# SECTION 11281 - CHLORINATION EQUIPMENT

## City of San Diego, CWP Guidelines

## PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes providing chlorine and chlorine solution handling equipment with controls, valves, piping, gages, switches, regulators, strainers, [tanks,] [air pad system,] safety devices, fittings, adaptors and accessories.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK:

1. Section 11260 Chemical Feeding Equipment, General
[2. Section 14600 Hoists and Cranes, General]
[3. Section 14605 Electric Monorail Systems]
[4. Section 15159 Rotameters]

1.3 SPECIFICATIONS AND STANDARDS

A. The WORK of the Section shall comply with applicable standards in the following:

1. Chlorine Institute, Inc.

1.4 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment**: An authorized service representative of the manufacturer shall visit the site for not less than [ ] days each for a minimum of two trips: one at the start of installation and the other at the time of field testing and startup.

## PART 2 -- PRODUCTS

2.1 GENERAL

A. Equipment shall be designed and constructed for continuous operation in a corrosive chlorine environment. Except as otherwise indicated, equipment and components of the chlorination system shall be as per recommendation of Chlorine Institute, Inc. and shall be the product of a single manufacturer.

2.2 SCHEDULE OF EQUIPMENT

A. **Major Equipment:** The WORK of this Section includes the following major equipment items:

| Quantity | | Equipment | Equipment Numbers |
|---|---|---|---|
| [ ] | - | chlorine feeders | [ ] |
| [ ] | - | standby pressure relief valve | [ ] |
| [ ] | - | [automatic switchover] vacuum regulator check units | [ ] |
| [ ] | - | electric chlorine evaporators | [ ] |
| [ ] | - | residual chlorine analyzers with recorders | [ ] |
| [ ] | - | chlorine gas leak detectors | [ ] |
| [ ] | - | chlorine gas injectors | [ ] |
| [ ] | - | chlorine solution distributor with flow meters | [ ] |
| [ ] | - | chlorine solution diffusers | [ ] |
| [ ] | - | chlorine scales or load cells | [ ] |

B. **Supplemental Equipment:** The WORK includes the following supplemental equipment items:

[ ] - Sets of 1-ton chlorine container connections including captive yoke type auxiliary container valves, flexible connections, and captive yoke type header valves, to connect to the chlorine manifolds.

[ ] - Chlorine expansion chamber assemblies conforming to the Chlorine Institute Drawing 136 Alternate B, including expansion chamber, flanged safety head with 400 psi rupture disc, chlorine pressure switch and alarm actuator.

[ ] - Chlorine pressure gauges, 0-200 psi, with 500 psi over-pressure protection, complete with header valve, union nut, and adapter, to connect to the chlorine header line.

[ ] - Chlorine vacuum gauges, 0-30 in Hg, with 500 psi over-pressure protection, complete with header valve, union nut, and adapter, to connect to the chlorine line.

[ ] - Chlorine gas filters.

[ ] - [ ] ppd chlorine vacuum regulator check unit and shut-off valves, with electric operator to reduce chlorine pressure to below atmospheric pressure and automatically shut-off the valve upon low temperature contact from the evaporator or loss of vacuum signal from the high/low vacuum switch. The unit shall include an integral regulator failure alarm switch.

[ ] - Chlorine gas pressure switches with header valves, union nuts, and adapters, to connect to the chlorine gas manifold, to activate a remote low pressure alarm signal.

[ ] - Chlorine gas high/low vacuum (0-30 in Hg) switch with header valves, union nuts, and adapters, to connect to the chlorine gas manifold, to activate a remote low vacuum alarm signal.

1 - Set of 1-inch chlorine line valves.

[ ] - Rotameters for chlorine [gas] [solution]

1 - Set of PVC diaphragm valves for throttling above rotameters.

1 - [Bulk storage chlorine emergency kit "C",] [1-ton container chlorine emergency kit "B".]

2 - Self-contained air breathing gas masks, with a 30-minute air supply, and fully encapsulated protective suits as required by OSHA, equipped with a NEMA 12 weatherproof FRP cabinet for wall-mounting outside the chlorine area.

1 - Safety chain and locking device anchorage system for all stored chlorine cylinders.

