

**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 11241 - Chlorination System**  
**(On-site Sodium Hypochlorite Generation System)**

**C O N T E N T S**

<b>PART 1 - GENERAL</b> .....	<b>1</b>
1.01 Scope.....	1
1.02 Scope of Work.....	1
1.03 General Operational Description.....	2
1.04 Submittals.....	2
<b>PART 2 - PRODUCTS</b> .....	<b>2</b>
2.01 General.....	2
2.02 Sodium Hypochlorite Generator (Electrolyzer).....	3
2.03 Control Panel.....	3
2.04 Rectifier.....	4
2.05 Sodium Hypochlorite Storage Tank.....	4
2.06 Brine Tank.....	4
2.07 Water Softener.....	4
2.08 Sodium Hypochlorite Dosing Pumps.....	5
2.09 Circular Chart Recorder.....	6
2.10 Equipment Anchorage.....	7
2.11 Hydrogen Dilution and Flow Sensor.....	7
<b>PART 3 - EXECUTION</b> .....	<b>7</b>
3.01 General.....	7
3.02 Instruction.....	8



**SECTION 11241  
CHLORINATION SYSTEM  
(ON-SITE SODIUM HYPOCHLORITE GENERATION SYSTEM)**

**PART 1 - GENERAL**

1.01 SCOPE

Contractor shall furnish and install on-site chlorination system as specified herein. Chlorination system shall consist of on-site sodium hypochlorite generation system equipment as shown on the Drawings and as specified herein, including all accessories and controls necessary for a complete and operable chlorination system. The on-site chlorine generation system shall be as manufactured by Clor-Tec.

1.02 SCOPE OF WORK

Work specified shall include manufacturing, furnishing, installing, startup, and testing of all equipment necessary to provide a complete on-site sodium hypochlorite generating system suitable for disinfection of potable water.

Contractor shall provide the services of a qualified manufacturer's representative to install, inspect, startup, calibrate, and provide equipment and operator training to Owner's personnel.

On-site sodium hypochlorite generation system equipment furnished and installed for this project shall include, but not be limited to, the following items:

<u>Quantity</u>	<u>Equipment</u>
1	Water softener system
1	Brine storage tank and appurtenances
1	Control Panel with Allen Bradley SLC 5/04 PLC
1	Sodium hypochlorite generator (Electrolyzer)
1	Rectifier
1	Sodium hypochlorite storage tank and appurtenances
1	Chlorine Analyzer
1	Circular Chart Recorder
2	Sodium hypochlorite dosing pumps with variable frequency drives

### 1.03 GENERAL OPERATIONAL DESCRIPTION

The on-site sodium hypochlorite generator system shall be capable of a continuous production of sodium hypochlorite from salt, water and electricity. Supply water shall pass through the water softener and provide water for the salt saturator and make-up water for brine dilution. Saturated brine solution water shall mix with make-up water to form a brine solution which shall enter the Hydrochlorite generator (Electrolyzer) which shall convert the brine solution to a consistent 0.8% solution of sodium hypochlorite and hydrogen gas, with the addition of a DC current.

Sodium hypochlorite solution shall be stored in the storage tank as shown on the Drawings. Dosing pumps shall draw off the storage tank and inject sodium hypochlorite into the well discharge piping water at the location shown on the Drawings.

### 1.04 SUBMITTALS

#### A. General

The Contractor shall prepare and submit complete and organized shop drawings as specified herein and as required by the General Conditions Section F, Special Conditions and shall include, but not be limited to the following:

1. Detailed specifications, fabrication, assembly, dimensions, materials of construction, performance characteristics, and installation instructions for all equipment provided.
2. On-site sodium hypochlorite generator system equipment drawings, specifications, wiring diagrams, conduit routing plans, and installation instructions.
3. Equipment Seismic Design, calculations (including equipment anchorage) for the water softener, chlorine solution storage tank, brine tank, rectifier, and sodium hypochlorite generator.
4. Operation and Maintenance Manuals for each item of equipment specified herein.

## **PART 2 - PRODUCTS**

### 2.01 GENERAL

On-site sodium hypochlorite generator system equipment shall be furnished with all features and accessories necessary to provide sodium hypochlorite generating, metering, storage, injecting, and dosing as shown on the Drawings and specified herein.

