

**TABLE OF CONTENTS**

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<b>DIVISION 11</b>		
11050	Process Piping	11
11055	Detailed Piping Specification	4
11059	Process Piping and Equipment Insulation	3
11105	Detailed Valve Specification	2
11363	Diaphragm Metering Pump Skid	4
11800	Soda Ash Silo Dehumidifier And Air Cannon Activators	3

## PROCESS PIPING

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### 1. GENERAL

#### 1.1 Description

- .1 This Section describes the pipe materials, fittings, appurtenances, installation and testing of the process systems.
- .2 Use the general requirements specified in this Section integrally with the more specific requirements listed in Section 11055 – Detailed Piping Specification Sheet.
- .3 Piping supports are generally not shown on the process Drawings. Provide the design of piping supports, pipe guides, expansion joints and anchors based upon final piping layout. Typical support details and structural attachments shown on the Drawings indicate the level of quality that will be considered acceptable.
- .4 The Contractor must provide the necessary submittals and ensure the proper registration of piping systems and system components as required by the Manitoba Labour and Immigration.
- .5 Standard of Acceptance: items specified by manufacturer's name and/or catalogue number form part of this Specification in order to define the standard regarding performance, quality of material and workmanship. When used in conjunction with a referenced standard, shall be deemed to supplement the standard.

#### 1.2 Definitions

- .1 Pressure terms used in this and other related sections are defined as follows:
  - .1 Operating Limits: the minimum and maximum pressure at which the piping system operates for sustained periods of time
  - .2 Test Pressure: the hydrostatic pressure used to determine system compliance.
- .2 Unless otherwise specified or shown, the interface between piped commodities common to process-mechanical and yard piping is below grade and 450 mm from the exterior face of a building or tunnel wall.
- .3 Pipe and appurtenance location terms used in this and other related sections are defined as:
  - .1 Tunnels, Pumphouse and Buildings: within an environmentally controlled enclosure where temperature is maintained above 5°C.
  - .2 Exposed, Aboveground: outside or within an enclosure which is not environmentally controlled so that the temperature is maintained above 5°C. For the purpose of defining exterior protection systems, this definition is extended to vertical piping to a point of 0.5 m below finished ground level.
  - .3 Underground or Buried: placed in soil and not tied to structures.
  - .4 Below Structures: below concrete slabs such as tanks, channels, buildings, pipe chases, foundation slabs, etc., but not including roadways or walkway structures.

## PROCESS PIPING

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- .5 Submerged: regularly or occasionally immersed in liquid; inside tanks or channels, and within 3.0 m above maximum water level of open tankage, including pipe and appurtenances within manholes, vaults, and chambers.

### 1.3 Reference Standards

- .1 Conform to the most recent version of the following reference standards:
  - .1 ANSI/ASME A13.1, Scheme for the Identification of Piping Systems
  - .2 ANSI/ASME B31.3, Process Piping
  - .3 ANSI/ASME B31.9, Building Services Piping
  - .4 ASTM A536, Ductile Iron Castings
  - .5 AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
  - .6 AWWA C110, Ductile-Iron and Grey-Iron Fittings, 3 Inch through 48 Inch, for Water and Other Liquids
  - .7 AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Grey-Iron Pipe and Fittings
  - .8 AWWA C115, Flanged Ductile-Iron and Grey-Iron Pipe with Threaded Flanges
  - .9 AWWA C151 (ANSI A21.51), Ductile-Iron Pipe, Centrifugally Cast in Metal Moulds or Sand-Lined Moulds, for Water and Other Liquids
  - .10 AWWA C600, Installation of Ductile-Iron Water Mains and their Appurtenances
  - .11 AWWA C606, Grooved and Shouldered Joints
  - .12 AWWA C651, Disinfecting Water Mains
  - .13 CPC, Canadian Plumbing Code
  - .14 CSA CAN3-Z299.3, Quality Verification Program Requirements
  - .15 EJMA STDS-93, Standards of Expansion Joint Manufacturers' Association, Edition No. 6
  - .16 Fluid Sealing Association Technical Handbook, Rubber Expansion Joint Division
  - .17 MIL-STD-810C, Environmental Test Methods
  - .18 MSS SP25, Standard Marking System for Valves, Fittings, Flanges and Unions
  - .19 SSPC-P3, Canadian Government Standards Board
  - .20 SSPC-SP6, Canadian Government Standards Board
  - .21 SSPC-SP10, Canadian Government Standards Board

## PROCESS PIPING

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- .22 National Fire Code of Canada
- .23 NFPA 300 (2003 Edition)
- .24 NPC, National Plumbing Code
- .25 TSSA, Technical Standards and Safety Association
- .26 Provincial Building Code
- .27 Provincial Plumbing Code

### 1.4 Design Requirements

- .1 The design has been completed to the degree necessary for the Contractor to Bid. It is not fully detailed and will require the Contractor to undertake design of and responsibility for minor aspects for the piping systems to be installed.
- .2 All process piping shall meet requirements of the Process Piping Code, B31.3, whether or not it falls within the Code scope. Manitoba Department of Labour and Immigration shall be the Code Authority whenever the piping system falls within the Code scope. The Contract Administrator shall be the Code Authority for process piping that does not fall within the Code scope.
- .3 Piping and Instrumentation Drawings, piping schematics, and piping layout Drawings are contained in the Drawings set. The Piping and Instrumentation Drawings (P&IDs) indicate all major pipework, valves, and appurtenances (other than cleanouts, purge points, etc.) The layout Drawings indicate the design concepts and are intended to illustrate a constructible method for the piping systems. Some appurtenances, supports, guides and anchors, and expansion joints are not fully shown. The Contractor's design will complement and detail these Drawings.
- .4 It is understood that some conflicts will arise that will require that the Contractor re-route some of his piping to allow for the installation of wiring, ventilation duct, or similar.

