

PROCESS VALVES

1. GENERAL

1.1 Description

- .1 This Section specifies the supply, installation and testing of process valves used for isolation, manual throttling, and bypass.

1.2 Definitions

.1 Valve Identification

- .1 Valves are identified in the drawings by valve symbols. Refer to the Drawings for lists of valve symbols and labels.

.2 Actuators:

- .1 Valves are supplied with their standard operators as detailed in Part 2 unless otherwise noted in Section 15105, Section 17419 or Instrumentation Specification Sheets.

.3 Detailed Valve Specification Sheets:

- .1 Detailed valve specification sheets are provided in Section 15105 for each type of valve which is:
 - 1 Identified in the process mechanical drawings with a valve symbol and/or,
 - 2 Described in Part 2 of this specification section.
- .2 Where there is a conflict between valves described in this Section and other valves described in Division 15 and Division 17, conform to the more stringent requirements.

.4 Instrument Data Sheets for Modulating Control Valves

- .1 Division 17 specifies and takes responsibility for the supply and installation of electric and pneumatic control valves, complete with valve body, actuator, position indicator, and other ancillaries. Valve bodies for these products will comply with the requirements as specified in Section 15105 and this Section.

1.3 Submittals

- .1 Shop Drawings: Submit the following information in accordance with Section 01300:

- .1 Catalog cuts and/or shop drawings for each type of valve indicating the valve number, materials of construction, dimensions, head loss characteristics through the valve, operating torque and valve end configuration.

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- .2 An amended Detailed Valve Specification Sheet for all valves. Indicate with check marks where the valve supplied meets the requirements specified and with written amendments where the product differs from the specification.
- .2 Operating and Maintenance data for incorporation in Operation and Maintenance Manual, as specified in Section 01300. Include complete description of operation together with detailed drawings, a complete list of replacement and repair parts, and parts manufacturer's identifying numbers.
- .3 Affidavits and registration numbers described below in Quality Assurance.

1.4 Quality Assurance

- .1 Provide Canadian Registry Number (CRN) designated by the Territory of Nunavut for each valve type.
- .2 Provide affidavits of compliance, as required by AWWA C500 for gate valves.
- .3 For butterfly valves to be installed below ground, provide affidavits of compliance with AWWA C504.
- .4 Valves are to be marked in accordance with MSS SP-25.

1.5 Shipment, Protection and Storage

- .1 Deliver valves to site using loading methods which do not damage casings or coatings.
- .2 Clearly tag valves stating size, type, coatings and mating parts.
- .3 Store on-site until ready for incorporation in the work using methods recommended by the manufacturer to prevent damage, undue stresses, or weathering.

2. PRODUCTS

2.1 General

- .1 Provide valves of the same type, size range and service from a single manufacturer.
- .2 Provide new, unused valves for the work.
- .3 Valve materials to be free from defects or flaws, with true alignment and bores.
- .4 Unless otherwise indicated on the Process and Instrumentation drawings or specified in Division 17, valves shall be the same size as the pipe run in which they are to be installed.
- .5 Clearly mark valve bodies in raised lettering to indicate the valve type, rating, and where applicable, the direction of flow. Conform to MSS SP25.

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- .5 Clearly mark valve bodies in raised lettering to indicate the valve type, rating, and where applicable, the direction of flow. Conform to MSS SP25.
- .6 Provide padlockable lockout feature on all sizes of the following valve types:
 - .1 Automated Control Valves (electric and pneumatic); FCV, LCV, PCV and XV only. Refer to the Drawings for abbreviation definitions.
 - .2 Specialty Valves; FV and PRV only. Refer to the Drawings for abbreviation definitions.
 - .3 Manual Isolation and Shut-off Valves; BF, BV, GL, GV, KV and PV only. Refer to Section 15105 for abbreviation definitions.
- .7 Specific requirements for the materials, ratings and service conditions for each valve are listed in Section 15105.
- .8 Valves to open counter-clockwise.