## 2.3 CHLORINE FEEDERS

A. **Control and Capacity:** Chlorine feeder capacities and control shall comply with the following:

1. Equipment No. [ ]

| | |
|---|---|
| Point of chlorination: | - [ ] |
| Control: | - [ ] |
| Chlorinator capacity: | |
| Stage I - lb/day | - [ ] |
| Ultimately - lb/day | - [ ] |
| Module: lb | - [ ] |

B. **Design:** The chlorine feeders shall be equipped with an electric motor actuated control valve, and an automatic flow proportional control, with a capacity range of 20:1 and manual dosage control. The chlorine feeder units shall contain, inside their cases, all working parts such as differential vacuum regulating valve, vacuum relief valve, meter for dosage rate (scaled in lbs/day of $Cl_2$), panel front-mounted supply vacuum and injector vacuum gauges, and panel front variable orifice control for manual dosage rate adjustment. These parts shall be visible from outside the unit either from the front or back, and shall be readily accessible.

C. **Feed and Safety Design:** Chlorine feeders shall be designed so that the chlorine gas shall be continuously fed under less than atmospheric pressure from the time that it passes the [automatic switchover] vacuum regulator check unit mounted at the [chlorine cylinder(s)] [evaporators] until it is absorbed in water at the injector. If the water supply to the injector should fail, or if the vacuum is not maintained, the chlorine vacuum regulator check unit shall

close automatically. Provisions shall be made for limiting the vacuum with the chlorine feeder in order to prevent back siphoning of water into the metering equipment.

D. **Materials:** Surfaces of parts in contact with chlorine gas in the presence of moisture shall be constructed of materials which are resistant to moist chlorine. The chlorine feeder case shall be constructed of fiberglass or similar chlorine corrosion-resistant material for [floor mounting] [wall mounting].

2.4 [AUTOMATIC SWITCHOVER VACUUM REGULATOR CHECK UNITS] [VACUUMREGULATOR CHECK UNIT] AND STANDBY PRESSURE RELIEF VALVE

$# _____

NTS: Specifier must select one of the following two paragraphs.

_____ #$

[A. Automatic switchover vacuum regulator check units shall be provided on [the manifold of each of the two banks of chlorine cylinders] [on each of the two chlorine cylinders.] The automatic switchover vacuum regulator check units shall convert chlorine gas to less than atmospheric pressure for use by the chlorinators. The automatic switchover vacuum regulator check units shall work in tandem whereby [one bank of cylinders] [one cylinder] is on line while the second is on standby. When the on-line supply is exhausted, the automatic valves shall switch positions and the standby supply shall be placed on-line. The system shall allow for manual gas shut-off, and contain integral drip leg heaters, liquid chlorine drip legs, and gas traps and filters.]

[A. A vacuum regulator check unit shall be provided on [the manifold of each bank of chlorine cylinders] [on each chlorine cylinder] [at each evaporator]. The vacuum regulator check unit shall convert chlorine to a less than atmospheric pressure state for use by the chlorinators.]

B. A standby pressure relief valve shall be located immediately downstream of the [automatic switchover vacuum regulator check units] [vacuum regulator check units]. In the event of a malfunction of the [automatic switchover] vacuum regulator check unit[s], the standby pressure relief valve shall vent chlorine via a vent pipe to a safe location outside of the building.

2.5 CHLORINE FEEDER CONTROL

A. Each chlorine feeder shall be automatically controlled by a 4-20 Ma electrical signal from the [ ] flow meter. Each chlorine feeder shall include a controller-positioner to convert the input signal to a mechanical movement to vary the orifice position, changing the dosage rate, and be compatible with the incoming flow signal. The chlorine feeders shall be operated by vacuum from the injectors as shown.

[B. Chlorinator No. [ ] shall operate on a compound-loop system with a 4-20 Ma flow proportional signal to the V-notch control valve and a variable vacuum or electrical signal from the residual analyzer to the vacuum regulating valve to achieve compound-loop control through 2 separate control valves.]

$# _____

NTS: The specifier must select either Paragraph 2.6 or Paragraph 2.7. The first version is a more up-to-date design, with a higher accuracy up to one part per billion chlorine residual, a higher price, and it is available from Wallace and Tiernan, only. The second version has been made for several years and is still available from Fischer & Porter.

_____ #$

[2.6 RESIDUAL CHLORINE ANALYZERS [ ]

A. **General:** Each residual analyzer shall be furnished to amperometrically analyze a continuous sample of [waste] water for total chlorine residual. Each unit shall display the residual in field selectable LED readout range of 0-5 mg/l and shall provide a proportional 4-20 Ma analog output. The measuring cell shall provide continuous on-line analysis of chlorine residual sensitive to one microgram per liter (0.001 mg/l). Each analyzer shall be furnished for [wall] [floor] mounting with a calibration accuracy of 2 percent of residual reading and an operating range of 10:1, in a NEMA 4X enclosure. The remote recorder shall comply with Section 13300.

