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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | November 16, 2009 | Modified ‘Related Sections’ |
| 3 | August 22, 2014 | First draft review (AV) |
| 4 | June 8, 2015 | Second Draft for Review (AV) |
| **5** | **September 16, 2015** | **Updated, Finalized Specification – Reference eDOCS #5823604-v5 (AV)** |
| 6 | May 26, 2017 | Updated references to standards ASME Boiler and Pressure Vessel Code (BPVC) 2017, TSSA Boilers and Pressure Vessel Regulation (O. Reg. 220/01), ASTM A568/A568M-15, ASME B16.11-2016, ASME B31.1-2016, ICS 1-2000 (R2005, R2008, R2015), NEMA 250-2014, Added Section 1.9 Approvals **(AAM)** |
| 7 | August 17, 2017 | Updated listed products. Those that were removed were replaced with performance specifications and standards.(CPD PMO, OMM) |

NOTE:

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# GEneral

## Summary

### Work of this section includes:

#### Hydro-pneumatic surge tanks for pressure zones.

#### Oil-free compressors, compressed air filters, and connecting compressed air piping and valving to control potable water levels inside the tanks.

#### All internal compressor interconnecting piping and appurtenances required to furnish a fully operational surge system for the pumping station suitable for potable water applications.

#### All controls and monitoring systems required to produce a fully operational surge control system as specified in the Contract Documents.

#### *[Consultant to create an alternate specification for other or non-hydro-pneumatic surge tanks as approved by the Region]*

## Related Sections

### *[Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.*

### *Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.*

### *Contractor is responsible for coordination of the Work.*

### *This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the section for the specific project it may be deleted.]*

### *[List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### [List Sections specifying products installed but not supplied under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### [List Sections specifying related requirements.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

#### Section 01300 – Submittals

#### Section 01430 – Operation and Maintenance Data

#### Section 01810 – Equipment Testing and Facility Commissioning

#### Section 03100 – Concrete Forms and Accessories.

#### Section 05500 – Metal Fabrications General

#### Section 05501 – Metal Fabrications Architectural

#### Section 05510 – Metal Fabrications Architectural

#### Section 09900 – Painting and Protective Coatings

#### Section 15080 – Process Piping Insulation.

#### Section 15200 – Process Piping and Fittings

#### Section 15205 – Process Valves and Operators

#### Section 16220 – Motors: 1 to 200 kW, 575V

## References

*[Delete .1 if Section 01060 – Regulatory Requirements is included in Contract Documents.]*

### Comply with the latest edition of the following statutes, codes, standards and all amendments thereto:

#### American Society of Mechanical Engineers (ASME)

##### ASME Boiler and Pressure Vessel Code (BPVC) 2017 edition

#### Canadian Standards Association

##### CSA B51-14, Boiler, Pressure Vessel, and Pressure Piping Code

##### CSA W59-13, Welded Steel Construction (metal arc welding)

#### Technical Standards and Safety Act, 2000

##### Boilers and Pressure Vessel Regulation (O. Reg. 220/01)

#### American Society for Testing Materials (ASTM)

##### ASTM A568/A568M-15, Standard Specification for Steel, Sheet, Carbon, Structural and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements. For SA-516-70 type steel for Hot-Rolled Carbon Sheet Steel

#### American Society of Mechanical Engineers (ASME)

##### ASME B16.5-2013, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard.

##### ASME B16.11-2016, Forged Fittings, Socket-Welding and Threaded. ASME B31.1-2016, Power Piping.

#### National Electrical Manufacturers Association (NEMA):

##### ICS 1-2000 (R2005, R2008, R2015), Industrial Control and Systems: General Requirements.

##### NEMA 250-2014 Enclosures for Electrical Equipment

#### Steel Structures Painting Council (SSPC):

##### SSPC-SP 6/NACE No.3, Commercial Blast Cleaning.

##### SSPC-SP 10/NACE No. 2, Near-White Blast Cleaning.

#### International Organization for Standardization (ISO):

##### ISO 8573-1:2010, Compressed Air – Part 1: Contaminants and Purity Classes

##### ISO 12500:2007, Filters for Compressed Air – Test Methods

## Measurement and Payment

*[Choose one of the following payment language provisions that best suits the individual project.*

*If this Section is not specifically referenced by an item in the Bid Form, please use the following language:*

.1 The work of this Section will not be measured separately for payment. All costs associated with the work of this Section shall be included in the Contract Price.