2.2 Drawings

- .1 The process schematics indicate major process valves required for the process to operate as intended.
- .2 The detailed process drawings, process standard drawings, and indicate the valves on the process schematics plus other valves required for isolation.
- .3 In pipe runs, less than 100mm diameter, in addition to the valves indicated on the P&IDs, detailed drawings and standard drawings, provide isolation valves in accordance with the detail piping specification sheets in Section 15055 in straight pipe runs at intervals no greater than 60m and at takeoffs to individual services. Provide ball isolation valves in pipe of 65mm diameter and less, or in pipe of less than 100mm diameter and carrying solids. Provide butterfly isolation valves in pipe of 75mm diameter and greater and not carrying solids.
- .4 Provide drain, air vent, and flushing connections in accordance with Section 15056.
- .5 Unless otherwise specified, provide gate valves 400mm and larger with a bypass valve sized in accordance with AWWA C500.
- .6 Where a valve may be required for the process to function correctly or is required to satisfy fire and safety codes but it is not shown in the drawings, inform the Engineer and provide details and suggestions for remedial action. Do not commence piping in the related pipe run until obtaining the Engineer's approval.

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2.3 Valve Ends

- .1 In pipe runs less than 75mm diameter provide valves with female threaded ends, unless indicated otherwise. Threads to conform to ANSI B1.20.1.
- .2 Valves in pipe runs equal to or greater than 75mm diameter to be flanged unless indicated otherwise.
- .3 For cast iron body valves, drill flanges to Class 125 pattern conforming to ANSI B16.1. For steel body valves, flanges to be Class 150 pattern or Class 300 pattern conforming to ANSI B16.5 or as noted in Section 15105.
- .4 Do not use grooved joint valve ends.
- .5 Use flanged joints for buried and exterior valves. The flanges are to be compatible with the pipe and jointing technique used.
- .6 Use flanged joints for buried butterfly valves.
- .7 Lug style wafer body valves shall have tapped holes, suitable for the bolt spacing of the pipe flanges placed on either side.
- .8 Wafer body valves shall not be used.
- .9 Use wafer body butterfly valves only for control applications, and only if other valve(s) are provided for blocking and isolation. Use lug style or flanged wafer body butterfly valves if the function is blocking and isolation, including control valves where separate block and isolation valves are not provided.
- .10 For gate valves, end flanges shall be integral with the gate valve body and be faced and drilled in accordance with ANSI B16.1, Class 125 flanges.

2.4 Manual Operators

- .1 Provide valves with manual operators unless specifically indicated otherwise on the process schematic drawings, mechanical drawings, in Section 15105, Division 17 or the Instrumentation Specification sheets.
- .2 For hand wheels, clearly show the direction of opening in raised lettering and symbols.

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- .3 Hand wheel diameter to conform to the following:

Nominal Valve Diameter (mm)	Minimum Hand Wheel Diameter (mm)
12	50
20	50
25	60
38	75
50	85
65	105
75	200
100	250
150	300
200	350
250	400
300	450
350	450
400	550
450	600
500	600
600 and up	600

- .4 The maximum rim pull on a hand wheel not to exceed 300 N when one side of the valve is at test pressure and the other side is at atmospheric pressure. Where a shaft mounted hand wheel would require greater than this force to operate, provide a gear operator. Unless different operators are scheduled or shown in the drawings, conform to the following minimum requirements:
- .1 Gate Valves: less than 300mm, hand wheel; equal to or greater than 300 mm, gear operator.
 - .2 Knife Gate Valves: less than 300mm, hand wheel; equal to or greater than 300 mm, gear operator.
 - .3 Globe and Needle Valves: less than 200mm, hand wheel; equal to or greater than 200 mm, gear operator.
- .5 Match existing operating nuts. Provide two eight-point operating wrenches.
- .6 Supply stem extensions and valve boxes for buried valves and stem extensions for submerged valves as specified in the drawings, Section 15105, and in Clause 2.5 of this Section.
- .7 Provide two operating tees.