### 1.5 Submittals

- .1 For each piping system refer to Section 11055, submit documentation listing pipe, fittings, flexible connectors, expansion joints, linings, coatings, and valving to be used for each pipe size and category.
- .2 A copy of this Specification Section and all referenced sections with each paragraph check-marked to show compliance or highlighted to indicate deviation.
- .3 Provide hanger, guide, and anchor, support system design details including locations, load information, design calculations and illustrative drawings, signed and sealed by a Professional Engineer registered in the Province of Manitoba. Refer to Section 11055.

## PROCESS PIPING

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- .4 For expansion joints submit manufacturer's catalogue data, Shop Drawings and assembly drawings confirming general arrangement, dimensions, tolerances, materials of construction, weights and installation details. Submit calculations to substantiate expansion joint selection and amount of pre-compression, signed and sealed by a Professional Engineer registered in the Province of Manitoba. Refer to Section 11055.
- .5 Prior to the commencement of welding, submit current and complete documentation of the welder's qualifications.

### 1.6 Coordination

- .1 Process and Utility Piping identification
- .2 Process and utility piping is identified in the Drawings by a two component alpha-numeric code, (Line Label) as follows:
  - .1 The first component of the code indicates the nominal line size.
  - .2 The second component of the code identifies the process fluid being conveyed, (Commodity).
  - .3 The process fluid (commodity) codes are defined in the Drawings.
- .3 Routing
  - .1 Coordinate piping installation routes and elevations with installation of sheet metal, process equipment, HVAC, instrumentation, and electrical work.

### 1.7 Quality Assurance

- .1 Welding certification
  - .1 All welders are to be certified under the Manitoba Department of Labour and Immigration and Regulations. As a minimum, welders will hold a Level B Journeyman Welder's Certificate.

### 1.8 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 Contract Administrator 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 Contract Administrator 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 Contract Administrator.

### 1.9 Shipment, Protection and Storage

- .1 Deliver pipe, fittings, and specials to Site using loading methods which do not damage pipe or coatings.
- .2 Piping materials delivered to Site will be clearly marked to indicate size, type, class/schedule, and coatings.

## PROCESS PIPING

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### 1.10 Warranty

- .1 Contractor shall supply new materials and re-do the Work should materials be found to be defective or not in compliance with the Specifications, or should the workmanship be found to be inadequate or the Work was not performed in accordance with the Specifications and referenced standards, codes and regulations. This warranty shall remain in effect for the maximum period of time allowed under Law.
- .2 Neither the Contract Administrator's inspections, checks, or any other tests or subsequent authorization to proceed with the Work, nor the Contract Administrator's waiving of the Contract Administrator's right to perform such tests, nor the Contract Administrator's decision not to solicit submission of material certificates or other quality assurance documentation relieve the Contractor from any degree of responsibility in regard to the Work or the corresponding warranty above. The Contractor agrees that the Contract Administrator's ability to fully assess the suitability of materials, procedures, worker qualifications and other relevant issues is limited. The Contractor bears full responsibility and is solely liable in these matters.

## 2. PRODUCTS

### 2.1 Function

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

### 2.2 Pipe Materials – General

- .1 All pipe materials to be new, free from defects and conforming to the reference standards identified in Section 11055.
- .2 Where any standard referenced has been superseded prior to bidding, the Contractor shall comply with the new standard.

### 2.3 Pipe Sizes

- .1 Where the pipe size is not specified, provide pipe with the sizes required by the National Plumbing Code. For small piping not described by the National Plumbing Code, use 12 mm nominal diameter.

### 2.4 Fittings

- .1 General
  - .1 Provide eccentric reducers in horizontal lines with the flat side on top, unless shown otherwise.
  - .2 Provide concentric reducers in vertical lines unless indicated otherwise.
  - .3 Provide long radius elbows unless otherwise shown. Provide smooth flow carbon or stainless steel elbows 350 mm and less, to ANSI B16.9. Provide mitred elbows greater than 350 mm, to AWWA C208 unless otherwise shown or specified. Use three piece construction unless otherwise shown or specified.

## PROCESS PIPING

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- .4 Provide fittings in concrete cylinder pipe fabricated from metal plate, cement lined and coated, and in accordance with AWWA C301. Dimensions to AWWA C208.

