or inert gas shield arc (GMAW) or gas tungsten arc (GTAW) welding.

.2 Welding procedures shall conform to CSA Z183.

.3 Bevel plain pipe ends prior to welding.

.4 Clean and dry welding surfaces thoroughly prior to welding, in an area not less than 0.3 m wide on each side around the welding line.

.5 Do not proceed with welding when metal temperatures fall below minus 18°C. Apply supplemental heat when metal temperatures are below 0°C, to heat the metal to 20°C.

.6 Maintain flanges, pipes, fittings, etc. in alignment during welding. Ensure that no part of the weld is offset by more than 20% of the pipe wall thickness.

.7 Make tack welds of material equal to the root pass. Tack welds which have not cracked may be incorporated in the root pass.

.8 Ensure the first bead obtains full root penetration with a minimum of weld material projecting within the pipe.

.9 For butt welds of pipe diameters less than 200 mm use a minimum of two passes. For larger pipe use three passes - minimum.

.10 For lap joints, weld joint in two passes minimum.

.11 Between passes, visually inspect bead for pinholes or other defects. Repair any defects prior to the placement of the next pass.

.12 Clean all flux, slag and other foreign material from the weld prior to applying a successive bead, and on completion of the weld.

.13 Do not start successive passes at the same point.

.14 Completely fill the joint with weld, and have a reinforcement greater than 1.5 mm and less than 3.0 mm, with no undercutting at the weld edges.

.15 Provide a smooth surface for coating application to exterior surfaces of pipe. Grind or buff all welds to a minimum radius of 6mm on all edges and corners. Adhere to latest edition of NACE RP0178. Refer to Section 09905.

.16 Contractor to provide access to all external welds in fabricated spool pieces for grinding purposes. This will ensure that the coating application on welds can be properly ground to achieve proper coating application. Provide maximum of 400 mm distance from any weld.

.17 Repair linings and coatings after welding.

3.7 Stainless Steel Welding

.1 Conform to reviewed stainless steel pipe welding procedures, which have been stamped and signed by a Professional Engineer and to Section 05500.

.2 Remove all scale, rust and any other surface deposits from the entire pipe and fittings before welding. Be particularly thorough with the internal surface preparation.

.3 For all stainless steel pipe intended to convey liquids, use inert gas backing (GMAW or GTAW) for field and shop welds. For these services, solar flux will not be allowed.

.4 Ensure the first bead obtains full root penetration with a minimum of weld material projecting within the pipe.

.5 Grind or buff all welds to a minimum radius of 6mm on all edges and corners to achieve a smooth surface, eliminate any pockets and eliminate any protruding root passes. Adhere to latest edition of NACE RP0178. If material thickness will not allow 6mm radius, make radius one half of material thickness.

.6 Ensure the OD weld (weld cap) is free of excessive weld cap and free of discoloration due to welding. Ensure all ID welds (root pass) or OD welds exposed to wastewater or corrosive fluids/environments are ground flush and have no discoloration.

.7 Passivation

.1 Passivate the inside of all stainless steel piping after completion of all piping and supports welding. Any welding after passivation will require passivation of the entire piping section again. A piping section is the length between flanges.

.2 Comply with ASTM A380, Standard Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems, and ASTM A967, Standard Specification for Chemical Passivation Treatment for Stainless Steel Parts, latest edition.

.3 Use fine grit carbide sandpaper to remove any discoloration, such as bluish due to overheating.

.4 Thoroughly clean the interior of the pipe and ensure there are no oil or grease deposits or particulate (such as from the sandpaper) using trisodium phosphate (TSP) solution per manufacturer's recommendation. Thoroughly rinse with tap water.

.5 Acid pickle using a solution of 20% nitric acid and 2% hydrofluoric acid in chloride-free water. Treat for no less than 2 hours at 20°C to 40°C. Do not do the work at less than 20°C. An equivalent pickling paste shall be used for air piping not designed to be filled with water. Follow the manufacturer's instructions.. Rinse thoroughly with chloride-free water (distilled or de-ionized) until the rinse water shows less than 0.1 mg/L of fluoride. Rinse thoroughly with chloride-free water (distilled or de-ionized) brought to pH 10 using ammonia (preferred). Alternatively caustic soda or soda ash may be used to increase the final rinse water pH, but the maximum concentration of chloride allowed in this solution is 1 mg/L. Note that chloride concentration in commercially available caustic soda and soda ash may be too high for this use. Completely drain and leave drying in warm air (not less than 20°C at the outlet end) overnight.