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- .8 Lever operators to conform to the following dimensions:

Nominal Valve Diameter (mm)	Minimum Length of Lever (mm)
6	80
12	80
20	100
38	150
50	150
65	150
75	175
100	225
150	250
200	300
250	450
300	450

- .9 Quarter turn lever operators to be perpendicular to the pipe run when the valve is closed.
- .10 Lever operators on ball valves to be two position. Provide butterfly valves with 10 position latching levers except where used to balance air flows. Where used to balance air flows provide infinite position, screw down levers.
- .11 The maximum pull at the end of the lever arm not to exceed 300 N when one side of the valve is at test pressure and one side is at atmospheric pressure. Where greater than this force would be required to operate the valve with a lever, provide a gear operator. Unless different operators are scheduled or shown in the drawings, conform to the following minimum requirements:
- .1 Ball Valves: less than 150mm, lever operator; greater than or equal to 150mm, gear operator.
 - .2 Butterfly Valves: less than 250mm, lever operator; greater than or equal to 250 mm, gear operator.
- .12 Gear operator to be worm gear type, equipped with a hand wheel and a visual indicator of the valve position. Equip operators with adjustable mechanical stop-limiting devices to prevent over-travel of the disc/ball in the open and closed positions and which are self-locking and designed to hold the valve in any intermediate position between full open and full closed. Gear operators shall be grease lubricated.
- .13 Operators for exposed service shall be gasketed for weatherproof service. Place gear boxes above ground and liquid surfaces.

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- .14 For manual valves on lines 75 mm and greater, mounted over 2.0m above the operating floor, provide chain wheel gear operators. Design the operator so that a force of 150N is sufficient to open the valve when one side of the valve is at test pressure and the other side is at atmospheric pressure. The chain pulley to mesh positively with the chain. Extend the chain from the valve operator to operating height 1.2 m above the floor or as directed by the Engineer. The exact dimensions shall be field determined. Provide approved chain hooks where required to prevent chain from hanging within traffic paths.

2.5 Stem and Couplings

- .1 Provide operating stems and couplings of stainless steel.
- .2 Provide the stem with a slenderness ratio (L/R) less than 200.
- .3 Hollow stems are acceptable but they must be provided with stem guides (mounting brackets) and thrust bearings designed to carry the weight of the stem extension, eliminate load on the stem, and prevent buckling.
- .4 Machine cut the threaded portion of the stem.
- .5 For stems in more than one piece and with a diameter of 44.5 mm and larger, join the different sections together by threaded and bolted connections.
- .6 Groove and key the couplings. The couplings are to be of greater strength than the stem.
- .7 Provide stem guides of stainless steel, type 304 and UHMWPE bushed.

2.6 Protective Coatings

- .1 Unless otherwise specified, provide valves coated in accordance with Section 09905.

2.7 Cathodic Protection

- .1 Unless otherwise specified, provide cathodic protection to underground valves.

2.8 Spare Parts

- .1 Provide one spare valve including the appropriate operator for each valve type and size.
- .2 Provide a list of all spare parts which would be expected to be required under normal conditions for a period of five years. At the Engineer's request, provide a price for these parts.

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3. EXECUTION

3.1 Preparation

- .1 The valve and piping arrangement indicated in the drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in the piping to allow for discrepancies between the valve dimensions shown and those supplied for the work.
- .2 Prior to the installation of the valves, field measure and check all equipment locations, pipe alignments, and structural installation. Ensure that the valve location and orientation provides suitable access to manual operators and that sufficient space and accessibility is available for pneumatic and electric actuators.
- .3 Where conflicts are identified, inform the Engineer and initiate the necessary piping modifications at no cost to the Owner.