### 2.5 Gaskets

- .1 For flat-faced flanges, use full-face gaskets. For Van Stone, lap joint and raised-face flanges, use full face or ring type gaskets. Conform to ASTM B16.21.
- .2 Use gasket materials for flanged connections suitable for the temperature, pressure, and corrosivity of the fluid conveyed in the pipeline.
- .3 Unless otherwise specified, minimum Gasket Material Thickness for full face gaskets:
  - .1 Up to 250 mm pipe diameter: 1.6 mm thick
  - .2 Greater than 250 mm pipe diameter: 3.2 mm thick
- .4 Unless otherwise specified, minimum gasket material thickness for raised face rings gaskets:
  - .1 Up to 100 mm pipe diameter: 1.6 mm thick
  - .2 Greater than 100 mm pipe diameter: 3.2 mm thick
- .5 Grooved type gaskets:
  - .1 Select material as recommended by the manufacturer for the service conditions indicated.
  - .2 Unless otherwise specified; for epoxy- and glass-lined piping systems for solids-carrying liquids, provide end-seal type gaskets.
  - .3 Unless otherwise specified, provide flush seal type gaskets for all other grooved joint systems. Acceptable Products: Gustin-Bacon Rigigrip, Victaulic Flush-Seal.

### 2.6 Bolts and Nuts

- .1 Provide hex head bolts and nuts. Threads to be ANSI B1.20.1, standard coarse thread series.
- .2 For general indoor service, use bolts conforming to ASTM A307, Grade A; nuts conforming to ASTM A563, Grade A.
- .3 Provide stainless steel bolts, nuts and washers for exposed, submerged, buried and concrete encased service; bolts conforming to ASTM A193, Grade B8, C1.1; nuts conforming to ASTM A194, Grade 8. Provide these also for connections above normal water level but which may be subjected to direct contact with splashed water.
- .4 Provide hot dip galvanized bolts, nuts and washers for use with hot dip galvanized Van Stone flange back-up rings and Lap-joint flange back-up rings.
- .5 Provide hex nuts equal to or less than 25 mm. Greater than 25 mm, provide heavy hex.

## PROCESS PIPING

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### 2.7 Structural Element Penetrations

- .1 Structural element penetrations are shown and referenced to a detail or Process/Mechanical Standard Detail. Where a structural element penetration is not referenced, conform to the Standard Detail relevant to the type of structure, exposure, and type of pipe.
- .2 Provide pipe sleeves capable of supporting the loads applied during placement of concrete or during blockwork erection.
- .3 Supply wall or floor penetrations into submerged areas, under slab areas, and where shown with a 6 mm thick water stop flange at least 50 mm larger than the pipe or pipe sleeve outside diameter. Continuously weld the water stop flange, both sides, onto the pipe or pipe sleeve. Fill annular space between the sleeve and pipe, where a sleeve is used, with non shrink grout in accordance with Division 3. Form reglets between the grout and the concrete and between the grout and the pipe, on "wet" sides of the wall penetration. Fill reglet with sealant.
- .4 For structural concrete wall and floor penetrations of non-insulated pipe between dry areas, furnish a sleeve which has an internal diameter at least 50 mm larger than the outside diameter of the pipe. For pipes 75 mm and less furnish a pipe sleeve 25 mm larger than the outside diameter of the pipe.
- .5 For masonry wall penetrations of non-insulated pipe, furnish a sleeve which has an internal dimension of at least 50 mm larger than the pipe outside diameter. For pipes 75 mm and less furnish a pipe sleeve 25 mm larger than the outside diameter of the pipe.
- .6 A Standard Detail is shown for segmented modular pipe seals. Where this detail is used for the penetration of a wall separating a dry area from an underground area, tighten the bolts from the inner face and fill the outer annular space with grout. Use stainless steel bolts and nuts in penetrations through walls separating underground or exterior areas from any other area. If seepage occurs during the warranty period, the Contractor is responsible for repair and/or replacement, at no cost to the City. Do not use this type of wall penetration below maximum ground water level elevation.

### 2.8 Insulation

- .1 Provide insulation where shown on drawings. Minimum insulation thickness: 25 mm. Use greater thicknesses as recommended by the manufacturer if more than 25 mm is required to lower the outer skin temperature to below 40°C.
- .2 Provide stainless steel bands over the insulation at a maximum of 300 mm centers.
- .3 Provide insulation and recovering for all piping where the pipe surface will sweat, where heat retention is required, and at the locations indicated on the Drawings.
- .4 Where pipe runs below ground, continue insulation and recovering to a depth 2.5 m below finished ground surface in grassed areas or 3.0 m below roads, walkways, and access pads.
- .5 Do not insulate over expansion joints or flexible hose connectors, in order to permit periodic inspection of connector bolting.
- .6 Recover all insulated pipe. Align longitudinal seams in aluminum recovering to shed water. Overlap radial seams a minimum of 50 mm.

## PROCESS PIPING

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### 2.9 Interior Finishes (Linings)

#### .1 General

- .1 Provide products with factory applied linings and finishes unless otherwise noted. Fittings and pipe of any one pipe system to be lined by the same manufacturer.
- .2 Do not shop coat the internal surface of stainless steel or plastic piping.
- .3 Provide No. 1 or No. 2B standard finish for gauge stainless steel pipe, as specified in ASTM A480. Finish heavier pipe to No. 1 mill finish or better, as specified in ASTM A480.
- .4 Unless otherwise specified, finish fittings in the same manner as the pipe run.