B. **Features:** Each analyzer shall include the following:

1. A 3-electrode amperometric cell to give stability and sensitivity, regardless of changes in sample characteristics.

2. Continuous on-line analysis of chlorine residuals down to one part per billion (0.001mg/l).

3. Allow continuous feedback control of chlorine residual down to ten parts per billion (0.01 mg/l).

4. Operator controls via the use of a touch keypad.

5. Three different display menus described below:

   A scrollable, informative operator menu with easy change of operating parameters, including alarm messages and a 4-digit operator defined access code to limit unauthorized changes.

   A supervisor's set-up menu with step-by-step displayed instructions and error messages to assure proper startup.

   An on-line self-diagnostic menu for calibration, servicing, and troubleshooting.

6. Pinpoint control of reagent feed rate via valveless, peristaltic pumps using brushless stepping motors for accuracy and reliability.

7. Automatic back-flushing of cell orifice and flow path, preset for zero to 48 times per day.

8. A magnetically coupled impeller in the cell to maintain constant sample velocity at the measuring cell and to provide grit bombardment to keep electrode surfaces clean.

9. NEMA 4X enclosure of electronics with plug-in connectors for cell and pumps.

10. Battery back-up in case of loss of power for up to 24 hours to ensure set point and calibration will not be lost.

[11. In addition to transmitting a signal to a remote recorder, the analyzer shall be equipped with compound loop control, motorized valve, and signal to the chlorinator for residual control.]

C. **Reagents:** The analyzers shall be designed to utilize inexpensive reagents such as battery acid for pH control of the sample.

[2.7 RESIDUAL CHLORINE ANALYZERS [ ]

A. **General:** Each residual chlorine analyzer shall be of amperometric type for the measurement of [free] [total] residual chlorine in [water] [waste water] over a range of 0 to [ ] mg/l. The equipment shall include indicating, amplification, and transmission equipment. The remote recorder shall comply with Section 13300.

B. **Mounting:** Chlorine residual analyzers shall be mounted in free-standing modular cabinets, with built-in sample water line and filter. [In addition to transmitting a signal to a remote recorder, analyzer [ ] shall be equipped with compound-loop control. The indicator shall have control set points and a motorized vacuum valve shall be mounted on the analyzer to transmit an 8- to 88-inch water vacuum signal to the chlorinator for residual control]. Internal wiring for the analyzer [and vacuum valve] shall be terminated at a single junction box inside the analyzer.

C. **Sampling Cell:** The sampling cell shall contain 2 electrodes which continuously detect the chlorine residual in the samples and generate an electrical signal proportional to the residual chlorine concentration. The cell shall have a means to prevent the adherence of any foreign materials to the electrode surface.

D. **Thermistor:** The thermistor immersed in the sample stream shall form a part of the electric signal circuit in order to compensate automatically for changes in the cell output due to the water temperature changes. The analyzer shall be furnished with one sample flow rate regulator to permit easy setting of the optimum flow. An electronic pulse pump shall be part of the sampling system to meter reagent and buffer into the sample. Analyzers shall have a motorized filter in the sample line.

E. **Output Signal:** The chlorine residual analyzer assembly shall include a signal converter which shall transmit an output signal of 4-20 mA. This signal shall vary in direct linear proportion to the value of residual chlorine. The analyzer and transmitter shall operate on a 120-volt, ac power source.

F. **Enclosures:** The analyzer instruments and accessories shall be furnished in neat enclosures to match the chlorinators. Sample piping shall be installed for connections at the back of the panel as shown.

2.8 CHLORINE GAS LEAK DETECTORS [ ]

A. **General:** The chlorine gas detection system shall provide a warning of the presence of chlorine gas in the chlorine storage room and chlorinator room.

B. **Design:** The detectors shall contain electro-chemical sensing cells requiring minimum maintenance and shall be sensitive to the presence of chlorine gas only. The sensing cell shall be connected to the electrical circuit to give an alarm when one ppm or more chlorine gas (by volume) is present in the air. [At 3 ppm, the signal shall start the scrubbing system and close all motor-operated valves at bulk storage tank(s) and motorized dampers on all ventilation air intake louvers]. Failures in the internal electrical circuit shall cause an alarm condition. The detectors shall be suitable for operation on 120-volts, single-phase, 60-Hz, ac, and they shall be wall-mounted units. A normally-closed contact shall be provided to operate annunciators and a normally-open dry contact shall be provided to operate exhaust fans in case of chlorine leaks. The leak detector housing and the remote sensor cable must be radio frequency interference (RFI) shielded.