## 2.02 SODIUM HYPOCHLORITE GENERATOR (ELECTROLYZER)

Electrolyzer shall be capable of generating an equivalent of 50 lbs. of chlorine gas per day of sodium hypochlorite solution at 0.8% strength. Electrolyzer shall utilize only softened water, DC power, and brine solution. Electrolyzer brine proportioning system shall consist of fill controls, peristaltic pump, flow meters, mixing panel, calibration tube, and appurtenances to automatically deliver a consistent brine solution to the Electrolyzer. The Electrolyzer shall start and stop based on level in the sodium hypochlorite tank. Electrolyzer shall be suitable for floor mounting and shall not consume more than the following:

- Water            15.0 gallons per pound of equivalent chlorine
- Salt              3.5 lbs. per pound of equivalent chlorine
- Power            2.5 kW-hr DC per pound of equivalent chlorine

## 2.03 CONTROL PANEL

The system control panel shall be fully capable of automatic control of the sodium hypochlorite generating system and be provided with an Allen Bradley Model SLC 5/04 programmable controller with operation interface. All controls shall be housed in a minimum NEMA 12 A304 stainless steel enclosure, suitable for wall mounting. Panel shall have alarms for high and low temperature, low cell level, and shall shut down generation system under these conditions and close a dry contact for "common alarm" to the telemetry panel. Control shall be capable of operating on 120/220 volts single phase power. Panel shall receive 4-20 MA signals from the following:

- A. Effluent chlorine residual analyzer
- B. Well discharge piping flow meter, total flow rate
- C. Sodium hypochlorite storage tank level

The controls shall provide the following functions:

- A. Start/Stop of the chlorine generation system based on level in the chlorine solution tank.
- B. Start/Stop of chlorine dosing pumps and adjustment of speed based on preset residual set point for plant effluent and closed contact from the telemetry system for pump to system operation. Said contact shall open when well pump to waste operation thereby stopping dosing operations.
- C. Residual analyzer calibration and display with corrected/proportional output 4-20 MA signal.

## Chlorination System

### Section 11241 – 4

D. Alarms with LCD displayed descriptions and output to the telemetry system:

1. Chlorine generator system fail
2. Low chlorine storage tank level
3. High chlorine residual
4. Low chlorine residual

E. Level control of the brine tank.

#### 2.04 RECTIFIER

Rectifier shall be capable of receiving 460 volt, 3 phase, 60 HZ power and converting power to DC current with sufficient capacity to drive the conversion of brine solution to sodium hypochlorite and hydrogen gas. Unit shall be suitable for floor mounting and shall be controlled by the Control Panel.

#### 2.05 SODIUM HYPOCHLORITE STORAGE TANK

Sodium hypochlorite storage tank shall be constructed of high density cross linked polyethylene construction suitable for storage of sodium hypochlorite. Tank shall have a minimum capacity of 800 gallons, equipped with a 4" top mounted flanged outlet with 4" vent to the outside of the building. 4" top mounted flanged outlet with blind flange for future forced ventilation fan (located 180° from 4" vent outlet), 2" flanged outlet fill pipe at top of tank, 1" outlet at bottom of tank, 2" flanged top outlet for level transmitter, and any other connection necessary for a complete system. Tank shall be furnished with cables for seismic anchorage, complete with floor anchor system.

#### 2.06 BRINE TANK

The brine tank shall consist of a heavy-duty plastic tank (minimum 250 gallons, maximum 48" tall) with lid, screened manifold flanged 2" water inlet, 1/2" NpT outlet, overflow drain, and 1" drain tank. Tank shall be adequately secured to the floor to prevent movement during a seismic event and be provided with floor restraints.

#### 2.07 WATER SOFTENER

Water softener shall be of the twin tank design, provided to remove calcium, magnesium, iron, and manganese to acceptable levels for the softened water to be used in the system. Water softener shall be an ion exchange system, as manufactured by Eversoft.

Water softener shall be provided with two sets of earthquake restraint chains mounted to metal building framing. Said chains shall be provided and installed at 1/3 points of softener canisters.

Chlorination equipment subcontractor shall coordinate with metal building manufacturer to provide adequate framing details for restraint chain mounting to building.

## 2.08 SODIUM HYPOCHLORITE DOSING PUMPS

### A. General

The chemical metering pump(s) shall be positive displacement, hydraulic type pump, driven by an electrical motor with hydraulic actuation of the diaphragm. The pump shall self-prime with 10 feet of water suction lift. Stroke length adjustment shall be controlled manually by a micrometer type adjuster with a scale indicating 2.0% length adjustment increments.

The motor shall be 1/2 HP, 230 volt, 3 phase, variable speed, single phase, constant speed, 175 to 1750 RPM, TEFC. The pump(s) shall be capable of operating against the maximum pressure of 150 psi. Once primed, the metering pump(s) shall operate with a minimum of 10 foot of water suction lift. Pump materials shall be PVDF with teflon diaphragm. Metering pump(s) and appurtenances shall be furnished by a single supplier to assure uniformity, compatibility and system responsibility. Chemical metering pump(s) shall be as manufactured by Alldos, Model KM254 and be suitable for the following:

1. Maximum discharge pressure = 150 psi
2. Liquid pumped = 1 percent sodium hypochlorite
3. pH = 8 – 9
4. Specific gravity = 1 to 1.3
5. Temperature range = 40 to 100 degrees F
6. Quantity = two, one duty and one standby
7. Flow rate = 32.2 gallons per hour, maximum output

### B. Appurtenances

#### General

Chlorination System  
Section 11241 – 6

Contractor shall furnish appurtenances as specified herein or shown on the drawings, to provide a complete and operable system. Where materials of construction are not specified, the manufacturer shall furnish materials compatible with the intended service condition and shall submit supporting data as required.