3.2 Valve Installation

- .1 Install valves in conjunction with the piping described in Section 15050 and with control valves and their appurtenances described in Division 17.
- .2 In horizontal pipe runs other than in locations where space does not permit, mount all valves except for butterfly valves and trunnion ball valves with a vertical operating shaft with the actuator at the top. Avoid installing install a valve with the operator shaft pointing down.
- .3 Mount butterfly valves and trunnion ball valves with the shaft in a horizontal orientation unless impractical.
- .4 Mount valves in a position for easy access to the operators and maintenance personnel.
- .5 When joining valves to pipe or fittings, do not over torque bolts to correct for misalignment.
- .6 Support valves in position using temporary supports until valves are fixed in place.
- .7 Permanently support valves to prevent transmission of loads to adjacent pipework and/or equipment.
- .8 Where valves are installed in PVC pipework greater than 100mm diameter, support valves independently and brace against operating loads and torque to prevent transmission of stresses to the adjacent pipework.
- .9 Generally pipe supports and hangers are not shown unless for indication purposes only.
- .10 Install gate valves in the closed position.

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- .11 Install valves which are bubble tight in one direction to seal in a direction opposite to normal flow unless otherwise noted or directed by the Engineer.
- .12 Unless otherwise specified, install single seated ball valves and knife gate valves with the seat downstream. Install at tank connections with seat away from tank. Install on pump discharge and suction lines with seat adjacent to the pump.
- .13 Install all valves in accordance with the manufacturer's recommendations.
- .14 Protect valves installed below grade with a shrink sleeve or polyethylene sheath attached to the pipe with tapewrap.
- .15 Insert wafer and lug wafer butterfly valves between the flanges in the closed position, align and bolt finger-tight. Then open the valve fully before torking the bolts. Test that the disk does not catch the edge of the flange on closing and opening.

3.3 Valve Testing

- .1 Ensure that the position indicated by the lever or actuator matches the actual position of the valve.
- .2 Operate valves under simulated and/or real process conditions to ensure they operate as intended.
- .3 Pressure test the valves in conjunction with the pipes in which the valves are installed as specified in Section 15050.

END OF SECTION

DETAILED PROCESS VALVE SPECIFICATION SHEETS

1. GENERAL

1.1 Description

- .1 The following pages provide a summary of the valve body materials, valve performances and reference specifications for use in the Work and should be read in conjunction with Sections 15050, 15055 and 15100. Furnish all valves in accordance with the requirements of this section and those requirements of Sections 15050, 15055, and 15100. Where there is a conflict, conform to the most stringent requirements.
- .2 The table in 1.2.1 below provides a list of the two letter valve abbreviations and the corresponding full valve type names referenced in the following Detailed Valve Specification Sheets. Provide the valve type as indicated in the drawings by the valve symbol shown. See the valve tables within the detailed pipe specification sheets (Section 15055) for guidance to specific valve types suitable for a given commodity and line size. See the Detailed Valve Specification Sheets for information on the valves.
- .3 Valves identified in the drawings with an equipment identification symbol or instrument identification symbol are specified in Sections 15100 and 17213, respectively. Detailed Valve Specification Sheets referenced by other sections are independent of the table below.
- .4 Named Acceptable Products are shown to define basic materials and performance criteria required for each valve type. Modify valves as specified to meet the service requirements of the system and detailed specifications.

1.2 Definitions

- .1 Abbreviations used in Detailed Valve Specification Sheets:

AV	- Angle Valve
BC	- Balancing Cock Valve
BD	- Butterfly Damper
BF	- Butterfly Valve
BV	- Ball Valve
CB	- Circuit Balancing Valve
CV	- Check Valve
DBV	- Duck Bill Valve
DV	- Diaphragm Valve
GA	- Gate/Root Valve
GL	- Globe Valve
GV	- Gate Valve
KV	- Knife Valve
MV	- Mud Valve

DETAILED PROCESS VALVE SPECIFICATION SHEETS

NV	- Needle Valve
PD	- Pump Discharge Valve
PV	- Plug Valve
TW	- Two Way/Three Way Multiport Valve
PN	- Pinch Valve
VE	- Vee Ball Valve

2. PRODUCTS

- .1 Detailed Valve Specification Sheets follow.