### 2.10 Exterior Finishes - (Coatings) Shop Applied

- .1 Provide Products with factory applied coatings and finishes as specified in the Detailed Pipe Specification Sheets.
- .2 Yellow Jacket

<b>Nominal Pipe Diameter (mm)</b>	<b>Minimum HDPE Thickness (mm)</b>
20	0.55
25	0.55
30	0.60
40	0.65
50	0.70
65	0.70
75	0.70
100	0.75
150	0.90
≥200	1.00

### 2.11 Exterior Finishes - (Coatings) Field Applied

#### .1 General

- .1 Use field applied finishes only for
  - .1 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
  - .2 To repair shop-applied exterior finishes
  - .3 To make up cutback distances at joints
  - .4 For fittings, couplings, valves and other appurtenances

## PROCESS PIPING

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- .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 For piping systems for flammable liquids or combustible liquids shall be wrapped with synthetic rubber or adhesive plastic tape for corrosion protection.
- .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 Contract Administrator 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.

### 2.12 Concrete

- .1 Provide concrete for concrete surround placed around buried pipe, and fill placed over buried pipe.

## 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, modify the piping arrangement as necessary at no additional expense to the City.
- .4 Advise the Contract Administrator of all modifications. Do not commence work on the related piping until all modifications have been reviewed by the Contract Administrator.
- .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

## PROCESS PIPING

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steel piping that may have been deformed out of roundness or dimpled. Such damaged sections shall be discarded.

### 3.3 Sleeves

- .1 Unless otherwise noted or approved by the Contract Administrator, 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 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.
- .4 Provide Yellow Jacket or tape wrap on all fittings and flanged, grooved, plain end and welded joints underground and below structures.
- .5 Unless otherwise specified or shown, for underground piping, provide groove joints or flex coupled joints at 6 m on center.
- .6 Use anti-seize compound with all stainless steel nuts and bolts.
- .7 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 the Manitoba Department of Labour and Immigration. 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.

## PROCESS PIPING

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- .6 Slope instrument air piping to condensate traps. Provide condensate traps as recommended by the manufacturer of the instrument air compressor.
- .7 Do not cut or weaken the building structure to facilitate installation.

### 3.6 Testing

- .1 Give the Contract Administrator 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 Supply all water, air, and inert gases required for pressure testing.
- .5 Supply all pumps, compressors, gauges, etc., required for testing.
- .6 Install air threadolets, air relief valves and line fitting valves as necessary to complete testing. Remove after testing and plug the threadolets.
- .7 Cap or plug all lines which are normally open ended. Remove on completion of testing.
- .8 Provide all temporary thrust restraints necessary for testing. Remove upon completion of testing.
- .9 Test all underground lines prior to backfilling. Do not place concrete surround until lines are tested.
- .10 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 Contract Administrator of such failure.
- .11 Isolate all low pressure equipment and appurtenances during testing so as not to place any excess pressure on the operating equipment.
- .12 Where defective material or equipment is identified, repair or replace using new material.
- .13 Release pressure safely, flush and drain liquid pipes after pressure tests. Release pressure safely and purge if needed all gas pipes after pressure tests.
- .14 Dispose of flushing water in manner approved by the Contract Administrator, which causes no damage to buildings or Siteworks.

**END OF SECTION**

## DETAILED PIPING SPECIFICATION

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### 1. GENERAL

#### 1.1 Work Included

- .1 The piping specification sheets on the following pages detail the requirements for each type of process pipe included in the Work.
- .2 The piping materials are listed on the specification sheets.

#### 1.2 Process Piping Commodity Summary

FW	Flushing Water	Stainless Steel, Mild Steel, (ERW or Seamless)
SEA	Service Air	Aquatherm Greenpipe SDR 7.4, working pressure 200 psi (1400 kPa)
SA	Soda Ash	PVC Sch80

### 2. PRODUCTS

#### 2.1 Schedule

- .1 Pages 2 to 4 following.
- .2 Piping located in the Sequencing Batch Reactor headspace is defined as "submerged".

