1. SCOPE

a. This equipment specification describes the **minimum technical requirements** for the design and installation of fluorosilicic acid injection equipment used in a water fluoridation system. For a specific fluorosilicic acid system, this specification shall be used in conjunction with the project specifications, data sheets, and project drawings for that system. The owner/operator of the public water system shall submit, in writing, any requested exceptions to the requirements of this specification for resolution by the Texas Fluoridation Project Engineer.

b. This specification details the minimum requirements of the fluoridation system for fluorosilicic acid injection systems that use bulk storage or carboy/drum storage. Vendors, suppliers, and contractors shall be selected from the approved vendor's list and approved equipment components list that are attached and made part of the DSHS contract documents. The owner/operator of the public water system shall submit, in writing, any requested exceptions to the lists of approved vendors, suppliers, contractors, or equipment components for review and approval by the Texas Fluoridation Project Engineer prior to their proposed use.

c. The owner/operator of the public water system shall be responsible for the final design, procurement, construction, assembly, inspection, and testing of the fluoridation system in accordance with the minimum technical requirements of this specification and the attachments of the DSHS contract listed herein.

d. If an existing fluoridation system is upgraded then the requirements applicable to the major equipment item being replaced or added, as new equipment, shall be in accordance with this specification.

2. APPLICABLE DOCUMENTS

a. The public water system owner, contractor, and equipment supplier and/or manufacturer shall consider and apply the most recent issue of the applicable standards and codes issued by the following associations and approval bodies as part of this specification.

- Uniform Building Code (UBC)
- Standard Building Code (SBC)
- Uniform Plumbing Code (UPC); Southern Standard Plumbing Code; National Standard Plumbing Code
- National Fire Protection Association (NFPA), NFPA 70 National Electrical Code
- United States Department of Labor - Occupational Safety and Health Administration (OSHA) CFR Part 1910

- American Water Works Association (AWWA), Water Fluoridation Principles and Practices, Manual M4
- ANSI/AWWA Standard for Hydrofluosilicic Acid, B703-00
- Morbidity and Mortality Weekly Report (MMWR), Engineering and Administrative Recommendations for Water Fluoridation, 1995, U.S. CDC, September 29, 1995/Vol. 44/No. RR-13
- ANSI/ASME B31 Piping Code
- ANSI Z358.1-2003 American National Standard for Emergency Eyewash and Shower Equipment
- Title 30, Part I, Texas Administrative Code (TAC), Chapter 290, Subchapter D, Rules and Regulations for Public Water Systems

b. Applicable General Specifications

- GS10.01-1 Bulk Storage Tank

c. Drawings

- Process and Instrumentation Diagrams (P&ID) specified in the Scope-of-Work applicable to that installation or upgrade project.
- T2-99004 DSHS Fluoride Tee (2-inch) for Day Tank Fill/Vent and Chemical Pump Suction Line Detail
- T2-99005 DSHS Fluoride Tee (1-1/2-inch) for Chemical Pump Suction Line and Bypass Detail

3. REQUIREMENTS

3.1 Item Definition.

3.1.1 General

a. The fluorosilicic acid system stores, pumps, and injects fluorosilicic acid into piping systems in public water systems at the volumes and pressures required by the project specifications or data sheets.

b. The fluorosilicic acid system includes the following major equipment items (MEI), components and appurtenances.

- Bulk storage tank and/or carboy/drum storage (MEI)
- Fluorosilicic acid transfer pump in the bulk tank or drum storage (MEI)
- Fluorosilicic acid day tank (MEI)
- Scale for day tank weight measurement (MEI)
- Fluorosilicic acid chemical metering injection pump (MEI)

- Piping, tubing, and valves
- Wiring
- Instrumentation
- Secondary containment systems
- Safety equipment
- Test equipment
- Foundations and enclosures (as required)

3.1.2 High point vents: High point vents are valved piping outlets located at high points in piping and equipment for operation, maintenance or testing.

3.1.3 Low point drains: Low point drains are valved piping outlets located at low points in piping and equipment for operation, maintenance or testing.

3.2 Characteristics.

3.2.1 Performance

a. The fluorosilicic acid system shall be designed for continuous service.
b. The system shall be sized and rated to provide the maximum and minimum injection pressures over the full range of specified injection rates.
c. Injection pump accuracy shall be plus or minus 1 percent between 10 and 100 percent of the rated flow rate.