3. EXECUTION – NOT USED

DETAILED PROCESS VALVE SPECIFICATION SHEETS

BV01

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Ball Valve	BV01	Liquid/Air	600	5-120	850	120
TYPICAL SERVICE						
On/Off valve for utility water, air, and chemical solution lines.						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document		Note 2	
Body	Bronze or Forged Brass		Size Range		10 mm to 65 mm	
Ball	Bronze or Chrome plated brass - floating		Rating		Class 125	
Seats	PTFE		Body/Valve Ends		Female Threaded (Note 3)	
Shaft	Bronze or Stainless Steel (Note 1)		Pattern		Compact, Regular Port	
			Operator		Lever	
			Lining			
			Coating			
NOTES						
1. Blowout-proof stem.						
2. Gas service valves to comply with CGA requirements						
3. Provide threaded end cap and chain when used for drain service.						
ACCEPTABLE PRODUCTS						
Newman Hattersley Fig. 1969		Crane CSC9202	Nibco 560/580		Watts B6100/B6000	

DETAILED PROCESS VALVE SPECIFICATION SHEETS

BV03

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Ball Valve	BV03	Liquid	100 – 750	5 to 40	1000	60
TYPICAL SERVICE						
Chemical/General Service Wastewater Lines						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document	Material: ASTM D1784 (Grade A) Threads: ASTM D2464		
Body	PVC		Size Range	10 mm to 65 mm		
Ball	PVC – floating ball		Rating	CWP 1000 kPag		
Packing	O-Ring, EPDM or Viton (Note 4)		Body/Valve Ends	Schedule 80, Female Threaded, True Union		
Seats	PTFE		Pattern	Full Port (Note 2)		
Shaft	PVC (Note 1)		Operator	Lever		
NOTES						
1. Blowout proof ball and stem required.						
2. Bi-directional.						
3. This valve is for use in PVC piping systems only; also refer to BV02.						
4. Do not provide BV05 valves with Viton rings on CHS services.						
ACCEPTABLE PRODUCTS						
Chemline 21 Series	Hayward Safe-Block		Nibco Tru-Block PVC		Fabco Superbloc	
IPEX VX-True Union						

DETAILED PROCESS VALVE SPECIFICATION SHEETS

CV01

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Check Valve	CV01	Liquid	600	5-30	850	50
TYPICAL SERVICE						
Check valve for utility water or wastewater.						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		Reference Document	Body Material: ASTM B62		
Body	Bronze		Size Range	10 mm to 65 mm		
Disc	Bronze		Rating	Class 125		
Seats	Bronze		Valve Ends	Female Threads		
Hinge pin, trim	Bronze		Type of Disc	Swing Check Regular Port		
Spring			Operator			
			Lining			
			Coating			
NOTES						
ACCEPTABLE PRODUCTS						
Crane 37	Newman Hattersley A60		Kitz No. 22	Jenkins 4092		
Toyo 236	Powell 560Y		Lunkenheimer 554			

DETAILED PROCESS VALVE SPECIFICATION SHEETS

NV01

GENERAL						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Needle Valve	NV01	Liquid/Air	800	5-100	1000	140
TYPICAL SERVICE						
Isolation valve for utility service.						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL	Reference Document		(Note 1)		
Body	Stainless Steel	Size Range		10 mm to 65 mm		
Stem	Stainless Steel	Rating		Class 150, 600 psi		
Seats	Stainless Steel	Valve Ends		Female threaded (Note 1)		
Seals/Packing	PTFE	Type of Disc		Needle		
Handle	Stainless Steel or Phenolic	Operator		Screwed Bonnet, Handwheel		
		Lining				
		Coating				
NOTES						
1. Female threads to suit commodity piping.						
ACCEPTABLE PRODUCTS						
Nupro JN Series	Anderson, Greenwood H Series	Lukenheimer 1733T	Parker FC-V12LNSS			
ECI Series 2000 FFG	Century CM2-IF44BT					

END OF SECTION

PIPE AND PIPE FITTINGS

1. GENERAL

1.1 Description

- .1 This section describes the pipe materials, fittings, appurtenances, installation and testing of the plumbing and HVAC systems.