**DETAILED PIPING SPECIFICATION**

**PD / SA**

<b>GENERAL</b>					
PROCESS FLUID	SYMBOL	MAXIMUM CONDITIONS		TEST CONDITIONS	
		PRESSURE (kPa)	TEMP. (°C)	PRESSURE (kPa)	DURATION
Soda Ash (in Silo and SBR Headspace)	<b>SA</b>	750	30	1000	120 minutes
<b>PIPE</b>					
LOCATION	SIZE (mm)	MATERIAL	RATING	SPECIFICATIONS	REMARKS
All	10 – 200	PVC	Schedule 80	ASTM D1785, CSA 137.3	
<b>COATINGS</b>					
LOCATION	SIZE (mm)	MATERIAL		SPECIFICATIONS	REMARKS
All	10 – 200	N/A			
<b>LININGS</b>					
LOCATION	SIZE (mm)	MATERIAL		SPECIFICATIONS	REMARKS
All	10 – 200	N/A			
<b>JOINTS</b>					
LOCATION	SIZE (mm)	TYPE	MAXIMUM SPACING	SPECIFICATIONS	REMARKS
All	≥75	Solvent Weld	N/A	ASTM D2467, D2564	Note 1
	≥75	Flanges	12m	ASTM D2467	
<b>FITTINGS AND APPURTENANCES</b>					
ITEM	SIZE (mm)	MATERIAL	RATING	SPECIFICATIONS	REMARKS
Flanges	10 – 200	PVC	Schedule 80		
ELL - Short Radius ELL - Long Radius, Couplings, Tees, Reducers, Reducing Outlets and Laterals	10 – 200	PVC	Schedule 80	ASTM D2467, Solvent Weld	
Plug	10 – 200	PVC	Schedule 80	ASTM D2467, Solvent Weld	
Cap	≥75	PVC	Blind Flange Schedule 80		
Flange Gaskets		Bl. Neoprene, Viton		ASTM F477	Note 3
PVC Solvent				ASTM D2564	Note 3
<b>NOTES</b>					
1. Provide Unions or flanges as shown on Drawings to allow for pipe disassembly. 2. Where pipe crosses a structural joint, install at the joint location an EPDM lined elastomer spherical moulded type expansion joint capable of 0.25 degrees angular movement and ±20 mm axial movement. 3. Gaskets and solvent material to be compatible with designated chemical solution.					

**DETAILED PIPING SPECIFICATION**

**FW**

<b>GENERAL</b>					
PROCESS FLUID	SYMBOL	OPERATING LIMITS		TEST CONDITIONS	
		PRESSURE (kPa)	TEMP. (°C)	PRESSURE (kPa)	DURATION
Flushing Water	FW	0-750	5-30	1200	120 minutes
<b>PIPE</b>					
LOCATION	SIZE (mm)	MATERIAL	RATING	SPECIFICATIONS	REMARKS
Tunnels and Buildings	≥75	Mild Steel (CW or ERW) or	Std. Wt.	ASTM A53, Grade B	FW pipe inside Exhaust Fan Building to be Stainless Steel
		Stainless Steel 316 <sup>Note 1</sup>	Std. Wt.	ASTM A312	
Below Structures	≥75	Mild Steel (CW or ERW) or	Std. Wt.	ASTM A53, Grade B	
		Stainless Steel 316L	Std. Wt.	ASTM A312	
<b>COATINGS</b>					
LOCATION	SIZE (mm)	MATERIAL		SPECIFICATIONS	REMARKS
Tunnels and Buildings	≥75 (Steel)	Paint – E1			Note 2.
	≥75 (316L SS)	N/A			
Below Structures	≥75 (Steel)	Concrete Surround			
	≥75 (316L SS)	Concrete Surround			
<b>LININGS</b>					
LOCATION	SIZE (mm)	MATERIAL		SPECIFICATIONS	REMARKS
Tunnels and Buildings	≥75 (Steel)	Liquid Epoxy – E2a		AWWA C210	Note 2.
	≥75 (316L SS)	N/A			
Below Structures	≥75 (Steel)	Liquid Epoxy – E2a		AWWA C210	
	≥75 (316L SS)	N/A			
<b>VALVES</b>					
TYPE	SIZE (mm)	VALVE SPECIFICATION (SECTION 11105)		REMARKS	
Ball Valve	≥75	All valves to be BV05 (see Section 11105)		Default isolation valve, ≥75	
<b>NOTES</b>					
1. Flushing water connection to RAS line shall be stainless steel (i.e., flushing water pipe inside exhaust fan building) 2. Tubing or piping located in the headspace of tanks is considered "submerged".					

**DETAILED PIPING SPECIFICATION**

**SEA**

<b>GENERAL</b>					
PROCESS FLUID	SYMBOL	OPERATING LIMITS		TEST CONDITIONS	
		PRESSURE (kPa)	TEMP. (°C)	PRESSURE (kPa)	DURATION
Service Air	<b>SEA</b>	0-750	5-30	1400	120 minutes
<b>PIPE/FITTINGS</b>					
LOCATION	SIZE (mm)	MATERIAL	RATING		
Tunnels and Buildings	<75	Aquatherm Greenpipe SDR 7.4			
Below, Structures		Mild Steel, ERW or Seamless	Std. Wt.	ASTM A53, Grade B	
<b>Coating</b>					
Below Structures		Liquid Epoxy	AWWA C210		

**END OF SECTION**

## PROCESS PIPING AND EQUIPMENT INSULATION

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### 1. GENERAL

#### 1.1 Scope

- .1 Process piping and equipment insulation.

#### 1.2 Quality Assurance

- .1 Install insulation employing skilled workers regularly engaged in this type of Work.
- .2 Materials shall meet or exceed fire and smoke hazard ratings as stated in this Section and defined in applicable building codes.

#### 1.3 Submittals

- .1 Submit Shop Drawings which indicate complete material data, "K" value temperature rating, density, finish, recovery jacket of materials proposed for this project and indicate thickness of material for individual services.