*OR If this Section is specifically referenced in the Bid Form, use the following language and identify the relevant item in the Bid Form:*

.1 All costs associated with the work of this Section shall be included in the price(s) for Item No(s). \_\_\_ in the Bid Form.

## *If the work of this Section is to be measured and paid for by several different methods, please amend the standard wording given above to reflect the different methods of measurement and payment.*]

## System Description

### High lift pump station serves pressure zone, referred to simply as Zone [ ].*[Consultant to amend as to actual pressure zone designation]*

### A surge control system is required to protect the piping systems within the pumping station and the piping network, which is served by the station, from excessive pressures caused by transients. Transients develop when power failure occurs and during regular operation when pump start-up and shut-down occur.

### The specified surge control system consists of the following components and sub-systems:

#### Zone [ ] *[Consultant to modify as required]:*

##### Surge tank(s), each with a minimum volume of [     ] m3,

##### Maximum and minimum operating pressures are: minus [     ] kPa (equivalent to [     ] m water column) and plus [     ] kPa (equivalent to [     ] m water column)

#### Oil-free air compressor(s), capable of supplying air to the surge tanks with total air flow of [     ] litres per second at a minimum pressure of [     ] bars.

#### Air compressors shall be suitable for potable water applications with no possibility of contamination from oils or other hydrocarbons associated with the equipment.

#### All internal interconnecting compressor piping.

#### A single external skid – mounted piping manifold mounted beside the compressor unit(s). The manifold shall contain one check valve and one manually operated isolation valve downstream of each compressor followed by a common header containing electrically actuated compressed air isolation valves, one for each hydro-pneumatic surge tank. Air filters shall also be included in the skid mounted air train.

#### Other equipment and appurtenances needed to produce a fully operational surge suppression system including tank supports, access hatches, standard flanged piping connections, liquid level sensing devises, all as required.

#### Internal and external protective coating systems for the surge tanks form an integral part of this Section. The coating work shall be executed as specified in Section 09900 – Painting and Protective Coatings.

#### Anti-sweat insulation and protective jacketing for each surge tank.

#### Access hatch or other ingress system, access ladder for each tank.

#### For the larger tanks, provide platforms and stairs as shown on the Drawings.

## Surge Tank Design Requirements

### Design and construct the surge tanks in accordance with the latest edition of the ASME Code for Boiler and Pressure Vessels (2017), CSA B51-14, and the ASME Code for Pressure Piping B31.1-2016. Provide units approved by and complete with all safety devices required by the Technical Standard and Safety Authority (Ontario).

### To minimize plate thickness requirements for the pressure Zone *[Consultant to amend]* tank(s), design and fabricate for 100% joint efficiency.

### Approximate tank dimensions and tank layout are shown on the Contract Drawings. Design and provide tanks meeting the minimum volume requirements for each pressure zone specified in the Contract Documents.

### Design reinforcement as required at openings to ensure that maximum specified wall plate thickness in the Contract Documents for Zone *[Consultant to amend]* tank(s) is not exceeded.

## Submittals

### Action Submittals:

#### Surge tank(s):

##### In accordance with Section 01300 – Submittals.

##### Complete dimensional fabrication drawings of surge tank, accessories, and piping. All drawings to be sealed by a professional engineer licensed to practice in Ontario.