.6 Collect all acids, caustics and rinses and take all necessary precautions to prevent spills on the ground. Neutralize as needed, for example blending acid and caustic wastes and using pebble or ground limestone, lime or other suitable material. Dispose of the neutralized waste as indicated by the Owner at the closest primary effluent channel. Note that the Owner may limit the volume that may be discharged over any period of time. Take measures to prevent freezing.

.7 Process air piping may not be filled with water unless laid flat on the ground or otherwise supported every 5 m and on each side of sliding supports.

.8 Pickling and passivating may require the ingress of an individual into the process air pipe. A single individual may do so once the pipe has been installed. Provide adequate ventilation that will blow any fumes away from the worker. This individual shall wear adequate protection per MSDS and clean, thick cloth socks over footwear. Confined entry procedures shall apply. Footwear, other items or tools that could scratch the stainless steel surface shall not be carried into the pipe.

3.8 Insulation

.1 Insulate piping systems in accordance with Sections 15055 and 15059.

3.9 Testing

.1 Give the Engineer 24 hours notice prior to testing.

.2 Do not insulate or conceal work until piping systems are tested and accepted.

.3 Complete any required weld tests.

.4 Interior of stainless steel piping shall be bright metal with no discoloration. Any discoloration, such as bluish tint at welds, will require spot pickling and passivation using

paste containing nitric acid and hydrofluoric acid, followed by rinsing and drying as indicated previously.

.5 Spot check the interior of the stainless steel piping and weld areas as indicated by the Engineer. Use 5% copper sulphate solution. After 10 minutes at not less than 15°C there shall be no observable deposit of metallic copper. Otherwise, pickling and passivation shall be repeated for the entire piping section. Carefully wipe off copper sulphate solution with several damp pieces of cloth.

.6 Supply all water, air and inert gases required for pressure testing.

.7 Supply all pumps, compressors, gauges, etc. required for testing.

.8 Install air threadolets, air relief valves and line fitting valves as necessary to complete testing. Remove after testing and plug the threadolets.

.9 Cap or plug all lines which are normally open ended. Remove on completion of testing.

.10 Provide all temporary thrust restraints necessary for testing. Remove upon completion of testing.

.11 Test all underground lines prior to backfilling. Do not place concrete surround until lines are tested.

.12 Test all existing piping where it connects to new piping to the first valve in the existing piping. Repair any failures in existing piping which occur as a result of the test after informing the Engineer of such failure.

.13 Isolate all low pressure equipment and appurtenances during testing so as not to place any excess pressure on the operating equipment.

.14 Where defective material or equipment is identified, repair or replace using new material.

.15 Release pressure safely, flush and drain liquid pipes after pressure tests. Release pressure safely and purge if needed all gas pipes after pressure tests.

.16 Dispose of flushing water in manner approved by the Engineer, which causes no damage to buildings or siteworks.

3.10 Pressure Testing of Liquid Lines

.1 Hydrostatically test all lines normally used for the conveyance of liquid using water as the test medium.

.2 Test pressures and durations shall be as specified in the detailed specification sheets.

.3 Ensure all lines are filled with water. Bleed air from all high spots using the taps provided specifically for that purpose.

.4 Zero leakage is permitted throughout the specified test period for all exposed piping, buried insulated piping, and any liquid chemical lines.

.5 Show evidence of leakage rates below 0.01 litre per hour per mm pipe diameter per 100m of pipe length for buried piping, unless otherwise specified.

.6 Test drains in accordance with the National Plumbing Code.

3.11 Pressure Testing of Gas, Air and Vapour Lines

.1 Hydrostatically or pneumatically pressure test, as shown in the table below, all lines normally used for the conveyance of gas, air, and/or vapour in accordance with Process Piping Code B31.3 procedures for testing pressure piping and CAN/CGA B105 for buried digester gas piping. Pneumatically test all instrument air lines in accordance with ISA-RP7.1.