2.9 CHLORINE SCALES [ ]

A. **General:** Chlorine scales shall be of the hydraulic compressive load cell type with one dial each at each scale as shown. Each chlorine scale shall have a [60-inch x 30-inch] [60-inch x 60-inch] [96-inch x 48-inch] platform, with [0-4,000 lb] [0-8,000 lb] [0-12,000 lb] capacity.

B. **Scale Rack:** Scales shall be furnished with racks designed to support [ ] standard 1-ton chlorine cylinders each. A standard 1-ton cylinder for chlorine weighs approximately 3,700 lb when full. Scale racks shall be equipped with heavy-duty casters to support the chlorine cylinders so that the cylinders can be easily rotated. The scale racks shall tilt up for cleaning. The racks shall receive a protective coating in accordance with Section 09800.

C. **Load Cells and Indicators:** The hydraulic compression type load cells shall be of the temperature stable type with damper installed to prevent shock damage. The load cells shall be connected to bourdon tube type dial indicators with flexible tubing, placed inside 1-1/2-inch PVC conduits, cast into the concrete floor. Hydraulic tubing may be mounted on the wall surface as indicated. [An adjustable low weight alarm switch activated by the pointer on the dial shall be provided to activate a remote chlorine low weight alarm. The switch shall be rated 5 amps at 110 volts ac and have a local, manual reset button]. The dial indicators shall be graduated in not greater than 20 lb increments and shall be capable of full scale tare adjustment. Tare adjustment shall not require the use of any special tools and shall be easily accessible for adjustment without dismantling the indicator. The dials shall be not less than 18 inches in diameter. [A 4-20 mA transmitter shall also be furnished with each scale's load cell measurement system as shown. The transmitter shall generate an electrical 4-20 mA output signal proportional to measured weight. Transmitter accuracy shall be within ± 0.5 percent at full scale measurement.]

D. **Accuracy of Scales:** The hydraulic compression load cell system shall produce an accuracy of plus or minus 0.25 percent of the full scale.

2.10 CHLORINE CYLINDER ANCHORAGE

A. **General:** The chlorine cylinder anchorage, for the cylinders on the scales and in storage, shall consist of safety chains and locking devices complying with the following:

1. Storage cylinders shall be tied down against the floor or walls with 1/4-inch galvanized steel chains and anchoring plates which shall be bolted to the floor, or wall.

2. The cylinders that are mounted on scales shall be fastened to the base of the scale. Holes shall be drilled and tapped in the base of the scale so that a 1/4-inch chain with 1/2-inch size eye hooks on each end can be strapped over each cylinder with the eye hooks installed in the holes. A tank binder shall be used to take up the slack of the chain. The binders shall be load binders of the lever type for 1/4-inch chains, all galvanized steel construction, with a 12-inch handle, and for approximately 5,000 lb capacity.

## 2.11 CHLORINE EVAPORATORS [ ]

A. **General:** The evaporators shall be a heated water bath type with electric heaters and having a maximum capacity of vaporing [ ] pounds of liquid $Cl_2$ per 24 hrs. The electric heaters shall be mounted external to the water bath and removable without the need of draining the bath water. The heaters shall be cycled through a capacitance type temperature probe located in the water bath section. The heated water shall be transferred from the heater section to the water bath via an all bronze circulating pump.

B. **Components:** The evaporator shall include the following:

1. Two [ ]-kw electric immersion heaters suitable for 440/480 volt, 3-phase, 60-Hz supply.

2. Corrosion resistant fiberglass or structural foam ABS weather-proof protective covering.

3. Instrument panel with gas pressure gauge, gas temperature gauge, water bath temperature gauge, water bath level indicator, and cathodic protection ammeter.

4. Automatic bath water level control and make-up, including pre-piped, waterproof, solenoid valve, electrodes assembled in evaporator, and a resistance type level controller installed in the electrical control box.

5. Low bath water level alarm switch including electrodes assembled in evaporator and a resistance type level alarm control unit mounted in the electrical control box.

6. Bath water temperature control switch.

7. Low bath water temperature alarm switch.

8. High bath water temperature alarm switch.

9. Ammonia type unions at all inlets and outlets.

10. Combination magnetic contactor with fusible disconnect switch in a NEMA 4 rated enclosure.

11. $Cl_2$ liquid line valves (one-inlet, one-outlet).