#### 1.4 Job Conditions

- .1 Deliver material to Site in original non-broken factory packaging, labeled with manufacturer's density and thickness.
- .2 Perform Work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

### 2. PRODUCTS

#### 2.1 General

- .1 Insulation Materials, Recovery Jackets, Vapour Barrier Facings, Tapes and Adhesives:
  - .1 Composite fire and smoke hazard ratings shall not exceed 25 for flame spread and 50 for smoke developed rating when tested in accordance with CAN4-S102, NFPA 255 or ASTM E84.
  - .2 Provide insulating materials and accessories that withstand service temperatures without smouldering, glowing, smoking, or flaming when tested in accordance with ASTM C441.
  - .3 All insulation materials shall meet current Building Code Standards, and packages or containers of such materials shall be appropriately labeled.
  - .4 Insulate fittings and valve bodies with preformed removable insulated fittings.

#### 2.2 Materials

- .1 Cold piping exterior: foamglass insulation with factory applied aluminum vapour barrier jacket, factory moulded to conform with piping. "K" value: maximum 0.035 W/m°C at 24°C. Service temperature: -40°C to 150°C.

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**PROCESS PIPING AND EQUIPMENT INSULATION**

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- .2 Recovery jackets: 0.9 mm smooth aluminum sheet or paintable canvas for all new insulated piping.

**2.3 Buried Piping**

- .1 Provide insulation for all buried piping with a soil cover of less than 2500 mm in grassed areas or less than 3000 mm below roads, walkways, and access pads.

**2.4 Above-ground Piping**

- .1 Provide insulation for all piping where heat retention is required, at the locations indicated on the drawings and for other piping systems where insulation is indicated on the process Drawings.
- .2 On exterior piping, provide aluminum jacketing with a minimum thickness of 0.9 mm, unless indicated otherwise.
- .3 Provide aluminum banding, 12 mm wide by a minimum of 0.5 mm thick with matching seals.
- .4 Provide polypropylene jacketing at elbows, tees or other changes of direction and where indicated. Use the heat-shrink type jacketing, with a minimal thickness of 0.1 mm.

**3. EXECUTION**

**3.1 Preparation**

- .1 Do not install insulation and recovering before piping and equipment has been tested and approved.
- .2 Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions.

**3.2 Installation**

- .1 Finish insulation neatly on hangers, supports, and other protrusions.
- .2 Locate insulation or cover seams in least visible locations. Locate seams on piping in ceiling spaces on the underside of the pipe.
- .3 Cover all insulated piping throughout with aluminum or paintable canvas recovery jacket secured with aluminum bands on 200 mm centres or screws on 150 mm centres, unless otherwise noted. Lap the joints a minimum of 75 mm. Align longitudinal seams in aluminum recovering to shed water. All bands and screws are to be accessible for service and removal.
- .4 Cold piping: seal lap joints with 100 percent coverage of vapour barrier adhesive. Seal butt joints with 50 mm wide strips of vapour barrier sealed with vapour barrier adhesive. For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells, seal all laps and joints.

**PROCESS PIPING AND EQUIPMENT INSULATION**

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**3.3 Process Pipe Insulation Installation Thickness Schedule**

<b>Piping or Equipment</b>		<b>Insulation Thickness (fibreglass) mm</b>	<b>Insulation Thickness (closed cell phenolic) mm</b>	<b>Recovery Jacket</b>
Insulated Process Piping, as shown on drawings	15 to 50 Over 50	25 50	25 25	As noted in 2.2

**END OF SECTION**

## DETAILED VALVE SPECIFICATION

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### 1. GENERAL

#### 1.1 Description

- .1 This Section provides a summary of the valve body materials, valve performances and reference Specifications for use in the Work.
- .2 This Specification Section is comprehensive; some commodities and valve types may not be applicable to the Work.
- .3 Section 1.2.1 provides a reference table of commodities and valves. The valve abbreviation therein indicates the Detailed Valve Specification Sheet to be referenced. Provide the valve type as indicated in the Drawings by the valve symbol shown. Match the symbol, commodity and line size to the Detailed Valve Specification Sheet.
- .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:

COMMODITY

FW Flushing Water

VALVE TYPE

BV Ball Valve

### 2. PRODUCTS

#### 2.1 Schedule

- .1 On the following page.

### 3. EXECUTION

**DETAILED VALVE SPECIFICATION**

**BV05**

<b>GENERAL</b>						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Ball Valve	<b>BV05</b>	Liquid	100 – 900	5 to 30	1000	50
<b>TYPICAL SERVICE</b>						
FW						
<b>VALVE MATERIALS</b>			<b>VALVE DESCRIPTION</b>			
ITEM	MATERIAL		Reference Document	MSS-SP72 (Note 4)		
Body	Cast Steel or Cast Iron or Steel		Size Range	75 mm to 450 mm (Note 5)		
Ball	Stainless Steel (316)		Rating	CWP 1400 kPag		
Packing	Reinforced PTFE or AFE		Body/Valve Ends	Split Body, Flanged (Note 4)		
Seats	Reinforced PTFE		Pattern	Full Port		
Shaft	Stainless Steel (315)		Operator	Notes 3		
	(Note 2)		Actuator	Note 3		
<b>NOTES</b>						
2. Blowout proof stem. 3. See Division 17. 4. Provide Class 125 to suit cast or ductile iron piping systems and Class 150 for steel systems. 5. Provide trunnion mounted ball on all valves 250 mm diameter and greater.						
<b>ACCEPTABLE PRODUCTS</b>						
Kitz 150 SCTBZM	Watts G4000/G4000T		Velan F-10402-SSGA	Neles Jamesbury Series 6000/9000		
American Valve Model 4000						

**END OF SECTION**

## DIAPHRAGM METERING PUMP SKID

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### 1. GENERAL

#### 1.1 Work Included

- .1 Supply and installation, testing, and commissioning of a complete and functional diaphragm pump systems for designated chemicals dosing application, as per the Drawings.