.2 For gas and air lines to be hydrostatically tested, check support system to ensure it is capable of withstanding loads imparted by test method. Provide any additional supports necessary in a manner acceptable to the Engineer. At the Engineer's request, provide calculations indicating design of temporary support system.

.3 Other than for chlorine and sulphur dioxide piping systems, use the following test medium:

Pipe Size Specified	Testing Medium	Test Pressure
50 mm and smaller	500 kPa or less	Air or water
50 mm and smaller	Greater than 500 kPa	Water
Greater than 50 mm	500 kPa or less	Air or Water
Greater than 50 mm	Greater than 500 kPa	Water

.4 Test pressures are identified in the detailed piping specification sheets.

.5 Zero leakage rate for insulated systems, and systems tested with water is required at the specified test pressure through the test period. Prior to commencing test using air, ensure air will be at ambient temperature and specified test pressure.

.6 Do not exceed 5% of the specified test pressure as the allowable leakage ate over the test period for other systems tested with air. Provide feed air pressure regulator with gauge and pressure safety valve with ring pressure set at not more that 20 kPag above the test pressure and adequately sized for both the compressor capacity and any condition that could result in pressure increases.

.7 Wet all joints using a mixture of soap and water in systems tested with air. Remake all joints which display leakage and retest. For stainless steel piping, repeat cleaning and passivation procedure indicated above for the entire piping section, then test for adequate passivation in the re-worked area.

.8 Test natural gas piping in accordance with CAN/CGA B139-1.

3.12 Cleaning and Flushing

.1 After installation and prior to testing, perform initial cleaning of process and utility lines. Clean piping greater than 150 mm and less than 600 mm by passing a tightly fitting cleaning ball or swab through the pipeline, unless specified otherwise. Lines greater than 600 mm may be cleaned manually or with a cleaning ball or swab. Give lines smaller or equal to 150 mm an initial flush or purge.

.2 After initial cleaning, connect the piping systems to related process and mechanical equipment. Insert temporary screens, provided with visible locator tabs, in the suction of pumps and compressors in accordance with the following table:

Suction Diameter, mm	Maximum Screen Opening, mm
0 - 25	1.5
30-75	6.25
80-150	12.5
>150	25

.3 Maintain the screens during testing, flushing/purging, initial startup, and the initial operating phases of the commissioning process. In special cases and with the Engineer's acceptance, screens may be removed for performance tests.

.4 Unless specified otherwise, flush liquid systems after testing, with clean water and screens in place. Maintain flushing for a minimum period of 15 minutes and until no debris is collected in the screens.

.5 Remove the screens and make the final connections after the screens have remained clean for a minimum of 24 consecutive hours of operation. Screens in solids handling systems are exempt; remove prior to placing the system in service.

.6 In air or gas systems with pipe sizes less than or equal to 150 mm, purge with air and/or inert gases before testing. Upon completion of testing and cleaning, drain and dry the piping with a dry air stream. Satisfy ANSI/ISA-S7.3 standards for instrument air systems.

.7 Brush clean steel pipe exterior to SSPC-P3 standard prior to painting. Also refer to Section 09905.

3.13 Disinfection

.1 Disinfect lines intended for potable water service after testing in accordance with AWWA C651.

END OF SECTION

PROCESS PIPE JOINTS AND EQUIPMENT CONNECTIONS

1. GENERAL

1.1 Description

.1 This section describes acceptable methods for jointing and connecting piping to equipment and appurtenances.

.2 Refer to the general piping requirements of Section 15050. Use the general requirements specified in this section and Section 15050 integrally with the more specific requirements listed in Section 15055.

1.2 Submittals

.1 With the submittals required in Section 15050, provide a listing of joining and connecting techniques used in the performance of the work.

1.3 Coordination

.1 Coordinate the jointing techniques with the piping requirements and ensure that the connection techniques match the requirements of the equipment and ancillary devices to which piping must attach.

1.4 Quality Assurance

.1 Refer to Section 15050 for welding quality assurance requirements.