##### Complete piping schematic drawings showing air and liquid piping, and flows directly associated with surge tank.

##### Fabrication drawings of surge control tank panel.

##### Complete electrical elementary diagrams and electrical interconnection diagrams for surge control tank.

##### Complete interior and exterior tank painting systems.

#### Compressor(s):

##### Complete equipment specifications,

##### Layout and installation drawings.

##### Operation and maintenance manuals.

### Informational Submittals:

#### In accordance with Section 01300 – Submittals.

#### Surge Tank(s):

##### Tank manufacturer’s written instructions.

##### Manufacturer’s Certificate of Compliance that tank is certified and stamped in accordance with ASME Boiler and Pressure Vessel Code (2017) Section VIII, Division 1. [Consultant to confirm applicability with new standard]

##### Manufacturer’s Certificate of Proper Installation.

##### Statements of Qualification: Tank welders.

##### Test Reports:

###### Date and time of testing.

###### Description of method of testing, including pumping combinations and pressure records.

###### Description of observed leaks and method and date of repair.

###### Description of catastrophic failures.

#### Compressor(s):

##### Manufacturers equipment specifications,

##### Weights and dimensions,

##### Operational characteristics

##### Information required by Sections 01430 – Operation and Maintenance Data and Section 01810 – Equipment Testing and Facility Commissioning.

## Qualifications

### The design of the tank(s) shall be carried out by a professional engineer, licensed to practice in the Province of Ontario, with specialized experience in the design and construction of pressure vessels in accordance with the applicable Codes and Standards cited in subsection 1.3.1. *[Subsection 1.3.1 to be amended by the Consultant as required]*

### Tank welders shall be CSA certified.

## Approvals

### The Contractor shall be responsible for registering the design of all required parts with the Director in accordance with O.Reg. 220/01, s.4(1). The Contractor must comply fully with all conditions in O.Reg. 220/01.

### All defects identified in accordance with O. Reg. 220/01, s.4 shall be rectified to meet the design pressure limits at no additional cost.

### The Contractor shall be responsible obtaining all required valid certificates of inspection in accordance with O. Reg. 220/01, s.5.

# PRODUCTS

## Surge Tanks

### Physical Data:

#### Pressure Zone[ ]*[Consultant to amend]*:

##### Surge Tank(s), net volume: Minimum of [     ] cubic metres per tank.

##### Configuration: vertical cylindrical shape with elliptical heads.

##### Diameter: Approximately [     ] metres.

##### Side-wall Length: Approximately [     ] metres.

##### Design Pressure: Rated for [     ] bars positive, [     ] bars negative.

##### Design Temperature: [     ] degrees Celsius.

### Attachments:

#### Elliptical Manhole(s): two required, design and fabricate in accordance with ASME Boiler and Pressure Vessel Code (2017), Section VIII, Article D10. Provide one manhole at the top of each tank centred on the top shell and one on each tank near the bottom shell.

#### Nozzles: inlet/outlet nozzles shall be fabricated to the dimensions and details shown on the Drawings.

#### Other openings in tank(s):

##### As shown and in accordance with ASME Boiler and Pressure Vessel Code (2017), Section VIII, Article D6. *[Consultant to confirm reference with updated standard]*

##### Flanged, in accordance with ASME B16.5-2013.

##### Number and type per surge tank:

###### One [     ] mm diameter compressed air inlet nozzle

###### One pressure relief nozzle sized to match safety valve inlet nozzle size and configuration. Safety valve to relieve tank pressure located near the bottom of the tank. Safety valve designed to handle water.

###### One [     ] mm diameter air release valve nozzle.

###### Nozzles sized as required for magnetic liquid level indicators.

###### One [     ] mm drain nozzle at bottom of surge tank

#### Pressure Relief (Safety) Valve:

##### One installed on each tank in accordance with Boiler and Pressure Vessel Code (2017), Section VIII, General Requirements, UG 125 and 126. *[Consultant to confirm reference with updated standard]*

##### Complies with CSA B51-14

##### Minimum design temperature of [ ] degrees Celsius.

#### Tank Support legs: lengths and elevations, including cross bracing as shown for each tank.

#### External lugs shall secure insulation and jacketing. Dimensions and spacing shall suit insulation and jacketing support requirements.