1.2 Quality Assurance

- .1 Welding materials, fabrication standards and labour qualifications must conform to ANSI/ASME B31.1, ANSI B16.25, ASME Section IX, and the Provincial Board of Labour Regulations latest current editions.
- .2 Use welders fully qualified and licensed by Provincial Authorities.
- .3 Oil Piping: CSA Standard B139, Installation Code for Oil Burning Equipment (latest edition).
- .4 Domestic Water, Drainage and Vent Piping: current Provincial and Municipal Codes.
- .5 All below grade steel piping shall be yellow jacketed with taped and sealed joints.
- .6 Non-specified pipe joining and pipe fitting methods such as T-drill and press fit are not permitted in any piping system covered under Division 15.
- .7 Conflicts:
 - .1 Review the Drawings prior to installation of piping, conduit services, and fixtures by this or any other division. Identify any conflicts and cooperate with the Engineer to determine the adjustments necessary to resolve these conflicts.
 - .2 Confirm the routing of each section of pipework with other services prior to commencement of installation. Advise the Engineer of any conflicts with existing services or services yet to be installed. Where necessary, amend the routing of pipework to avoid conflict and confirm with the Engineer.

PIPE AND PIPE FITTINGS

2. PRODUCTS

2.1 Pipe

	Service	Material
.1	Sanitary drainage, and vent, inside building, above ground	`DWV' copper, ASTM B306 Cast iron, CSA B70, PVC SDR-35 for sizes to 300 mm
.2	Sanitary vent, outside building	Cast iron, CSA B70
.3	Domestic water, above ground (inside building)	Type `L' hard copper
.4	Glycol heating to 120°C	Steel, Sch.40, ASTM A53, Grade B heating to 120°C
.5	Oil (above ground)	Steel, Sch.40, ASTM A120
.6	Diesel engine exhaust Grade B	Steel, Sch.40, ASTM A53 UL Listed Insulated Position Pressure Piping System
.7	Equipment drains and overflows	Sch.40, galvanised steel, ASTM A120 Type `L' hard copper ASTM B88M

2.2 Fittings and Joints

	Service	Material	Joint
.1	Sanitary drainage and vent inside building, above ground	Cast iron	Gasket clamp
		Wrought or Cast copper	Lead-free Solder
.2	Domestic water, above ground	Wrought copper, bronze	Lead free solder, brazed for pipes over 50 mm
		Cast bronze	Screwed
.3	Glycol heating to 120°C	Banded malleable iron, 1033 kPa, up to 50 mm	Screwed
		Steel, same schedule as pipe, for sizes 50 mm and larger	Welded
		Wrought copper,	95-5 solder, brazed bronze,

PIPE AND PIPE FITTINGS

		Service	Material	Joint for pipes over 50 mm
.4	Oil (above ground)		Cast brass	Screwed
			Cast bronze	Flare tube
			Malleable iron, banded, 1033 kPa	Screwed
			Forged steel	Screwed
			Forged steel, socket weld	Welded
			Steel, same schedule as pipe	Welded
.5	Diesel engine exhaust Grade B		Cast bronze	Flared tube
			Steel, same schedule as pipe, all sizes	Welded
.6	Equipment drains and overflows		Galvanised banded malleable iron	Screwed
			Wrought copper, bronze	50-50 solder
			Cast brass	Screwed
.7	Use factory fabricated butt welded fittings for welded steel pipes.			
.8	Use long radius elbows for steel and cast iron water piping, including grooved mechanical fittings.			
.9	Where not shown or otherwise specified, use solvent weld joints for PVC piping. Minimize number of threaded joints on all PVC piping.			