3.2.2 Physical characteristics.

a. In systems with bulk storage tanks, the tank size and height conforms to the physical size limitations and availability of the acid transfer pump.
b. Secondary containment systems shall be used to contain uncontrolled releases of fluorosilicic acid during operations and maintenance activities.
c. Personnel protection equipment such as gloves, jackets, goggles, and face shields, etc. shall be provided at all times for the safe handling of fluorosilicic acid.

3.2.3 Maintainability.

a. The fluorosilicic acid system shall be designed and constructed for ease of maintenance, repair, and modifications to the system components.
b. Adequate space shall be provided for access to and maintenance of all system components without removing any major assembly.

3.3 Design and Construction.

3.3.1 General.

a. The system shall be designed and orientated to facilitate interconnection with the water system at the point where the fluorosilicic acid is introduced into the water treatment process.
b. The system shall be supplied complete with any support structures, piping, valves, safety equipment, and any other features necessary to ensure safe operation. Placing the system into service shall only require connection to external electrical circuits and designating the point at which the fluorosilicic acid is introduced into the water treatment process.
c. The bulk storage tank shall be set on a suitable concrete foundation designed for the soil conditions, wind loading, and other environmental factors unique to that water treatment facility.

3.3.2 Materials.

a. Construction materials shall be in accordance with the General Specifications (GS), the approved equipment component list, approved list of vendors, data sheets, and process and instrumentation diagrams (P&ID) associated with the project, and shall be suitable for the intended chemical service and environmental conditions.
b. All metallic components wetted by the fluorosilicic acid shall be of Hastelloy-C 276, Carpenter 400, or Monel 400 Series material. Non-wetted metallic components shall be of Type 304 or Type 316SS material.
c. The lining of the double-walled tanks must be certified by American National Standards Institute(ANSI) /National Sanitation Foundation International (NSF) Standard 61.

3.3.3 Bulk Storage Tank (when specified on process and instrumentation diagram).

a. The bulk storage tank shall be an ASTM D 1998 Type 1 tank constructed of virgin high-density cross-linkable polyethylene per GS10.01-1.
b. The bulk storage tank shall be designed and oriented to facilitate interconnection with other equipment and piping associated with the fluoridation system.
c. The bulk storage tank shall be supplied complete with a ladder, work platform, landing, handrails, any support structures, piping, tank fittings, safety features, and other features necessary to ensure safe operation.
d. The bulk storage tank shall be placed on a smooth concrete pad or foundation.
e. The tank shall have the capacity stated on the data sheet and process and instrumentation diagram.
f. The bulk storage tank shall have, at a minimum, the following appurtenances and accessories.

- Fill, transfer pump, pressure/vacuum vent connections as specified on the tank data sheet.
- Level transmitter connection
- 24, 19, 10 or 7 inch Manway

- Secondary containment tank drain connection

g. All appurtenances and fittings installed in the inner tank shall be through the closed dome top only. The outer containment shell shall contain only one bulkhead fitting with drain valve located as low as possible to the knuckle radius of the outer tank.
h. The double-walled bulk tanks must have a level that identifies the tank's contents, and a device that indicates the amount of chemical remaining in the tank per 30 TAC §290.42(f)(1)(C).

3.3.4 Polyethylene Carboys/Drums, (when specified on the process and instrumentation diagram as the form of bulk storage).

a. Closed-Head polyethylene drums meeting DOT regulations shall be equipped with two bung outlets, (1) 2 inch NPT and (1) 2 inch buttress opening with 3/4 inch NPT center reducer.
b. A vent connection tie-in shall be provided at the 3/4 inch NPT center reducer of the 2-inch buttress connection to the fluoridation system external vent.
c. A suitable fluorosilicic acid transfer drum pump shall be installed in the 2-inch NPT opening.
d. The carboy/drum shall be placed on the secondary containment drum storage pallet using suitable material handling equipment with a capacity of 110% of the carboy/drum.
e. The carboy storage drums must have a level that identifies the tank's contents, and a device that indicates the amount of chemical remaining in the tank per 30 TAC §290.42(f)(1)(C).

