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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | September 30, 2009 | Review/update of the document “Related Sections” |
| 3 | April 2, 2013 | First Draft – Consolidated Comments Spec Update Project |
| 4 | June 17, 2013 | Finalized for Legal Review. Incorporation of new Commissioning and Computerized Maintenance Management System Data Requirements Specification cross references. |
| 5 | May 27, 2014 | Revised to incorporate Legal Services’ comments |
| 6 | July 15, 2014 | Amended to reflect changes related to commissioning specification and name change (AV) |
| 7 | September 24, 2014 | Updated, Finalized Specification – Reference eDOCS #1029460-v5 (AV) |
| 8 | February 18, 2015 | Updated standards (AV) |
| **9** | **March 2, 2015** | **Updated, Finalized Specification – Legal Reference eDOCS #5043356 v12 (AV)** |
| 10 | March 1, 2017 | Updated for references to NSF 372. (AV) |

NOTE:

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**The on-line copy is the current version of the document.**

# GEneral

## Scope of Work

### The work of this Section covers the supply, delivery, supervision of installation and testing of the fibreglass reinforced plastic tanks and accessories.

### Unit Responsibility: The work requires that the fibreglass reinforced plastic tank, complete with all accessories be the end Product of one responsible system manufacturer or responsible system supplier. Unless otherwise indicated in the Contract Documents, the Contractor shall obtain each system from the supplier of the equipment who will furnish all components and accessories of the system to enhance compatibility, ease of operation and maintenance, and as necessary to place the equipment into operation in conformance with the specified performance, features and functions without altering or modifying the Contractor’s responsibilities under the Contract Documents. The Contractor is responsible to the Region for providing the equipment systems as specified in this Section.

## 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.]*

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

### [List Sections specifying related requirements.]

#### Section 01060 – Regulatory Requirements

#### Section 01300 – Submittals

#### Section 01425 – Computerized Maintenance Management System Data Requirements

#### Section 01600 – Materials and Equipment

#### Section 01640 – Manufacturers’ Services

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

#### Section 05500 – Metal Fabrication General

#### Section 06500 – FRP Products and Fabrications

#### Section 11010 – Equipment General Requirements

#### Section 11530 – Chemical Storage Tanks

#### Section 11601 – Tank Lining Systems

#### Product requirements for ...[item]... for installation under this Section.

## References

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

#### American National Standards Institute (ANSI)

##### ANSI/ASME B16.5-2013, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.

##### ANSI/NSF Standard 61: Drinking Water System Components – Health Effects

##### NSF 372-2011: Drinking Water System Components – Lead Content

#### ASTM International (ASTM):

##### ASTM E84-14, Standard Test Method for Surface Burning Characteristics of Building Materials

##### ASTM C582-09, Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistance Equipment.

##### ASTM D2563-08, Standard Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.

##### ASTM D2583-13a, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impresser.

##### ASTM D2584-11, Standard Test Method for Ignition Loss of Cured Reinforced Resins.

##### ASTM D3299-10, Standard Specification for Filament-Wound Glass Fiber Reinforced Thermoset Resin Corrosion-Resistant Tanks.

##### ASTM D5685-11, Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe Fittings

##### NFPA 255-2000, Standard Method of Test of Surface Burning Characteristics of Building Materials, 2000 Edition.

## Definitions

### FRP: Fibreglass reinforced plastic.

## Standards

### The materials and workmanship employed in the manufacture of all equipment shall conform to the applicable standards established by the following organizations (Canadian standards shall take precedence over American standards in the event of duplication or conflicting requirements):

#### ASTM (C582-09; D2563-08; D2583-13a; D2584-11; D3299-10, E84-14).

#### ANSI/ASME (B16.5-2013), Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.

## Design Requirements

### Design Loads: In accordance with Section 01600 - Material and Equipment.

### Design the tank, including resin selection, wall thickness, methods and locations of support, and stiffener requirements. The design shall be prepared in accordance with the Contract Documents and modified by Consultant approved changes.

## Submittals

### General: Administrative, shop drawings, samples, quality control, and closeout submittals shall conform to the requirements of Section 01300 - Submittals.

### In addition to the requirements of Section 01300 - Submittals, submit the following additional detailed shop drawing information:

#### Fabricator's catalogue information, descriptive literature, specifications, and identification of materials of construction, including complete resin system information.

#### Letter from resin manufacturer stating that selected resin is suitable for intended service and NSF 61 and/or NSF 372-2011 certified for drinking water applications as required.