#### 1.2 Submittals

- .1 Submit Shop Drawings in accordance with Section 01300.
- .2 Operation and maintenance data: provide for incorporation in O&M Manual as specified in Section 01735. Include complete description of operation together with general arrangement and detailed drawings, wiring diagrams for power and control schematics, parts catalogue with complete list of repair and replacement parts with section drawings illustrating the connections and identifying numbers.

#### 1.3 Shipment, Protection, and Storage

- .1 Ship pre-assembled to the degree possible.
- .2 Provide storage instructions indicating specific requirements to ensure there is no uneven wear, distortion or weathering of components.
- .3 Identify all other special storage requirements.

### 2. PRODUCTS

#### 2.1 Description

- .1 Provide equipment capable of pumping ClearTech LimeClear™ from a 205 L storage drum in the configuration shown on the Drawings.
- .2 Each pumping system includes a diaphragm metering pump, pressure relief valve, pulsation damper, pressure, backpressure valves, drip tray, and all associated piping and fittings, in accordance with the Drawings.
- .3 The whole system shall take into account the atmospheric temperature, the specific gravity, viscosity, flammability, and temperature of the fluid being pumped.

#### 2.2 Tag Numbers

- .1 C661-P-P (Duty).
- .2 C662-P (Standby).

#### 2.3 Acceptable Manufacturers

- .1 Abel (as supplied by Power & Mine).

## DIAPHRAGM METERING PUMP SKID

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- .2 Prominent (as supplied by Metcon).

### 2.4 Capacities and Performance

- .1 Liquid properties:
  - .1 Specific gravity: 1.00 to 1.03.
  - .2 Boiling point: not available.
  - .3 Freezing point: -1°C.
  - .4 Classification: Class 1B liquid.
  - .5 Non-flammable.
- .2 Ambient environment temperature -40°C to 35°C.
- .3 Diaphragm Metering Pumps:
  - .1 Pump shall discharge between 11 and 27 mL of product to each batch (corresponding to 3 to 7 mg/L per 3800 L batch).
  - .2 Maximum backpressure: 100 kPa (before backpressure valve).
  - .3 Maximum negative suction lift (barrel empty): 2.5 m.
  - .4 Maximum differential pressure pump suction and discharge: 135 kPa.

### 2.5 Materials

- .1 Diaphragm: EPDM or PTFE capable of operation over the range of specified fluid temperatures.

### 2.6 Diaphragm Pumps

- .1 Provide diaphragm metering pump with hydraulic double diaphragm.
- .2 Provide gearbox with manual speed adjustment for altering pump frequency.
- .3 The pumps shall provide a constant flow rate for a particular stroke length and provide constant output flow over the full range of fluid levels in the storage tanks.
- .4 The pumps shall have a pumping accuracy of  $\pm 5$  percent.
- .5 Construct the pump parts in contact with the fluid from materials suitable for the specified fluids.
- .6 Provide pressure relief valve and backpressure regulating valve for each pump discharge, sized for the maximum pump flow with an adjustable pressure range. Valve material to be compatible with the fluids being pumped.

## DIAPHRAGM METERING PUMP SKID

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- .7 Provide motors in suitable for Phase 120V.
- .8 Provide heat tracing on enclosure together with a thermostat, if required for protection of the equipment at low temperatures.

### 2.7 Control Description

- .1 The pump is started automatically by the Distributed Control System (DCS) at the start of the soda ash batch preparation sequence. The metering pump shall inject the volume of chemical required to produce the desired concentration in the 3800 L batch tank and then shut off.

### 2.8 Spare Parts and Maintenance Materials

- .1 Provide the following spare parts:
  - .1 Two (2) pump diaphragms.
  - .2 One (1) set of ball check valves.
  - .3 One (1) set of ball check valve seats.
  - .4 One (1) set of gaskets and O-rings.
  - .5 One (1) backpressure valve diaphragm.
  - .6 One (1) pressure relief valve diaphragm.
- .2 Provide a list of spare parts which would be expected to be required over a period of five years under normal conditions. At the Contract Administrator's request, provide a price for the listed parts.

## 3. EXECUTION

### 3.1 Manufacturer's Representative

- .1 To ensure the equipment is installed, operated, and maintained in accordance with the manufacturer's recommended procedures, arrange for a technically qualified manufacturer's representative to witness the installation Work, certify correct installation, train operating and maintenance staff, and undertake system testing.

### 3.2 Installation

- .1 Ensure the equipment is installed as required to provide satisfactory service.
- .2 Instruct installer in the methods and precautions to be followed in the installation of the equipment.

### 3.3 Testing

- .1 Ensure the equipment, including all component parts, operates as intended.