2.3 Unions, Flanges and Couplings

- .1 Size 50 mm and under: 1033 kPa malleable iron, bronze to iron ground joint unions for threaded ferrous piping, air tested for gas service, all bronze for copper piping.
- .2 Sizes 65 mm and over: 1033 kPa forged steel welding neck flanges for ferrous piping, 1033 kPa bronze slip-on flanges for copper piping. Gaskets shall be 1.5 mm thick performed synthetic rubber bonded asbestos. Gaskets for gas service shall be synthetic rubber.

PIPE AND PIPE FITTINGS

- .3 Flange bolting: For systems up to 120°C, use carbon steel stud bolts, semi-flushed and heavy hex nuts, ASTM A307-GrB. For systems up to 215°C, use alloy steel bolts ASTM A193-GrB7, and semi-finished heavy hex nuts ASTM A194-Gr2H.
- .4 Where permitted by the Engineer, use grooved mechanical couplings to engage and lock grooved or shouldered pipe ends and to allow for some angular deflection, contraction and expansion. Couplings consist of malleable iron housing-clamps, C-shaped composition sealing gasket EPDM Grade 'E' and steel bolts. Use galvanised couplings for galvanised pipe. Victaulic brand or Grinnel Gruv-Lok only.

3. EXECUTION

3.1 Preparation

- .1 Ream pipes and tubes. Clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

3.2 Pipe Handling

- .1 Inspect each pipe and fitting prior to installation. Do not install damaged pipe or pipe with damaged protective coatings.
- .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 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.

3.3 Connection

- .1 Screw joint steel piping up to and including 40 mm. Weld piping 65 mm and larger, including branch connections. Screw or weld 50 mm piping for liquid systems.
- .2 Make screwed joints with full cut standard taper pipe threads with approved non-toxic joint compound applied to male threads only.
- .3 Make joints for plain end pipe with gasket and clamp type mechanical fastener.
- .4 Use grooved mechanical couplings and mechanical fasteners, only where permitted by the Consultant.
- .5 Use galvanised couplings with galvanised pipe.

PIPE AND PIPE FITTINGS

- .6 Make connections to equipment, specialty components, and branch mains with unions or flanges.
- .7 Provide dielectric type connections wherever joining dissimilar metals in open systems. Brass adapters and valves are acceptable.
- .8 Use insulating plastic spacers for copper pipe installation in metal studs.

3.4 Route and Grades

- .1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furring to a minimum.
- .2 Slope water piping 0.2% and provide hose bibb drains at low points.
- .3 Equip low points with 20 mm drain valves and hose nipples.
- .4 Provide air collection chambers with manual air vent at all high points of system. Collection chambers to be 25 mm dia. or line size whichever is greater and 150 mm high minimum. Square tees may only be used to assist with complete venting and draining.
- .5 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting. Top flat for water.
- .6 Grade horizontal drainage and vent piping 2% minimum, unless noted otherwise.
- .7 Pipe the discharge from all relief valves, safety valves, vents, drains, water columns and overflows to the nearest building drain. Pipe to glycol recovery tanks for a glycol based system.

3.5 Installation

- .1 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.
- .2 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions.

PIPE AND PIPE FITTINGS

3.6 Welded Pipe Branch Connections

- .1 Make branch connections according to the following schedule.

Legend:

T: Forges tee or reducing tee

S: Socolet

W: Weldolet

HEADER	15	T								
	20	T	T							
	25	T	T	T						
	30	T	T	T	T					
	40	T	T	T	T	T				
	50	S	S	S	T	T	T			
	65	S	S	S	S	T	T	T		
	75	S	S	S	S	S	T	T	T	
	100	S	S	S	S	S	T	T	T	T
	15	20	25	30	40	50	65	75	100	
BRANCH										

END OF SECTION