#### Catalogue information and cuts for all manufactured items, highlighted to show items proposed to be installed.

#### Complete design calculations for tanks, supports, and appropriate accessories, including safety factors used.

#### Tank data indicating equipment number, pressure rating, diameter, straight shell lengths, overall lengths, wall thickness, corrosion barrier thickness, and details of nozzle designs.

#### All dimensions and location of all major elements of the FRP tanks and accessories, critical clearance requirements, and support dimensions requirements.

#### Tank capacity chart indicating litres and cubic metres of volume for each 150 mm (6 inches) of depth, and cumulative total from bottom.

#### Fabricator’s detailed requirements for tank foundations.

#### Recommended bolt torque for bolted FRP connections.

### Samples: Laminate sample representative of production quality of surface finish and visual imperfections.

### Full details of tank maintenance requirements, dimensions, volume, suction piping configuration and other information in an electronic format suitable for upload to the Region’s CMMS (Maximo). Refer to Section 01430 Operation and Maintenance Data and to Section 01425 - Computerized Maintenance Management System Data Requirements.

### Quality Control Submittals: In addition to the requirements of Section 01300 - Submittals, provide the following quality control information:

#### Fabricator’s Certificate of Compliance with fabrication requirements for each tank.

#### Qualifications of fabricator’s Quality Assurance Supervisor.

#### Copy of fabricator’s Quality Assurance Program.

#### Quality Assurance Inspection:

##### Qualifications of an independent FRP Quality Assurance Inspector.

##### Initial QA Inspection Report.

##### Certification of Factory Acceptance Testing.

#### Manufacturer’s Certificate of Proper Installation in accordance with Section 01640 - Manufacturers’ Services.

## Quality Assurance

### Fabricator’s Quality Assurance Supervisor: Minimum of five years of experience in the fabrication of fibreglass structures.

### Designer: Registered professional engineer licensed to practice in the Province of Ontario.

### Independent FRP Quality Assurance Inspector:

#### Minimum five years of experience as an FRP inspector.

#### Representing a corporately and financially independent organization which can function as an unbiased inspection authority and is otherwise satisfactory to the Region.

#### Professionally independent of manufacturers, suppliers, and installers of the systems being inspected.

## Delivery, Storage, and Handling

### In accordance with Section 01600 - Material and Equipment. In addition, prepare and protect tank for shipment as follows:

#### Mount the tank on padded cradles if shipped horizontally or on a suitable skid if shipped vertically.

#### Protect flanged nozzles with wooden blinds bolted to flange and having a diameter of 50 mm (2 inches) greater than outside diameter of flange.

#### Provide either rigid plugs inside ends to prevent deflection or wooden boxes for un-flanged components. Brace the open end of thank tank with a suitable stiffening member in order to prevent deflection.

#### Do not ship components or other pieces loose inside the tank.

#### Load the tank with at least 50 mm (2 inches) of clearance between the tank (including fittings) and bulkheads, or the bed of the vehicle.

#### Regardless of the mode of transportation, firmly fasten and pad components in order to prevent the shifting of the load or flexing of components while in transit.

## Sequencing and Scheduling

### Do not ship the tank from the factory to the Site until the Consultant has reviewed and approved the Certification of Factory Acceptance Testing.

## 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.]*

# PRODUCTS

## Supplements

### Some specific requirements related to this Section are attached as supplements at the end of the Section.

## Service Conditions

### [Operating Pressure: Atmospheric.]

### [Indoor or outdoor]

## Manufacturers

### All equipment provided under this Section shall be provided and modified as required to conform to the performance, functions, features, and materials of construction specified in this Section.

### Acceptable manufacturers of the FRP tanks and accessories specified in this Section are as follows:

#### *[Consultant to provide list of three acceptable Manufacturers and Products.]*

#### Approved Equivalent.

## Materials

### Filament Wound: Fabricate in accordance with Type I (filament-wound), Grade 1 (epoxy-resin) refer to ASTM D5685-11.

### Tank material shall be suitable for actual location of installation, for example: if the tank is to be located outside of a building, suitable protection from sunlight and temperature ranges to be incorporated into the design.

### Resin:

#### Shall be suitable for intended service.

#### Liner Resin: Premium grade and corrosion resistant, such as chlorendic polyester, vinyl ester, or bisphenol A fumarate polyester (for non-drinking water equipment) or other approved compounds for use in drinking water treatment.

#### Use same resin throughout entire tank structural layer.

#### Add ultraviolet absorbers to surfacing resin in order to improve weather resistance.

#### No dyes, pigments, or colorants, except in exterior gel coat.

#### No fillers or thixotropic agents.

#### Additives may be added to achieve fire retardancy. The Flame-spread rating of finish laminate shall be less than 25, as determined by ASTM E84-14. Additives shall not be added to interior layer, unless specifically required.