3.3.5 Bulk Storage Tank Fluorosilicic Acid Transfer Pump and Motor.

3.3.5.1 Transfer Pump.

a. Unless otherwise specified, the transfer pump shall be of the tube style vertical seal less centrifugal pump with axial flow type prop impeller.
Hastelloy C and PTFE components to operate submerged in fluorosilicic acid. The tubeset shall be of polypropylene construction with a diameter of 1.875 inches or 1.625 inches depending on the pump manufacturer.

3.3.5.2 Motor Driver.

a. Motor shall be single-phase, 60-Hertz, totally enclosed, fan cooled, and (TEFC) induction motor.
b. The motor shall be splash proof and supplied with a corrosion resistant coating suitable for corrosive environments.
c. Motor shall have a built-in overload protection switch.
d. Motor rating shall exceed the maximum expected pump horsepower requirements including losses.

3.3.6 Carboy/Drum Fluorosilicic Acid Transfer Pump.

3.3.6.1 Hand Pump.

a. The body and shaft of hand pumps shall be of PVC, PVDF, or high-density polyethylene construction.
b. Valves and seals shall be of Teflon and/or Viton suitable for fluorosilicic acid service.
c. Transfer hose shall be of polyethylene construction and connected to the fluorosilicic acid system day tank using suitable stainless steel hose clamps.

3.3.6.2 Motor Driven Drum Pump.

a. Electric motor driven drum and container pumps used for the transfer of fluorosilicic acid shall be supplied in accordance with Sections 3.3.5.1 and 3.3.5.2.

3.3.7 Day Tank

a. The double-walled day tanks as well as the carboy storage drums, must have a level that identifies the tank's contents, and a device that indicates the amount of chemical remaining in the tank per 30 TAC §290.42(f)(1)(C).
b. The double-walled day tanks must be sized for a one-day supply in order to prevent over-feeding. If a double-walled day tank is proposed to hold more than a one-day supply, additional information will be required for submittal when the PWS submits their notification to the TCEQ PRT.
c. Only natural color double-walled day tanks will be used so that if there is any leak from the inner tank, it can easily be seen through the outer tank.
d. The outer containment tank of the double-walled day tank shall have no more than one appurtenance. The only allowed appurtenance is for the installation of a chemical resistance drain valve. If a drain is installed, the appurtenance shall be located as close to the vertical walls bottom as feasible without compromising the integrity of the outer containment tank.

3.3.7.1 Closed Head Day Tanks, 60-Gallon and Larger

a. Closed-head molded day tanks shall be of cross-linked or high-density linear polyethylene construction and consist of a tank with a 5-inch to 10-inch threaded lid, non-vented with gasket, and straight bulkhead fittings for equipment connections from the top only. **No side penetrations are permitted.** Tank capacity shall be as specified per the project drawings and equipment specifications. Tank color shall be natural or translucent.
b. The capacity of the tank for each nominal outside diameter tank size shall vary as a function of height up to a maximum overall height of 42 inches.
c. The day tank top shall be equipped with a 1-inch tank fill connection for acid transfer, a 1-1/2 inch pump suction/pump relief tubing with tee installation, per standard

drawing **T2-99004,** for each process chemical injection pump, and (1) 1-inch connection installation for tank vent.

d. The day tanks shall be of double containment type construction or the day tank shall be set in a suitable open top tank with a capacity of at least 110% of the capacity of the day tank. Day tanks shall always be set on a scale that is used to record the daily usage of fluoride.
e. The foot valve of the pump suction supply tube, with tube straighteners, shall be installed 1-inch from the bottom of the day tank, and no more than 3 days of acid shall be present in the tank. The amount stored in the day tank shall vary with seasonal usage such that it contains the 3-day maximum during a period. If tank stability problems are noted, then the suction tube can be shortened and the same 3-day maximum of acid shall be supplied above the foot valve, which is above some quantity of acid in the tank added for stability. The shortened suction tube effectively limits the amount of acid available for injection.