12. Diaphragm type pressure gauges, (0-200 psi with 500 psi over pressure protection), with isolation valves.

13. Drain and vent connections.

C. **Tank:** The water bath tank shall be hot-dipped galvanized on both the inside and outside. The outside of the water bath tank shall be insulated with polyester urethane foam. The inside of the water bath tank and the outside of the gas chamber shall be protected from corrosion by cathodic protection. The cathodic protection shall use magnesium anodes. The current shall be adjustable and displayed on a panel mounted ammeter.

D. **Gas Chamber:** The gas chamber shall have a liquid inlet and gas outlet clearly marked. There shall be a liquid inlet located at the bottom of the gas chamber for the purpose of flushing and draining. The chlorine evaporator (vaporizer) gas chamber and pressure relief valve shall comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division I and also meet the recommendations set by the Chlorine Institute.

E. **Power Supply:** The evaporator shall be completely pre-wired, including magnetic starter, all controls, switches and manual disconnect to one 440/480-volt terminal strip, and one 110-volt terminal strip.

F. **Safety Design:** Evaporator systems shall include safety devices in feed and discharge lines and they shall ensure that chlorine gas fed from the evaporator to the chlorinators is in a less than atmospheric pressure state.

G. **Gas Pressure Relief System:** There shall be a $Cl_2$ gas pressure relief system using a rupture disc (set at 400 psi). Should the pressure on the gas side exceed 400 psi the disc will rupture and activate a diaphragm pressure switch (set at 20 psi), this switch shall be used to sound an alarm. Should the pressure continue to rise a pressure relief valve (set at 560 psi) shall open and discharge to a safe location outside of the building. After opening, the pressure relief valve shall close when the gas pressure settles down below 560 psi.

H. **Liquid $Cl_2$ Pressure Relief System:** There shall be a $Cl_2$ liquid pressure relief system provided on the liquid line at all points where liquid $Cl_2$ could get trapped between two valves. In addition, there shall be as a minimum one relief system provided with the evaporator and one provided for every 375 feet of liquid line. The $Cl_2$ liquid pressure relief system shall use a rupture disc (set at 400 psi) and an expansion chamber minimum 23 inches long and 6-5/8 inches in diameter conforming to ASME Section VIII, Division I code for unfired pressure vessels. Should the pressure on the liquid side exceed 400 psi the disc will rupture and activate a diaphragm pressure switch (set at 20 psi), which shall sound an alarm.

I. **Vacuum Regulating Unit:** Each evaporator shall also have a [ ] ppd electrically operated, vacuum regulating valve and check unit installed in the gas discharge line. The valve shall be connected to the water temperature switch on the evaporator and if the water temperature drops, the switch shall close the valve. The valve shall also close on loss of operating vacuum. The unit shall contain a heater rated at 25 watts, 120 volts, 60-Hz.

2.12 CHLORINE INJECTORS

A. **General:** Chlorine injectors shall be suitable for the capacities and pressure conditions indicated and shall include threaded or flanged connections, manual throat adjustment and double check arrangement to prevent water from leaking into the chlorine gas supply, when the injector is not operating. Each injector shall be equipped with a vacuum gauge, and an auxiliary spring-loaded diaphragm.

B. **Injector Schedule:** Injectors shall comply with the following:

| | |
|---|---|
| Point of application | - [ ] |
| Injector size - in | - [ ] |
| Feed rate - lb/day | - [ ] |
| Dilution water - gpm | - [ ] |
| Water pressure - psig | - [ ] |
| Back pressure - psig | - [ ] |
| Length of vapor line - ft | - [ ] |
| Length of solution line - ft | - [ ] |

2.13 SUPPLEMENTAL EQUIPMENT AND PIPING

A. **General:** The WORK includes piping, valves fittings, gaskets, bolts, nuts, couplings, supports and other materials required for the installation. Materials in contact with chlorine shall be suitable for this service. Installation, cleaning, and testing shall comply with Chlorine Institute's recommendations. During erection, cutting oil, grease and other foreign material inside any portion of the system shall be removed by methods such as flushing or cleaning with cloth saturated with trichloroethane or other suitable chlorinated solvent. THE CONTRACTOR SHALL NOT USE HYDROCARBONS OR ALCOHOLS FOR CLEANING. New equipment, pipe, fittings and accessories received in an oily condition shall be dismantled and cleaned before use.