1.5 Shipment, Protection and Storage

.1 Refer to Section 01600 and Section 15050 for Shipment and Storage.

2. PRODUCTS

2.1 Function

.1 Provide for the joining of the pipe materials, fittings, and appurtenances as described below, for the piping systems shown.

2.2 General

.1 Connect piping using joints not readily disassembled only where shown and where not otherwise specified. Provide joints which may be disassembled as indicated on the drawings, and at the minimum, within 1.0m of any connection to equipment, on both sides of structural penetrations, within 0.6m of all threaded end valves, and at the spacing specified in the detailed piping specification sheets.

.2 Where new pipe crosses a new or existing structural expansion joint and the pipe is supported from each side of the structure, provide a flexible coupling in pipe to allow for differential settlement. Select flexible connection suitable for pipe material.

2.3 Welding Materials

.1 Use welding materials conforming to CSA W48.1.

.2 Provide electrodes compatible with the material welded and which deposit metal with strength and corrosion resistance properties at least equivalent to the base metal.

.3 Provide proper storage for welding rod. Provide rod ovens in cold or inclement weather.

.4 Keep stainless steel rods separate from other materials in marked containers.

2.4 Dissimilar Metal Connections

.1 Where dissimilar metals are to be connected, furnish dielectric fittings and/or isolating flanges.

2.5 Carbon Steel Piping

.1 Less than 75mm in diameter: butt-weld or use threaded couplings. Use unions where disassembly is required.

.2 Equal to or greater than 75mm in diameter: where not specified or shown otherwise, butt-weld according to ASME Boiler and Pressure Vessel Code or furnish flanges, conforming to ANSI B16.5, Class 150. Where disassembly is required, flanges are sufficient.

.3 Companion flanges for connection to cast iron or ductile iron equipment flanges shall be refaced to be flush with the companion flange.

.4 Where grooved joint fittings are shown for use in steel piping systems, meet the following requirements:

.1 Use flexible style couplings for all buried service pipe, all pipe greater than 300mm in diameter, for pipe less than 300mm in diameter in rack mounted piping assemblies, and for grooved joints adjacent to pump or blower suction and discharge where grooved joints are used for noise and vibration control. Acceptable products are: Gustin-Bacon 100 or Victaulic Style 77.

.2 Use rigid style couplings in all other applications. Acceptable products are: Gustin-Bacon 120 Rigi-Grip or Victaulic Style 07 Zero-Flex.

.3 With the Engineer's prior acceptance, flange assemblies may be substituted for above ground steel piping which is not lined where rigid style couplings are shown or specified. Note any such substitutions in the submittals prior to fabrication.

2.6 Stainless Steel Tubing

.1 Use stainless steel compression fittings.

.2 Furnish compression couplings for stainless steel tubing of the same material as the pipe, capable of withstanding the maximum pressure to which the pipe is subjected.

2.7 Schedule Stainless Steel Pipe

.1 Less than 75mm in diameter: socket-weld pipe. Where disassembly is required, use threaded unions.

.2 Equal to or greater than 75mm in diameter: butt-weld pipe; where disassembly is required, use flanges.

.3 Flanged Connections:

.1 Make flanges on stainless steel piping stainless steel slip-on, rolled-angle collar Van-Stone type, with a galvanized steel back-up ring drilled to ANSI B16.1, Class 125. Make the angle ring thickness equal or greater than the pipe or fitting to which it is welded. Stamped (pressed) collars are not acceptable.

.2 For submerged joints, make the backup ring stainless steel.

.3 For digester gas services, make the flanges Lap-joint type with galvanized steel back-up ring and in accordance with CGA B105. For submerged joints, make the back-up ring stainless steel.

.4 Conform to ASTM A182 or ASTM A276, Class 150, for threaded connections to stainless steel pipe, threadolets to be shop welded to the pipe at the locations specified.

2.8 Gauge Stainless Steel Pipe

.1 Less than 75mm in diameter: socket-weld pipe. Where disassembly is required, use socket weld unions.

.2 Equal to or greater than 75mm in diameter: butt-weld pipe; where disassembly is required, use flanges.