3.3.7.2 Closed Head Drums/Carboys, 15-Gallon to 55-Gallon,

e. Closed-Head polyethylene drums meeting DOT regulations shall be equipped with two bung outlets, (1) 2 inch NPT and (1) 2 inch buttress opening with 3/4 inch NPT center reducer. Tank capacity shall be as specified per the project drawings and equipment specifications. Tank color shall be natural or translucent.
f. A tank connection tie-in shall be provided at the 3/4 inch NPT center reducer of the 2-inch buttress opening.
g. The day tank shall be placed on the scale, shall be set in an open top containment tank and placed on the scale.
h. The 2-inch NPT opening drum bung shall be replaced with the fluorosilicic acid pump suction/tank vent/ and pump relief tubing installation per standard drawing **T2-99004**.
i. The foot valve and tube straightener of the pump suction supply tube shall be installed at the bottom of the day tank and no more than 3 days of acid shall be present in the tank. If tank stability problems are noted, then the suction tube can be shortened and the same 3-day maximum of acid shall be supplied above the foot valve, which is above some quantity of acid in the tank added for stability. The shortened suction tube effectively limits the amount of acid available for injection.

3.3.8 Scale.

a. The scale shall be of the platform hydraulic/electronic type suitable for industrial and commercial duty.
b. Platform hydraulic/electronic type scale capacity shall be 400 to 2000 lbs. with analog or digital display shall be in 0.1 lb. or 2.0 lb. increments with an accuracy of +/- 4 ounces or +/- 8 ounces.

3.3.9 Fluorosilicic Acid Chemical Injection-Metering Pump

a. Unless otherwise specified by the process and instrumentation diagrams (P&ID) the fluorosilicic acid chemical injection-metering pump shall be a positive displacement electronic solenoid type diaphragm-metering pump or a peristaltic type metering pump.

3.3.9.1 Electronic Solenoid Type Diaphragm-Metering Pump

a. The metering pump should be sized to feed fluoride near the midpoint of its operating range. The pump should be sized to operate 30% to 70% of capacity.
b. The pump capacity should be limited to a maximum adjusted fluoride level of 2 mg/l when calculated for the annual average water production rate.
c. The pump volume shall be adjustable while in operation from zero to maximum capacity.
d. Unless otherwise specified, the capacity adjustment shall be by readily accessible dial type knobs, one for changing the pump stroke length and the other for changing the stroke frequency. Both knobs shall be located opposite of the fluid end. On-off switch shall be integral with the frequency control knob.
e. The pump drive shall be totally enclosed with no moving parts. The solid-state electronic pulser shall be fully encapsulated with no exposed circuits. The pump electronics shall be housed in a splash proof chemical resistant housing.
f. The pump shall stop pulsating when the discharge pressure exceeds 35% of the pressure rating.
g. Materials of construction:
    - Head and Fittings: Acrylic/PVDF
    - Ball type check valves: PTFE/Teflon
    - Diaphragm: Hypalon
    - Check valve: Hypalon
h. Unless otherwise specified, each pump shall be supplied with a 4-Function Valve, or approved equal, that provides 1) positive diaphragm-type anti-siphon, 2) 20 PSI continuous backpressure, 3) line depressurization/priming, and 4) pressure relief.

3.3.9.2 Electric Peristaltic Type Metering Pump

a. The peristaltic metering pump should be sized to feed fluoride near the lower end of its operating range. The pump should be sized to operate 10% to 40% of capacity.
b. The pump capacity should be limited to a maximum adjusted fluoride level of 2 mg/l when calculated for the annual average water production rate.
c. The pump shall be scalable to the maximum plant capacity.
d. The pump tubing and fittings shall be compatible with 23% to 25% fluorosilicic acid.

3.3.10 Piping.

3.3.10.1 General.

a. Piping and valves shall be constructed of non-metallic components unless otherwise specified by the project specifications or project drawings.
b. Piping and tubing shall be firmly fixed in a neat and orderly arrangement and shall not obstruct access for maintenance, operation, or adjustment of any equipment as shown on the process and instrumentation diagrams (P&ID).
c. Supports shall be designed and positioned to provide maximum protection against mechanical impact, vibration, or maintenance.
d. Plastic piping and tubing shall be stored, handled, and joined in accordance with the instructions and procedures of the pipe or tubing manufacturer.
e. Piping and double containment pipe systems located overhead of common work areas and/or worker egress areas such as walkways, doorways, stairways, etc. shall utilize metallic piping components suitable for wetting by fluorosilicic acid per Section 3.3.2 or be encased by a metal jacket. Non-metallic piping and double containment pipe systems may be incased by a carbon or stainless steel pipe jacket in straight runs that provide safe egress. Metallic piping or jackets shall be used to provide personnel protection in the event of fire and to provide mechanical guarding of non-metallic components in overhead locations.
f. Removable fabricated metal mechanical guards shall be used on non-metallic piping systems to cover tubing, valves, piping components, and piping that is not incased by a secondary containment line wherever it is subject to mechanical damage by impact at locations exposed to personnel or could present an environmental hazard. This requirement does not apply at the discharge manifold of the metering pumps unless operating conditions warrant mechanical guarding. Transitions from below ground to above ground shall be mechanically guarded if piping or piping components are subject to mechanical damage by impact at locations exposed to personnel or present an environmental hazard.