#### Magnetic Liquid Level Sensors:

##### Two per tank as specified in subsection 2.3

### Insulation and Jacketing

#### Insulation: Flexible Polyolefin Foam Pipe Insulation [F.P.F.] minimum 25 mm thick as specified in Section 15080 – Process Piping Insulation. The work is an integral part of this Section.

#### Jacketing: PVC jacketing as specified in Section 15080 – Process Piping Insulation. The work is an integral part of this Section. The jacketing shall have a minimum thickness of 3 mm, or thicker if needed, to provide a neat uniform appearance without bulges and depressions.

### Lifting Lugs: Provide suitably attached for equipment assemblies and components weighing over 50 kg.

### Equipment Identification Plates: Provide 16-gauge stainless steel identification plate securely mounted on each separate equipment component and control panels in a readily visible location. Plate shall bear relevant equipment information in die-stamped block type lettering.

### Anchor Bolts: Supply galvanized anchor bolts, designed by the equipment manufacturer, to be installed under Section 03100 – Concrete Forms and Accessories.

### Provide internal and external protective coatings in accordance with requirements of Section 09900 - Painting and Protective Coatings and as described in the following subsection. The protective coating work forms an integral part of this Section.

#### Zone *[Consultant to amend]* tanks:

##### Interior surfaces: Surface preparation, prime and finish coats in accordance with requirements of Section 09900, 3.7, “Steel and Cast Iron – Submerged; totally or partially submerged in potable water.”

##### Exterior surfaces: Surface preparation, prime and finish coats in accordance with requirements of Section 09900 – Painting and Protective Coatings, 3.7, “Steel Cast Iron; High humidity, moisture, condensation, spray exposure.”

### Access Stairs, Ladders and Platforms:

#### Provide aluminum access stairs, ladders and platforms as indicated in accordance with Section 05500 - Metal Fabrications General and Section 05501 - Metal Fabrications Architectural.

##### Provide and install: aluminum access ladders from floor level at elevation [Consultant to provide appropriate elevations] to the top of the tanks. Provide ladder with safety slide rail.

##### Acceptable Products (for all ladders indicated on the Contract Drawings):

###### MSU Mississauga Ltd.,

[A-8379 aluminum extension with slotted slide rail clamp,

model 3157 spring loaded safety stop,

model 3156 spring loaded safety clip,

model 3158 slide rail coupling of cast aluminum,

model 3162 safety harness,

trolley and safety belt attachment ]

###### *[Consultant to confirm and update model references ]*

###### Approved Equivalent

#### Design, provide and install aluminum open grating platforms with handrails, cantilevered access platform and chained gates as indicated on the Drawings. Provide welded steel supports for the aluminum platforms.

#### For the Zone *[Consultant to amend]* tanks, design, provide and install aluminum open grating type platforms at elevation *[Consultant to provide appropriate elevations]*, spanning from the concrete structure to the side of the tanks.

#### Design, provide and install open grating type stairs from elevation*[Consultant to provide appropriate elevations]* down to elevation *[Consultant to provide appropriate elevations]* as indicated on the Drawings.

#### Stairs shall be cantilevered from the side of the tank. Provide stairs with aluminum handrails and other appurtenances as required and indicated.

#### Aluminum members shall be bolted to steel members with 316 SS bolts and shall be separated from the steel members by neoprene gaskets.

## Compressors

### Provide air supply compressor(s), including electric panel and required controls, with the following features:

#### Operation: Oil lubricated, air cooled rotary screw compressor,

#### Minimum pressure rating: [     ] bars,

#### Mono-skid for compressor and electric panel,

#### Power rating: [     ] kW.

#### Provide filters on the discharge side as required to ensure no risk of contamination of the potable water in the surge tanks. *[Consultant to assess the need for “oil free” compressors so as not to allow for the potential of contamination from oil leakage into the potable water system]*

#### In addition to standard particulate filter and mounted in series with the standard filter, provide two additional filters: 1) a high efficiency coalescing filter that will remove liquid water and aerosol to 0.01 ppm and particles down to 0.01 microns, and 2) an active carbon filter for removal of oil vapours and hydrocarbon odours with a maximum remaining oil content of 0.003 ppm.