.3 Flanged Connections:

.1 Make flanges on stainless steel piping stainless steel slip-on, rolled-angle collar Van-Stone type, with a galvanized steel back-up ring drilled to ANSI B16.1, Class 125. Make the angle ring thickness equal or greater than the pipe or fitting to which it is welded. Stamped (pressed) collars are not acceptable.

.2 For submerged joints, make the backup ring stainless steel.

.3 For digester gas services, make the flanges Lap-joint type with galvanized steel back-up ring and in accordance with CGA B105. For submerged joints, make the back-up ring stainless steel.

.4 Conform to ASTM A182 or ASTM A276, Class 150, for threaded connections to stainless steel pipe, threadolets to be shop welded to the pipe at the locations specified.

2.9 Copper or Brass Piping

.1 Use soldered couplings. Where disassembly is required, use compression unions.

.2 Use soldered couplings conforming to ANSI B16.26. Use lead free solder conforming to ASTM B32 and the National Plumbing Code.

.3 In potable water systems, use lead free solder conforming to ASTM B32 and National Plumbing Code.

.4 Solder used in DWV systems will be 50/50 type.

.5 Furnish compression couplings for copper and brass tubing of copper, suitable for the maximum pressure of the pipe, conforming to ANSI B16.26.

2.10 Ductile Iron Piping

.1 For above ground ductile iron piping, where not shown or otherwise specified, use grooved joints in accordance with AWWA C606. Flanges may be used if approved by the engineer and where needed to connect to equipment or piping appurtenances.

.2 For below ground piping systems, use slip-on joints for unrestrained systems. Where shown or indicated, use bolted mechanical joints.

.3 Provide Class 125 flanges on cast or ductile pipe, conforming to ANSI B16.1.

.4 For grooved piping systems, provide pipe with rigid cut grooves for exposed services, and flexible cut grooves for buried services. Acceptable coupling products are: Gustin-Bacon 500 series and Victaulic Style 31.

.5 Push-on joints: rubber ring compression, bell and spigot type. Assemble in accordance with AWWA C600 and manufacturers recommendations. Do not use on fittings or other appurtenances.

.6 Bolted mechanical joints: Comply with ANSI A21.10 and ANSI 21.11.

.7 Where restrained mechanical joints are shown or specified, ensure joints can be disassembled after installation. Do not use internal restraints. Factory apply retainer weldments. Do not use joints which employ set screws, retainer glands, or concrete thrust anchors. Acceptable products are: Lok-Ring, or TR Flex.

.8 When tying into existing ductile iron piping, replace existing ductile iron pipe back to the nearest joints to avoid field cutting.

2.11 Cast Iron Piping

.1 For cast iron drain pipe inside structures or concrete encased, use gasket and retaining clamp type mechanical joint conforming to CSA B70.

2.12 PVC and FRP Piping

.1 Where not shown or otherwise specified, use solvent weld joints for PVC and FRP piping. Provide flanges or unions where disassembly is required.

2.13 Concrete Cylinder Piping

.1 Bell and spigot joint: fabricate to AWWA C301 and/or C303. Provide and assemble rubber gasket joints in accordance with the pipe manufacturer's recommendations. After the joint has been made, verify the position of the gasket. Separate, rejoin and check joints which are not properly positioned.

.2 Welded joint: use only where shown or approved by the Engineer. Weld exterior of joint. Use compatible filler rod as necessary to provide appropriate weld size.

.3 Restrained joints: Type 1) Flanges to AWWA C207. Complete with a reinforcing ring welded to pipe cylinder; Type 2) specially fabricated U-shaped clamps, ductile iron to ASTM A536, which when used with wedge rings to ASTM A36, rubber gaskets and stop rings, minimize pipe movement. Bolt in accordance with manufacturer's recommendations; Type 3) or a grooved joint style complete with a reinforcing ring welded to the pipe cylinder and grooved to accept the fitting.

.4 Ensure pipe design can withstand stresses induced by joint design.

.5 Grout each joint after installation with cement mortar in accordance with manufacturers directions.