**DIAPHRAGM METERING PUMP SKID**

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- .2 Cooperate with the installer to fulfill the requirements for successful testing of the equipment by completing Form 103, included in Section 01670.

**3.4 Commissioning**

- .1 Attend during commissioning of the process system which includes the equipment.

**END OF SECTION**

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**SODA ASH SILO DEHUMIDIFIER AND AIR CANNON ACTIVATORS**

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**1. GENERAL**

**1.1 Work Included**

- .1 Supply and installation, testing, and commissioning of a complete and functional dehumidifier to prevent soda ash from absorbing humidity that will affect product flow inside the silo, as per the Drawings.
- .2 Supply and installation, testing, and commissioning of a complete and functional air canon activator system to minimize compaction of soda ash inside the silo, and to ensure the soda ash flows satisfactorily inside the silo, as per the Drawings.

**1.2 Submittals**

- .1 Submit Shop Drawings in accordance with Section 01300.
- .2 Operation and maintenance data: provide for incorporation in O&M Manual. Include complete description of operation together with general arrangement and detailed drawings, wiring diagrams for power and control schematics, parts catalogue with complete list of repair and replacement parts with section drawings illustrating the connections and identifying numbers.

**1.3 Shipment, Protection, and Storage**

- .1 Ship pre-assembled to the degree possible.
- .2 Provide storage instructions indicating specific requirements to ensure there is no uneven wear, distortion or weathering of components.
- .3 Identify all other special storage requirements.

**2. PRODUCTS**

**2.1 Dehumidifier**

- .1 Provide CON-V-AIR Solutions Model HC-300 dehumidifier sized appropriately for the silo and material being protected.

**2.2 Air Cannons**

- .1 Provide CON-V-AIR Solutions Model P4040 air canon activator system capable of fluidizing of the soda ash to aide its movement within the silo, achieved through the sudden air expansion coming out of the activators. Include CON-V-AIR Solutions Model P5E04 factory-assembled control panel.

**2.3 Tag Numbers**

- .1 SA C626-1.
- .2 SA C626-2.

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**SODA ASH SILO DEHUMIDIFIER AND AIR CANNON ACTIVATORS**

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.3 SA C626-3.

.4 C627-AD.

**2.4 Acceptable Manufacturers**

.1 CON-V-AIR Solutions.

**2.5 Dehumidifier**

.1 Provide one (1) dehumidifier.

.2 Provide dehumidifier housing with desiccant wheel and drive.

.3 Provide electric reactivation heater and reactivation fan assembly.

.4 Provide factory-wired control enclosure with indicating package.

.5 Including piping and supports for connection between dehumidifier and silo roof.

**2.6 Air Cannon Activator System**

.1 Provide three (3) air cannon bin activator assemblies each including:

.1 One (1) 38 mm (1.5 inch) carbon steel injector.

.2 One (1) 56 L (2 cu ft) carbon steel high pressure tank.

.2 Provide one (1) factory-assembled control panel.

.3 Provide three (3) kits to mount the injectors onto silo cone complete with rigid and flexible connections.

**2.7 Control Description**

.1 System sequencing and operation to be controlled by manufacturer supplied control panels.

.2 The dehumidifier will continuously blow dry atmospheric air into the silo.

.3 The air cannon activator system will receive a control signal from the manufacturer-supplied panel to initiate the “blast” cycle based on an adjustable timer. Upon initiation of the “blast” cycle, the solenoid on one of the air cannons will be energized for an adjustable period of time, and then will shut down. Once the “blast” cycle of the first air cannon has been completed, there is an operator adjustable time delay before the “blast cycle” for the next air cannon is initiated. Similarly, after the second air cannon is finished, the third air cannon will go through its cycle.

.4 Provide the control panel with sufficient i/o to allow integration into the plant DCS system (being upgraded as part of main plant expansion).

**SODA ASH SILO DEHUMIDIFIER AND AIR CANNON ACTIVATORS**

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**2.8 Painting**

- .1 Shop prime and paint equipment in accordance with manufacturer's standard.

**2.9 Spare Parts and Maintenance Materials**

- .1 Provide the following spare parts:
  - .1 One (1) solenoid valve.
  - .2 One (1) injector assembly.
- .2 Provide a list of spare parts which would be expected to be required over a period of five years under normal conditions. At the Contract Administrator's request, provide a price for the listed parts.

**3. EXECUTION**

**3.1 Manufacturer's Representative**

- .1 To ensure the equipment is installed, operated, and maintained in accordance with the manufacturer's recommended procedures, arrange for a technically qualified manufacturer's representative to witness the installation Work, certify correct installation, train operating and maintenance staff, and undertake system testing.

**3.2 Installation**

- .1 Ensure the equipment is installed as required to provide satisfactory service.
- .2 Instruct installer in the methods and precautions to be followed in the installation of the equipment.
- .3 Cooperate with the installer to fulfill the requirements for a successful installation.

**3.3 Testing**

- .1 Ensure the equipment, including all component parts, operates as intended.
- .2 Cooperate with the installer to fulfill the requirements for successful testing of the equipment.

**3.4 Commissioning**

- .1 Attend during commissioning of the process system which includes the equipment specified in this section and to ensure the equipment functions as intended in the process system.

**END OF SECTION**