#### Curing System:

##### As recommended by the resin manufacturer or as specified in this Section.

##### Apply the colour coat after the inspection of laminate has been completed.

##### Cure all products to a minimum of 90 percent of the minimum Barcol hardness specified by the resin manufacturer.

##### Measure Barcol hardness in accordance with ASTM D2583-13a.

#### Post-cure the tank and appurtenances in accordance with the resin manufacturer’s recommendation for time and temperature. Post curing should be completed with warm to hot dry air, free of combustion products. Hot spots shall be avoided.

#### For hypochlorite service, no methyl ethyl ketone peroxide (MEKP) cobalt catalyst system shall be allowed in liner. Cure the liner with benzoyl peroxide dimethyl aniline. The structural layer may be cured with either catalyst system.

#### Storage tanks shall be fully compatible with the type of chemicals being stored in such tanks and in accordance with the more stringent requirements for drinking water applications as required by NSF 60 and/or 61 and/or NSF 372 as applicable. Reinforcement:

#### Veil: Chemical surfacing mat, 12 to 16 mm thick per layer, with a finish and a binder compatible with the lay up resin. Provide double layers of Nexus™ as a chemical resistant veil.

#### Interior Layer: A resin-rich interior surface ranging from 100 mils to 120 mils using a chopped strand mat backing the veil. Use no additive in the corrosion barrier.

#### Chopped Strand Mat: Type E glass, minimum 1.5 ounces per square foot, with silane finish and styrene soluble binder.

#### Continuous roving used in chopper gun for spray up: Type E glass.

#### Woven Roving: Type E glass, nominal 24 ounces per square yard, 4 by 5 weave, with silane type finish.

#### Continuous roving used for filament winding: Type E glass with a silane type finish, with a yield of a minimum of 110 strand yards per pound.

### Laminate:

#### Reinforce inner surface with a resin-rich surfacing veil ranging from 10 mm to 20 mm in thickness.

#### The resin content of the inner surface shall be minimum of 80 percent by weight.

#### Construct the interior layer of resin reinforced with at least two plies of chopped strand mat. The thickness of the interior layer shall be a minimum of 100 mm.

#### The glass content of the combined inner surface and interior layer shall be 27 percent plus or minus 5 percent.

#### The exterior or structural layer shall be filament wound. Filament winding shall be with continuous strand roving to provide a glass content of 60 to 80 percent.

#### Marking:

##### Identify each tank with the fabricator's name, capacity in litres, maximum temperature, design pressure/vacuum, specific gravity, pH, resin, minimum thickness, vessel numbers, vessel name, and date of manufacture.

##### Provide permanent marking. Seal decals, labels, etc., into the laminate exterior with clear resin.

##### Incorporate a placard bearing frame into the tank structure or surface that allows easy signage changes.

### Nozzles:

#### Finish the nozzles flush with the inside surface of tank, unless otherwise indicated in the Contract Documents.

#### Gaskets:

##### Provide two [     ] mm ([     ] inch) thick full face elastomeric material gaskets per nozzle, having a hardness of Shore A60 plus or minus 5.

##### Material shall be suitable for intended service.

#### Flanged Nozzles: Rated at [     ] kPa ([     ] psi), with other dimensions and bolting corresponding to ANSI B16.5-2013 for [     ] kg ([     ] pound) steel flanges.

#### Back face of flanges shall be spot faced, flat and parallel to flange face of sufficient diameter to accept standard SAE flat metal washers under bolt head or nut.

#### Nozzles shall have a minimum [     ] mm ([     ] inch) projection as measured from the face of the flange to the shell.

#### Nozzle orientation and locations shall be detailed in the Contract Documents. The final locations will be determined by the Consultant during shop drawing review.

## Appurtenances

### Supports:

#### Pipe Supports:

##### Provide for all tank overflow pipes, internal down comer and recirculation pipes.

##### Spacing of supports shall be as recommended by fabricator, but shall not be greater than [     ] m ([     ] feet) on centre.

##### Shall allow for the isolation and removal of the pipe.

##### FRP complete with necessary bolts, nuts, and washers.

##### Exposed pipes and valves shall be guarded and marked

#### Level Probe Supports: FRP.

### Platforms, Ladders, Handrails, and Kick plates:

#### Material: FRP as specified in Section 06500 - Fibreglass Reinforced Plastic Products and Fabrications.

#### Fasteners: Type 316 stainless steel.

### Lifting Lugs: Provide suitably attached for tanks weighing over 45 kilograms (100 pounds).

### Anchor Bolts: Type 316 stainless steel bolts, sized by the fabricator, and 12mm (1/2 inch) minimum in diameter and as specified in Section 05500 - Metal Fabrications General.