2.14 Polyethylene (HDPE) Piping

.1 Refer to pipe manufacturer's specifications for product information and installation instruction.

.2 HDPE pipe joined by method of thermal butt fusion should conform to ASTM D 2657.

.3 Provide bell and spigot type joints conforming to ASTM D3212.

.4 Provide pipe, pipe support and restraints to withstand stresses induced by joint design.

.5 Provide pipe, pipe supports and restraints to withstand the stresses incurred during placement of concrete surround.

2.15 Flanges

.1 General requirements for flanges are as follows:

.1 Provide compatible flanges for mating to equipment or valves.

.2 Provide flat-faced flanges on each side of butterfly valves.

.3 For steel piping, provide weld neck flanges on both sides of wafer or lug body valves.

.4 A Lap-joint flange on digester gas services or Van-Stone flange on schedule 10S stainless steel piping systems is acceptable.

.2 Do not use slip-on flanges that are attached to a pipe by means of set screws and gaskets (uni-flange, etc.)

2.16 Threaded Couplings

.1 Make screwed joints using American Standard threads to ANSI B1.20.1.

.2 Use Teflon tape as thread lubricant for threaded joints.

.3 Provide threaded-end to flanged-end adapters where required to connect to flanges.

2.17 Grooved Joint Couplings

.1 Fabricate grooved joint couplings of ductile iron to ASTM A536, and in accordance with AWWA C606.

.2 For ductile iron pipe, provide cut grooves in pipe and fittings in accordance with AWWA C606. Rolled grooves and roll-groove type joints are not acceptable.

.3 For steel pipe, provide cut grooves in pipe and fittings in accordance with AWWA C606. Alternatively, rolled grooves and roll-groove type joints may be used on bare steel pipe. Rolled grooves and roll-groove type joints are not acceptable on steel pipe that is internally lined.

.4 Cut or rolled grooved joints are not acceptable in stainless steel piping less than schedule 40S, carbon steel piping less than schedule 40, and PVC piping less than schedule 80. Provide suitable end pipe piece for grooving as needed if piping wall is thinner.

.5 For all grooved joints, grind or buff edges to a minimum radius of 6mm. Coordinate with coupling manufacturer to ensure proper fit.

.6 In grooved joint piping systems requiring end-seal type gaskets, provide grooved joint couplings and grooved pipe in accordance with gasket manufacturers recommendations. Acceptable manufacturers: Gustin-Bacon, Victaulic.

.7 Where grooved joint piping systems connect to equipment or to flanged valves, meters, or other sensing devices; use grooved joint flanges or flange adapters. Flange adapters have been used to develop the piping layout shown in the drawings unless specifically noted otherwise. Acceptable products are: Tyler Groove to Flange Fittings or Victaulic Flange adapters. Where the Contractor chooses to use grooved joint flanges rather than the indicated adapters, piping modifications required to suit this change are the responsibility of the Contractor. Make full allowance for piping disassembly and access to the face of equipment.

2.18 Flexible Couplings - Type I

.1 Unless specifically shown otherwise use Type I flexible couplings where a flexible coupling is shown or required.

.2 Type I General Requirements:

.1 Centre ring: steel, shop coated for corrosion protection.

.2 Gaskets: fabricated of material suitable to the service conditions.

.3 For submerged, buried or below structure applications, use stainless steel bolts, nuts and washers and provide center ring with epoxy coating.

.4 Provide the necessary amount and appropriate size of restraining rods and gussets as recommended by the manufacturer.

.5 Type 1 - Restrained; use a flexible sleeve-type coupling with restraining rods, and gussets welded to the pipe. Provide sufficient restraint to resist pressure equal to twice the system test pressure.

.6 Do not use Type 1 flexible couplings in pipe systems which undergo thermal expansion and contraction; also, do not use these couplings at structural joints.

.3 Flexible Couplings - Type IA

.1 Flexible sleeve type couplings: cylindrical centre ring, two follower rings, two resilient gaskets, and connecting bolts.

.2 Acceptable products are:

.1 Dresser Style

.2 Ford Meter Box

.3 Robar

.4 Rockwell

.5 Viking Johnson

.4 Flexible Couplings - Type IB

.1 Flanged flexible sleeve type couplings: flanged cylindrical centre ring, a companion flange, one follower ring, one resilient gasket, and connecting bolts.