B. **Piping and Gauges:** Pressure and vacuum gauges mounted on chlorine gas and chlorine solution lines shall be protected with diaphragm seals. Steel pipe and fittings used for chlorine pressure lines, and PVC pipe and pipe fittings used for chlorine gas under vacuum and chlorine solution, shall comply with a Section 15010. All flanges and unions on chlorine pressure piping shall be ammonia type, suitable for that service. Threaded joints shall be made up with compounds or tape especially recommended for chlorine service.

C. **Valves:** Shut-off valves installed in chlorine pressure piping shall be threaded 3-piece ball valves, 300-lb rating, with forged carbon steel body, Hastelloy "C" trim, modified Teflon Seal and seal model ball and stem with 1/4 turn open or closed operator.

D. **Testing Gas and Liquid Piping:** After cleaning, as described in paragraph A, above, the piping shall be tested at the indicated pressure and then drained and dried as follows. Apply steam to the piping from the upper piping end. Condensate and foreign matter shall be drained from the piping at the lower end, but not into the chlorine storage tanks. Steaming shall be continued until the line is thoroughly heated and cleaned. The steam supply shall then be disconnected and while the piping is still hot, dry air having a maximum dew point of -40 degrees F, shall be blown through the piping until the dew point of the discharge air equals that of the entering air. The piping shall then be tightly sealed against entry of moisture.

[E. **Testing of Vessel:** The chlorine storage vessel interiors shall be cleaned but shall not be steamed. Before admitting chlorine or testing for piping leaks, the interiors of the storage vessels shall be dried with minus 40 degrees F air as described above.]

F. **System Testing:** After drying, the [tanks and] chlorine gas and liquid piping system shall be pressurized with dry air to 150 psi and tested for leaks by application of soapy water to the outside of joints. Leaks shall be repaired and the line shall be redried and retested. Chlorine gas shall then be introduced into the line, the test pressure built up to 150 psi with dry air, and the system tested for leaks, using strong aqua ammonia (commercial 26EBe).

G. **Purging:** Piping and equipment shall be thoroughly purged of chlorine before repairs.

[H. **Flexible Connectors:** The one-inch flexible metal hoses at the chlorine unloading facility (4 required) shall be approximately 10 ft long, fabricated of a material compatible with chlorine, with one-inch male pipe sections on each end. The hose ends shall be modified as required with the appropriate fittings and shall be leak-free during chlorine liquid unloading to the tank truck at one end, and the fixed piping of the unloading facility at the other end.]

2.14 NAMEPLATES, TOOLS AND SPARE PARTS

A. Nameplates, tools and spare parts shall comply with Section 11260 and as indicated herein.

B. The following spare parts shall be furnished by the CONTRACTOR:

| Item No. | Description | Quantity |
|---|---|---|
| 1 | [3/8-inch flexible tank connections, each with 2 cylinder and header valves] [Bulk storage tank connections, each with 4 angle valves and one relief valve] | [ ] |
| 2 | Preventive maintenance kit for vacuum regulating check units | [ ] |
| 3 | [one] [3/4]-inch chlorine liquid/gas shut-off line ball valves | [ ] |
| 4 | Complete set of special gaskets | 2 sets |
| 5 | One-inch expansion loops, each with cylinder and header valves | [ ] |
| 6 | Instruction books | 3 |
| 7 | Spare rotameters for all chlorinators | 1 set |
| 8 | Spare rupture discs for all safety heads | 1 set |

2.15 MANUFACTURERS

A. Products shall be manufactured by one of the following (or equal):

1. Fischer & Porter

2. Wallace and Tiernan (Pennwalt)

**PART 3 -- EXECUTION**

3.1 INSTALLATION

A. **General:** Equipment shall be installed in accordance with Section 11260 and with the recommendations of the Chlorine Institute, Inc.

B. **Chlorine Diffusers:** Chlorine diffusers shall be installed as indicated to feed chlorine solution into the water stream. Diffusers shall be supported with corrosion resistant supports of monel or suitable plastic, and shall be installed for easy removal and disconnection.

3.2 PAINTING

A. **Factory Painting:** Factory painting shall conform to manufacturer's standard factory finish provided it does not discolor in the presence of hydrogen sulfide fumes, high water vapor atmosphere, alkaline water vapor, and concentrated chlorine (oxidizing) condition..

B. **Field Painting:** Equipment which did not receive a factory finish shall be painted in accordance with Section 09800. Factory painted items requiring touching up in the field shall be cleaned of all foreign material and shall be primed and top coated with the manufacturer's standard factory finish.

** END OF SECTION **