### Tank Insulation and Heat Tracing.

#### Apply heat tracing, insulation, and reinforced resin coat after inspection of tank laminate is complete. Ensure all aspects are suitable for actual conditions at location of installation including UV protection for outdoor applications.

#### Mount the heating panel to the tank in accordance with the manufacturer’s instructions. Heat tracing shall be a complete system, including the heat panel, control thermostat, and installation kit.

#### Cover electrical heat tracing panel around exterior using 50mm (2 inches) of polyurethane foam, 100 mm layer of resin and chopped fibreglass strand, and exterior pigmented gel coat.

#### Insulated Tank: The U factor at the tank wall and top shall not be more than [ ] kilojoules per hour (and [ ] Btu per hour) per foot per degree Celsius (and degrees Fahrenheit).

#### Operate from 115 volt, 60 Hz, single phase ac with the necessary thermostats and temperature controls.

#### Manufacturers and Products:

##### [Consultant to provide additional list of three acceptable Manufacturers and Products.]

##### Approved Equivalent.

### Top Surface: The top surface of all tanks shall be provided with a full cover, finished with a non-slip surface created by a heavy sprinkling of sand into the surface of the final surface resin coating.

## Source Quality Control

### Independent FRP Testing Inspector:

#### The Contractor shall ensure that the independent FRP Testing Inspector will be present at the point of manufacture at the time the fabrication is started, to perform the following:

##### Observe manufacturing methods, machinery, and techniques to assure compliance with general industry standards relating to all aspects of FRP tanks and these Specifications.

##### Observe the initial fabrication to verify compliance with these Specifications.

##### Observe quality control methods for mixing resins and the testing of completed equipment.

##### Generally observe the quality of other ongoing fabrication.

##### Prepare the Initial QA Inspection Report.

#### The Contractor shall ensure that the Independent FRP Testing Inspector will be present at the point of manufacture, upon completion of fabrication and prior to shipment, to perform or witness the following:

##### Visual inspection in accordance with the requirements of ASTM D2563-08.

##### Barcol Hardness measurements in accordance with ASTM D2583-13a.

##### Acetone sensitivity test for internal secondary bonds.

##### Glass content by ignition loss on three cutouts in accordance with ASTM D2584-11.

##### Hydrostatic Leak Test: .1 Perform on each tank. .2 Fill to top nozzle; allow to stand for two hours with no visible leakage.

#### Prior to beginning repair work, repairs deemed acceptable by the Independent FRP Testing Inspector shall be approved by the Consultant.

### Identify and retain all cutouts. The Consultant may select certain cutouts for testing for physical properties of laminate.

### Factory Test Reports: Certify results, by signature, of the following:

#### Inspections.

#### Results of hydrostatic testing.

#### Test reports of physical properties of standard laminates.

# EXECUTION

## Installation

### In accordance with the fabricator’s written instructions.

### Accurately place anchor bolts using the templates furnished by fabricator and as specified in Section 05500 - Metal Fabrications General.

## Field Quality Control

### Functional Test:

#### Conduct testing on each tank.

#### Conduct the hydrostatic leak test with a tank full of clean water. Allow water to stand for 24 hours to verify no leakage.

#### Provide written confirmation or conduct a further hydrostatic test utilizing the same chemical to be stored in the tank (acknowledging the specific gravity of the chemical may be significantly more than that of water).

#### If the hydrostatic test is with the actual chemical, the Contractor shall be responsible for spill management (in the event of a leak or failure) and/or transferring the chemical to alternate locations.

#### Commissioning activities shall be performed in accordance with Section 01810 – Equipment Testing and Facility Commissioning.

## Manufacturer’s Services

### The Contractor shall ensure that the fabricator’s representative will attend at Site in accordance with Section 01640 - Manufacturers’ Services, and Section 01810 - Equipment Testing and Facility Commissioning for installation assistance, inspection, and certification of proper installation.

## Supplements

### The supplements listed below, attached following “End of Section”, form part of this Section: *[Consultant to provide the data sheets and insert types of data sheets in the list below]*

#### Tank Data Sheets:

##### [     ]

##### [     ]

##### [     ]

##### [     ]

##### [     ]

**END OF SECTION**