#### Mount the filters as part of the skid mounted valve train assembly.

#### Good access for maintenance.

### Equipment Code Conformance: CSA and ASME standards. [Consultant to amend to incorporate cited standards in 1.3.1 and others as required].

### Compressor Type, approved Products:

##### Ingersol Rand plc

##### Atlas Copco Canada Inc.

##### Approved Equivalent

### Electric motor driven, single stage rotary screw with the following features:

#### Capacity: minimum [     ] /sec at [     ] kPag.

#### standard enclosure with [     ] dba sound level.

#### [     ] Kw motor in accordance with Section 16220 – Motors: 1 to 200 kW, 575V.

#### NEMA 4 enclosure.

#### Baseplate.

#### Mounted dryer and filters as specified on the Drawings.

#### Standard efficiency air filter shall be in compliance with ISO 8573-1:2010 and ISO 12500:2007.

#### Power outage restart.

#### One year’s supply of air filters for each filter type and one year’s supply of lubrication oil.

### A single external skid–mounted piping manifold mounted beside the compressor units. The manifold shall contain one check and one manually operated isolation valve downstream of each compressor followed by a common header containing the four electrically actuated compressed air isolation valves for each surge tank. Provide full port ball valves rated for the operating pressure of the compressors, ASME B16.5-2013 flanged, with electric actuators as specified in Section 15205 - Process Valves and Operators, schedule 40 steel piping as specified in Section 15200 - Process Piping and Fittings. The skid mounted piping and valving manifold shall include the air filters specified in the Contract Documents.

## Magnetic Liquid Level Sensor

### Provide and install Pro-Mag magnetic liquid level sensor supplied by ProMag Ltd. or Approved Equivalent, two for each surge tank. Provide a [     ] mm diameter chamber with the following options: *[Consultant to refine options with approval from the Region]* Operating pressure to [     ] kPag.

#### Indicating height of [     ] metres for the [     ] cubic metre tanks, indicating height of [     ] metres for the [     ] cubic metre tanks.

#### Flanged connections to the surge tanks complete with isolation gate valves.

#### Metric graduations.

#### LCD level display transmitter.

#### 4-20 ma transmitter output proportional to liquid height in a 600 ohm load.

### Acceptable alternate manufacturer:

#### *[Consultant to provide a minimum of two additional acceptable manufacturers]*

#### Magnetrol Liquid level indicator

#### Approved Equivalent.

## Fabrication

### Fabricate tank in accordance with ASME Boiler and Pressure Vessel Code (2017), Section VIII.

### Fabricate of welded carbon steel, Grade ASTM SA 516-70 or better.

### Plate Thickness: Determine in accordance with allowable stresses listed in the Code (BVPC) for material, pressure, and temperature specified. To avoid requirements for conducting post-welding stress relief procedures for the field welded Zone *[Consultant to amend]* tanks, maximum plate wall thickness shall not exceed 38.2 mm (1.5 inches).Provide reinforcement as required at openings so that the maximum plate wall thickness is not exceeded.

### Heads: As specified in ASME Boiler and Pressure Vessel Code (2017) , Section VIII, Division 1 *[Consultant to confirm reference with updated standard]*.

### Shell and Head Thicknesses: Include minimum corrosion allowance of 2 mm.

### Fabricate inlet/outlet nozzles as detailed on the Drawings.

### Stamp and certify tank in accordance with ASME Boiler and Pressure Vessel Code (2017), Section VIII, Division 1 *[Consultant to confirm reference with updated standard]*.