3.3.10.2 Vents and Drains.

a. Low point connections, each with a valve, shall be located at low spots in piping to facilitate flushing and draining. Valved drain connections shall be installed on equipment or piping that is not self-draining.
b. High point vent connections, each with a valve, shall be located at high spots where gas or vapor may be trapped to vent accumulations and to facilitate flushing and draining operations.
c. Day tank and drum/carboy vent lines shall be installed with sufficient slope and placement to freely drain back into the tank without forming a liquid seal.
d. Vent and drain connections operated only during shutdown or maintenance operations shall be provided with a suitable plug or blank.

3.3.11 Ladders, Cages, Stairs, and Handrails.

3.3.11.1 General

a. Design, fabrication, and erection of ladders, cages, stairs, and handrails for bulk storage tanks shall be in accordance with applicable OSHA and ASTM requirements, project specifications, and the following additional requirements.
b. Stairways or ladders shall be self-supporting.
c. The top of the stairway or ladder landing shall be 30 inches below the elevation of the top of the outer containment tank shell if no runway or manway exists; else the top of the landing shall be 30 inches below the tank runway elevation with man way.
d. Treads: All steel and fiberglass stairs shall have treads made of grating. All treads shall have an even distinctive leading edge with nosing of a non-slip design. Nosing shall extend 1/2 to 1 inch over the leading edge of a tread.
e. The greatest rise height within any flight of stairs shall not exceed the smallest by more than 3/8-inch, (provide uniform rise height between treads). This requirement includes rise height between top or bottom tread and platform, floor, or landing.
f. Clear Pathway: A 2 ft. - 6 in. minimum width is required for egress stairway and ladder stiles.
g. Bottom Landing: A 2 ft. – 6 in. X 2ft. – 6 in. minimum landing area is required at the base of a stairway or ladder.
h. Top Landing/Tank Platform: A 3 ft. – 6 in. X 3 ft. – 6 in. minimum landing/tank platform is required at the top of a stairway or ladder where access to the top of a tank is required for maintenance operations. The platform profile adjacent to the tank shall conform to the radius of the tank.
i. Unless otherwise specified, the rise/run combination shall be 7-3/4 in. rise height/9-3/4 in. tread run (38 degrees – 29 minutes).
j. Ladders, cages, stairs, and handrails shall be fabricated from either hot-dipped galvanized steel in accordance with ASTM A123, Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip or fabricated from hot-dipped galvanized steel with fiberglass grating components, or fabricated using structural members and grating of fiberglass construction, or fabricated from steel that is sandblasted to near white and painted with an acid resistant two part epoxy coating system.

3.3.12 Electrical Control of Chemical Injection Metering Pumps

3.3.12.1 General

a. The fluoride chemical injection-metering pump shall be electrically interlocked, in series, with the ground source water well or water treatment plant (WTP) control circuit such that the fluoride metering pump cannot operate unless water is being produced.

Typical well or water treatment plant control systems include the following:

a) Ground source water well pump motor control,
b) Ground source water well flow control valve with actuator position detection circuit for artesian flow control,
c) Raw water service pump(s) control circuit at a water treatment plant,

d) WTP raw water inlet control valve actuator position detection circuit,
e) A flow meter with flow controller or flow meter with intelligent control (PLC or SCADA) that detects a minimum flow condition on ground source water well or detects the flow of raw water supply to a surface water WTP.