The following appurtenances shall be provided

1. Brine tank water fill automatic valve and level switch to be controlled by the Control Panel.
2. Flowline ultrasonic level transmitter to be mounted on the chlorine solution storage tank with power supply from control panel.
3. Back pressure valve for dosage pump as manufactured by Griffco Valve, Inc. as follows:

Furnish backpressure valve on the discharge side of each pump to maintain a constant backpressure to aid in accurate metering of the pump. Valve shall be adjustable from 5 psig to 150 psig and set per the manufacturer's recommendation for the actual operating conditions of the system.

4. Effluent chlorine total residual analyzer and controller for pacing dosage pumps including 499ACL chlorine probes, 1054 BCL chlorine analyzer, and inline sensor housing, as manufactured by Rosemount Analytical.
5. Solution injector, Capital Controls, Model 111-1 with corp. stop for injection of chlorine into the discharge header and for effluent sample.
6. Variable Frequency Drives (VFD) (two) for dosage pumps rated 1/2 HP, 220 volt, single phase, 60 HZ, Model AF-300 Micro Saver II, G.E./Fuji Electric.

Each VFD shall be provided with control to receive a 4-20 MA signal to vary output for variable speed control of the dosage pump.

## 2.09 CIRCULAR CHART RECORDER

### A. General

Circular chart recorder shall be 10", two pen, seven day, recorder with repeatability of 0.25% and dead band of 0.20% of span. Recorder shall be surface mount type with standard door and operate at 120 VAC, 60 HZ. System shall use disposal cartridge type inking. Multiple pen recorders shall be provided with multiple colors. Recorder shall accept 4-20 mA DC signal input from the metering and analyzing system equipment. The recorder shall simultaneously record water flow rate (gpm) and total chlorine



residual (0-10 mg/L range). Recorder shall be ABB Instrumentation Commander 1900, Bristol Series 4330, Foxboro Series 40P, or equal. Recorders shall be calibrated to the transmitter range specified.

#### 2.10 EQUIPMENT ANCHORAGE

The Contractor shall provide Type 316 Stainless Steel Epoxy equipment anchorage in accordance with Equipment Seismic Design Calculations per Section 1.04, Submittals, herein.

#### 2.11 HYDROGEN DILUTION AND FLOW SENSOR

- A. The hydrogen dilution system shall dilute the hydrogen concentration to below 25% of LEL or 1% by volume.
- B. The hydrogen dilution blowers shall generate a minimum flow of 80 SCFM.
- C. The hydrogen dilution system design shall incorporate the following safety features:
  - 1. Blower current sensing
  - 2. Air flow switch positioned in the dilution ductwork
  - 3. Differential pressure switch positioned in the dilution ductwork vent stack
  - 4. Software controlled safety interlocks to detect control system sequence failure

Hydrogen dilution system shall be wall mounted adjacent to the chlorine storage tank and system ductwork shall be connected to the specified vent stack with PVC piping.

### **PART 3 - EXECUTION**

#### 3.01 GENERAL

The on-site sodium hypochlorite generator system equipment shall be installed and tested as shown on the Drawings and specified herein:

- A. The Contractor shall arrange to have the manufacturer/supplier of the equipment specified in this Section furnish the services of competent factory-trained personnel to provide the installation and start up of all equipment. Allowance for this service shall be included by the manufacturer in the price of his equipment. Installation and erection of all assemblies and components shall be in accordance with the details indicated on the Drawings, approved shop drawings, and the printed instruction of the manufacturer.

Chlorination System  
Section 11241 – 8

- B. After installation, the systems shall be put through all operations in the presence of the Owner. Visual inspection will be made for proper installation, operation, alignment, and lubrication. Manufacturer shall provide a certificate stating installation is satisfactory.

3.02 INSTRUCTION

After the equipment has been installed, tested, and adjusted, and placed in satisfactory operating condition, the equipment manufacturer shall provide classroom instruction to Owner's operating personnel in the use and maintenance of the equipment. Contractor shall give the Owner formal written notice of the proposed instruction period at least two weeks prior to commencement of the instruction period. Scheduled training shall be at a time mutually acceptable to the Owner and the manufacturer. During this instruction period, the manufacturer shall answer any questions from the operating personnel. The minimum instruction period shall be as specified in Section SC 21, Special Conditions - Special Provisions and as long as necessary to address details of operation, routine maintenance, repair, and special equipment features.

**END OF SECTION 11241**