### Interior (Submerged) Surface Treatment: Preparation and protective coatings shall be in accordance with Section 09900 – Painting and Protective Coatings, requirements for Steel and Cast Iron, submerged in potable water exposure.

### Exterior Surface Treatment: Preparation and protective coatings shall be in accordance with Section 09900 – Painting and Protective Coatings, requirements for Steel and Cast Iron, high humidity, moisture, condensation exposure.

### Surge tanks for pressure Zone *[Consultant to amend]* shall be shop fabricated. All welding and surface protection treatment shall be completed before transportation to the Site.

### If is expected that the surge tanks for pressure Zone *[Consultant to amend]* are dimensionally too large to be completely shop fabricated. Minimize the extent of field welding by prefabricating the largest possible components that can practicably be transported from the shop to the Site. Shop fabricate tank components for final assembly in place at the Site. Shop bevel edges of components to achieve full plate penetration welds in the field. Pre-assemble components in the shop to ensure proper fit-up at the Site prior to transportation. Coat the prefabricated components with a primer in accordance with the requirements of Section 09900 - Painting and Protective Coatings prior to transportation.

### Fabricate aluminum ladders, stairs and platforms in accordance with Section 05500 - Metal Fabrications General and Section 05501 - Metal Fabrications Architectural.

## Source Quality Control

### Check weld quality by radiography as specified in the referenced Codes and Standards. Where 100% joint efficiency is required, all welds are to be radiographed as specified.

### Hydrostatically test pressure Zone *[Consultant to amend]* tank(s) in shop or in the field after final completion (if large tank) at 1.5 times design pressure for a minimum of 24 hours.

### Repair leaks found during testing prior to painting.

# EXECUTION

## Installation

### General: Install surge tanks as indicated on the Drawings. Coordinate tank installation with inlet/outlet water piping.

### Level tanks and grout supports as specified in Section 03100 - Concrete Forms and Accessories before anchoring.

### Pressure Zone *[Consultant to amend]* Tank(s) (Shop Assembled, Small): Install as indicated on the Drawings. Repair any damage which may have been caused to the protective coating systems during transportation and/or during installation.

### Pressure Zone [*Consultant to amend*] Tank(s) (Field Assembled, Large): Field assemble shop fabricated components in the final location. Coordinate with inlet/outlet piping installation. After initial assembly of components, complete all welding in accordance with the referenced codes and standards. Grind all welds smooth.

### After field assembly of the Zone [*Consultant to amend*] has been completed (in large tank case), finish the coating systems installation as follows:

#### Prepare all interior and exterior surfaces along weld seams and in other areas where the shop-applied primer may have suffered damage, and reapply new primer in accordance with Section 09900 – Painting and Protective Coatings.

#### Apply internal and external coating systems in accordance with Section 09900 – Painting and Protective Coatings.

#### Provide all environmental controls necessary to carry out the coating system installation.

### Assemble Accessories: Make process, control, and electrical connections.

### Make piping connections such that misalignment stresses are not induced in tank nozzles.

### Install insulation and PVC jacketing in accordance with Section 15080 – Process Piping Insulation. Fit insulation and jacketing neatly around protruding appurtenances and other tank fittings. Install jacketing to fit the contours of the tanks and to provide a neat uniform appearance without bulges and depressions.

### Install ladders, platforms and access stairs in accordance with Section 05500 - Metal Fabrications General and Section 05510 - Metal Fabrications Architectural.

## Field Quality Control

### Field Static Test:

#### Hydrostatically test installed surge control tank for 4 hours minimum at 1.5 times design pressure, both positive and negative pressure, before dynamic testing.

#### Repair leaks detected during testing.

### Functional Test:

#### Dynamic Test: Perform in response to flow startup and stoppage.

#### Testing with Multiple Pumps: Increase number of pumps, one at a time. Test to maximum design flow rates and provide a detailed report to the Consultant.

#### Record pressures for the dynamic operation of each pump combination in startup and shutdown of flow.

#### Inspect and test components for alignment, operation, and connection, and performance.

**END OF SECTION**