In all cases, the metering pump shall be electrically interlocked to inject fluorosilicic acid only when the well or water treatment plant control system indicates that water is being produced for treatment.

b. Unless otherwise specified, all ground water sources produced by artificial lift (pump) or by artesian flow that have a dedicated fluorosilicic acid chemical injection-metering pump shall have a secondary flow-based electrical interlocked control circuit in addition to the requirements listed in 3.3.12.1a. The secondary interlock shall be electrically wired, in series, to detect/verify the flow of water before the metering pump operates. Allowed flow detection techniques include the following: a) thermal or paddle type flow switch, b) pressure actuated switch (mounted downstream of any block valves and check valves on the discharge of a pump), or c) a flow meter with flow controller or flow meter with intelligent control (PLC or SCADA) that detects a minimum flow condition. An exception to this requirement may be granted for those installations where the ground water source discharges into an above ground storage tank/clearwell. Ground water sources discharging directly into a public water supply distribution system shall have a secondary flow-based electrical interlock.

c. It shall be physically impossible to plug a fluoride chemical injection-metering pump into any continuously active ("hot") electrical outlet. If the metering pump is not hardwired directly into the electrical circuit providing interlock protection to the well or service pump, then the metering pump shall be equipped with a **special**, clearly labeled plug (6-15P or 6-20P) that is compatible only with a special outlet (6-15R and/or 6-20R) on a dedicated interlocked electrical control circuit. Note that a 6-20R receptacle accepts either a 6-15P or 6-20P plug, and that a 6-15R receptacle accepts only a 6-15P plug.

3.3.12.2 Power Supply Requirements for Chemical Injection-Metering Pumps

a. Fluoridation systems with **two or less** metering pumps shall provide an enclosure, each with one single gang plug outlet receptacle (socket) for connection of the metering pump power plug with one two-position selector switch and one momentary contact push button. This installation is typical of systems with one fluorosilicic acid injection point where one pump is used for injection service with one 100% spare pump, or no spare pump. The outlet and switches shall be installed in a NEMA 12 enclosure. A NEMA approved drip proof cover shall be supplied over the socket receptacle outlet for installations subject to rain exposure, drips, or water splash. One outlet shall be designated as the "interlock protected circuit", with power to that socket controlled by a heavy-duty two-position selector switch (ON/OFF). The

"interlock protected circuit" shall be hardwired directly to the dedicated electrical interlock circuit used for metering pump control specified in Section 3.3.12.1. The other receptacle outlet shall be designated as the "test circuit" with power to that socket controlled only by depressing a momentary contact pushbutton. The test circuit outlet receptacle shall not be capable of being supplied with continuously active power or "hot"; to power the test circuit requires the momentary contact button to be depressed by the operator.

b. Fluoridation systems with **three or more** metering pumps shall provide an enclosure, each with one single gang receptacle socket outlet for connection of the metering pump power plug with one two-position selector switch and one momentary contact push button **for each pump that is used to continuously inject fluorosilicic acid**. The spare pump does not require a dedicated enclosure. The power supply cord for each spare pump shall be of sufficient length to plug into the interlock controlled power supply circuit of the "failed" metering pump. The installation of each dedicated power supply enclosure shall be in accordance with the requirements of Section 3.3.12.2.a.

c. Electrical wiring and installation inside the control panel shall conform to the requirements of NFPA 70, National Electric Code (NEC).

d. Internal panel wiring shall be installed by the control panel vendor.

e. Switches (operator interfaces) and push buttons shall meet the requirements for NEMA A600 heavy-duty oil-tight switches. Rating for all switch components: 600 VAC, 10 Ampere continuous rating. Panel mounted devices such as switches, lamps, and push buttons shall be waterproof, dust-tight, and corrosion resistant.
Push button: Momentary contact, size: 25-mm; 1inch diameter flush mount; color: red; legend plate: black with white letters, markings: Push to Run; contact block shall be fitted with a minimum of 1-normally open and one normally closed spare contact.
Selector Switch: Contact maintained, non-illuminated; size: 30-mm; color: black; selector position: left-contact open (OFF), right-contact closed (ON); knob type: standard or extended flag (gloved hand); legend plate: black with white letters, markings: Off-On, size: 2-1/4 inch square.

3.3.12.3 Receptacles

a. Outdoor receptacles shall be mounted 2 feet above the operating floor or platform. Indoor convenience receptacles shall be mounted 18 inches above the floor.
b. One duplex 120-volt, 60-Hertz convenience receptacle shall be provided for maintenance purposes within 5 feet of the control panel.
c. Receptacles that supply power for portable hand power tools or are outdoor receptacles shall have ground fault interrupters for personnel safety.