.2 Acceptable products are:

.1 Dresser

.2 Ford Meter Box

.3 Robar

.4 Rockwell

.5 Viking Johnson

.5 Flexible Couplings - Type IC

.1 Transition flexible sleeve type couplings: Cylindrical centre ring, two follower rings two resilient gaskets, and connecting bolts.

.2 Acceptable products are:

.1 Dresser

.2 Robar

2.19 Flexible Couplings - Type II

.1 Flexible pipe couplings: progressive sealing, capable of two degrees angular deflection in all directions, leakproof.

.2 Acceptable manufacturers:

.1 Straub

.2 Young Nam Company (YNC)

.3 Casing: 304 or 316 stainless steel.

.4 Lockparts: Steel, shop coated for corrosion protection. 304 stainless steel for buried or submerged services.

.5 Gaskets: fabricated of material suitable to the service conditions.

3. EXECUTION

3.1 Mild Steel Welding

.1 Refer to Section 15050 for mild steel welding requirements.

3.2 Stainless Steel Welding

.1 Refer to Section 15050 for stainless steel welding requirements.

3.3 Threaded Joints

.1 Conform to the requirement of ANSI B31.3 Process Piping Code.

.2 Ream the end of all pipes to remove all burrs and cuttings when fabricating threaded joints.

.3 Clean out pipe and repair linings and coatings prior to joining.

.4 Apply Teflon tape to male threads and join pipe. Use both Teflon tape and Teflon sealing compound on stainless steel pipe threads. Do not use extra tape to make up for slack in the joint.

.5 Provide joints at spacings noted in Section 15055 to allow for pipe disassembly.

3.4 Flanged Joints

.1 Clean flanges and gaskets prior to connection.

.2 Lubricate gaskets with soapy water and apply anti-seize compound to the bolts.

.3 Bring flanges into close parallel and lateral alignment.

.4 Tighten bolts progressively. Proceed from side to side of the flange.

.5 Washers may not be used to take up excess bolt length.

.6 Provide approximately two full threads bolt projection beyond nuts.

.7 When joining steel to cast iron flanges, take care to avoid damage to the cast iron flange. Ensure both flanges are flat-faced and use full face gaskets.

.8 Align flanges which connect piping to mechanical equipment to close parallel and lateral alignment prior to tightening bolts. Do not place undue strain on the equipment.

.9 Provide flanges at spacings noted in the drawings and in Section 15055 to allow for pipe disassembly.

.10 Allow a minimum of 150mm to face or 200mm to edge of flange from wall, floor or ceiling unless otherwise shown on the drawings.

.11 On gauge stainless steel piping, consider the flange assembly weight in the design of the piping supports.

3.5 Grooved Pipe Joints

.1 Groove all pipes to be joined by this method in accordance with the manufacturer's recommendations.

.2 Repair linings and coatings after grooving.

.3 Where connecting grooved joint pipe to flanged equipment or valves, use a transition coupling a minimum of 150mm in length with a Class 125 FF flange at one end and a grooved joint at the other, unless otherwise specified or shown.

.4 Alternately, use split flanges fabricated specifically for grooved joint pipe to connect to flanged equipment, valves, meters, or sensing devices. Provide restraint on joints to prevent valve body rotation when the operator is torqued.

.5 Provide joints at spacing noted in Section 15055 to allow for pipe disassembly.

.6 Allow a minimum of 150mm to face or edge of grooved joint coupling from wall, floor or ceiling unless otherwise shown.

.7 On epoxy lined piping systems and in accordance with the coupling manufacturer's recommendations, continue the epoxy lining around the ends of each pipe to the edge of the cut groove; provide the same on each fitting.

.8 On glass lined piping systems and in accordance with the coupling manufacturer's recommendations, continue the lining around the ends of each pipe to the edge of the cut groove; provide the same on each fitting. Alternately a glass lining patch kit or mastic similar to Sikaflex 1A is acceptable on the glass lined pipe ends to the outside groove.

END OF SECTION