3.3.12.4 Pull-Points

a. Pull-points shall be installed so that no conduit run or secondary containment-piping run has more than four 90-degree bends, or four equivalent 90-degree bends.
b. If conduit runs exceed the equivalent of a 200 –foot straight run or contain more than the equivalent of three 90-degree bends, then pull fittings and junction boxes or other suitable approved techniques shall be provided to reduce pulling forces. One 90-degree bend shall be considered equivalent to 50 feet of straight run pipe or conduit.

3.3.13 Workmanship.

a. Workmanship by the Contractor shall be in accordance with Equipment Specification ES-1, General Specification GS10.01-1, applicable project drawings, and DSHS approved vendor drawings where applicable.
b. Unless otherwise specified, the Contractor shall comply with all applicable industry standards except where applicable project specifications and drawings define tolerances, procedures, processes or other requirements that exceed the industry standard.
c. The Contractor shall comply with all published manufacturer's instructions or documentation in full detail, including each in-step process or procedure sequence specified or recommended by the manufacturer of the component or equipment item.
d. Any conflicts or discrepancies among the specifications or procedures shall be defined in writing by the Contractor whom shall then notify the Texas Fluoridation Project (TFP) Engineer in writing of a conflict for resolution by the TFP prior to installation, fabrication, and/or construction.

3.3.14 Identification and Marking

a. A nameplate of phenolic, stainless steel, or other approved material shall identify each identifiable major equipment item. The nameplate shall be secured to the equipment item by stainless steel screws, stainless steel rivets, or by use of a suitable adhesive compatible with the equipment item's materials of construction.
b. Name plates shall be embossed with the following information, as applicable:
    - Equipment item
    - Equipment item tag number
    - Size
    - Pressure rating
    - Temperature rating
c. Instrumentation shall have phenolic or stainless steel tags permanently attached with stainless steel wire, screws, or rivets, or by use of a suitable adhesive compatible with the equipment item's materials of construction.
d. Chemical transfer lines shall be color coded in accordance with 30 TAC Part 1 Chapter 290.42.

3.4 Fluoridation System Technical Requirements

a. The fluoride chemical injection pump shall be wired electrically in series with a main well pump, service pump, or other approved plant control system such that it cannot operate unless water is being produced (interlocked).
b. Unless otherwise specified, a flow switch, pressure switch, or other approved flow-based secondary interlock device shall be provided as back-up protection in water systems serving less than 500 people. The device shall be electrically interlocked to the metering pump to provide secondary flow-based control.
c. Fluoride injection should occur where all of the water to be treated water passes; however, fluoride should not be injected where substantial losses of fluoride can occur such as downstream of chlorine injection points.
d. Fluoride injection into a water line should be located in the lower third of the pipe and the injection quill shall extend a minimum of one-third of the pipe's diameter into the pipe.
e. A corporation stop valve with safety chain shall be used at the fluoride injection point when injected into a line under pressure.
f. A drop out piping spool with isolation valves shall be provided at injection points in a pressured line to allow for the maintenance and inspection of anti-siphon devices and to remove fluoride injection quills.
g. A minimum of two anti-siphon devices shall be installed on all fluoride metering pumps. One valve shall be located at the fluoride injection point and the other at the metering pump head on the discharge side or as a separate anti-siphon device in the discharge line immediately downstream of the chemical metering pump. Each anti-siphon device shall have a diaphragm that is spring-loaded in the closed position.
h. The pump shall always be mounted above the day tank using only top penetration suction tubing. A fluoride solenoid chemical metering pump shall not be mounted more than 5 feet higher than the lowest normal liquid level in the day tank. **Flooded suction supply lines shall not be used to feed a fluoride chemical injection pump.**
i. The solenoid metering pump should be sized to feed fluoride near the midpoint of its operating range. The pump should be sized to operate 30% to 70% of capacity.
j. The peristaltic metering pump shall be sized to feed the fluorosilicic acid near the lower end of its operating range. The pump should be sized to operate 10% to 40% of capacity.
k. The pump capacity should be limited to a maximum adjusted fluoride level of 2 mg/l when calculated for the annual average water production rate.
l. Priming valves on fluoride metering pumps shall be spring-loaded.
m. A spare pump **does not** have to be supplied or installed for each size of metering pump used to inject fluorosilicic acid.
n. In line mixers or small mixing tanks shall be installed in the finished water line if the first customer is less than or equal to 100 feet from the fluoride injection point **and** if there is no storage tank located in the line before the water reaches the first customer.
o. A master meter on the main water service line must be provided on systems adding fluoride.

p. Fluoride feed lines shall be color coded, when practical, or clearly marked with tags or signage. Pipe that is color-coded shall be painted light blue with red bands in accordance with the Uniform Plumbing Code. The word "fluoride" and the direction of flow shall be painted on the pipe or affixed to the pipe with a label
q. All hose connections within reach of fluoride feed equipment shall be provided with hose bib type vacuum breakers.
r. All fluorosilicic acid shall conform to AWWA standard B-703.
s. Fluorosilicic acid shall not be diluted prior to injection.
t. No more than a 7-day supply of fluorosilicic acid should be connected at any time to the suction side of a chemical metering pump. All bulk storage tanks with more than a 3-day supply shall have a day tank. A day tank should only contain a small amount of acid, usually a 1 to 3 day supply. The public water supply owner/operator shall seasonally adjust the volume of acid available in the day tank to be pumped to meet the 3-day limit criteria.
u. Day tanks shall be located on scales; daily weights shall be measured and recorded.
v. Day tanks and carboys/drums shall be **completely** sealed and vented to the outside. Note that the vent for fluorosilicic acid shall be located high since the vapors produced are lighter than air.
w. Bulk storage tanks and day tanks shall be provided with secondary containment.
x. Fluorosilicic acid piping or tubing on the discharge of the chemical metering pump shall have secondary containment, except at the connection to the injection point and at the chemical injection pump.
y. Per 30 TAC 290.42(d) (13) (A), the fluoride feed lines shall be color coded in white with yellow bands for surface water treatment plants.

3.5 Precedence of specifications, standards, and codes.

a. Texas Department of State Health Services (DSHS) and grantee project specifications, equipment specifications (ES), drawings (in combination with applicable detail specifications and data sheets), approved list of vendors, and approved equipment component lists take precedence over all other specifications, standards, and codes.
b. Texas Department of State Health Services and grantee general specifications (GS) take precedence over all other specifications, standards, and codes except DSHS and grantee project specifications and drawings.
c. Appropriate standards, codes, and practices of the associations and approval bodies listed in section 2 of the DSHS general specifications shall apply in cases not covered by the DSHS general specifications or DSHS drawings.
d. DSHS specifications take precedence over grantee specifications unless reviewed and approved in writing by the Texas Fluoridation Project Engineer.
e. Any conflicts or discrepancies among the documents listed in a, b, c, or d above shall be called to the attention of the Texas Fluoridation Project Engineer for resolution prior to purchase, design, fabrication, or construction.

4. QUALITY ASSURANCE PROVISIONS

4.1 Tank tests and Inspections.

a. The tank manufacturer shall hydrotest each tank used in the assembly of the double containment tank. The minimum holding time for the water test shall be 12 hours after the filling height is reached.
b. The Contractor shall inspect tanks immediately upon delivery to the site. If damaged, then the Contractor shall notify the tank supplier, tank owner/grantee, and the Texas Fluoridation Project Engineer at once. The bottom of the bulk storage tank shall be visually inspected 100% for any damage. All tank fittings shall be 100 % inspected for tightness and physical damage.
c. Contractor shall not install damaged tanks until repairs are made in accordance with the tank manufacturer's instructions after approval of the repair procedure by the project engineer.
d. Contractor shall hydrotest the installed tank using potable water filled to the top of the straight wall section of the inner tank. The minimum holding time for the water test shall be 12 hours after the filling height is reached. Leaks shall be repaired in accordance with approved repair procedures. The Contractor shall remove all hydrotest water from the tank after completion of the test.

4.2 Piping hydrotest.

a. All piping and tubing operating at greater than atmospheric pressure shall be hydrotested prior to the introduction of fluorosilicic acid.
b. Any leaks shall be repaired by the Contractor and re-tested prior to commissioning the system.