WARNING: TO AVOID SEVERE PERSONAL INJURY DUE TO INHALATION OF CHLORINE, USE AN APPROVED GAS MASK AND VENTILATION EQUIPMENT WHEN REMOVING THE RUPTURE DISC.

CAUTION: When installing rupture disc, ensure that the groove of the disc fits the mating tongue of safety head to avoid altering the operating level of the rupture disc.

Refer to 50.202.007.011. The expansion chamber is isolated from the chlorine by the rupture disc (10). Since the expansion chamber is not exposed to chlorine under normal conditions no preventative maintenance is required for the expansion chamber. The expansion chamber has a pressure switch (5) attached to it to monitor the chamber's internal pressure. The pressure switch (5) is preset to 20 psi at the factory. During initial start up this switch should be tested prior to installing the rupture disc (10) into the safety head union.

4.12 "In-Place" Cleaning of the Evaporator Cylinder

The rate of residue buildup varies considerably with the type of impurity, the source of chlorine supply, the rate of usage, and various other factors. The following maintenance cleaning procedure should be implemented every 12 months, or sooner if a loss in superheat or reduction in chlorine capacity is observed. These instructions describe a method for cleaning chlorine residue from the evaporator without removing the cylinder. The special accessories required by this procedure for cleaning and drying are available in kit form in Evoqua Water Technologies Part No. W3T109990. The replacement gaskets required for each evaporator are included in parts kit W3T110050. A water supply line of 3/4-inch pipe size at a minimum pressure of 20 psi must be available. The hose required is not furnished as part of either kit. If these instructions are carefully followed, the cylinder should be clean and dry when restored in service.

In some circumstances, it could be desirable to thoroughly review the relative advantages of cleaning versus simply replacing the evaporator cylinder, thereby eliminating the time and necessary complexities of the cleaning process and enjoying the security and full operating capacity provided by a new cylinder. This choice would take into consideration the local cost and availability of personnel, facilities, equipment, and time required for the cleaning process measured against the installed cost of a new cylinder. This comparison can be made only on the basis of individual local circumstances.

Under normal operating conditions, deposits will accumulate in the evaporator cylinder and, over a period of time, will reduce its operating capacity. For this reason, periodic cleaning is required to remove these deposits.

CAUTION: Refer to the instruction book provided with the equipment for complete details on recommended frequency and procedures to properly accomplish this cleaning.

To clean the evaporator cylinder "In-Place," perform the following steps.

WARNING: ANY MOISTURE, INCLUDING ATMOSPHERIC, IS HIGHLY CORROSIVE WHEN COMBINED WITH CHLORINE. TO AVOID SEVERE PERSONAL INJURY AND EQUIPMENT DAMAGE AS A RESULT OF EXTREME CORROSION, THE CYLINDER MUST BE ABSOLUTELY DRY AFTER CLEANING IS COMPLETED.

a. With the evaporator controls on, evacuate the chlorine cylinder as follows:

(1) Close the evaporator outlet valve. When the outlet valve is closed, gas will form inside the cylinder, thereby pushing liquid chlorine back to the supply container.

WARNING: IF THE SUPPLY CONTAINER DOES NOT HAVE ADEQUATE RESERVE CAPACITY TO ACCEPT THE MAXIMUM CONTENTS THAT ARE BEING FORCED FROM THE EVAPORATOR CYLINDER, DO NOT STOP THE CHLORINATOR. INSTEAD, IN ORDER TO PREVENT OVER-FILLING AND DEVELOPING EXTREME PRESSURES WITHIN THE SUPPLY CONTAINER, CLOSE THE SUPPLY VALVE AND USE THE CHLORINATOR OR GAS DISPOSAL SYSTEM TO COMPLETELY EVACUATE THE EVAPORATOR AND ITS CONNECTING PIPELINES.

(2) If the maximum amount of contents can be forced out of the cylinder to the supply without exceeding the rated capacity of the supply container, the outlet valve can be closed. However, do not shut any valves in the chlorine supply piping.

NOTE: If the evaporator outlet is closed or chlorination is stopped, and if the inlet valve to the evaporator and the valves to the ton container or tank cars are open, the pressure within the evaporator cylinder will not exceed the pressure in the ton container or tank car.

WARNING: TO AVOID AN OVERPRESSURE CONDITION CAPABLE OF RUPTURING THE PIPING SYSTEM AND RESULTING IN A DISCHARGE OF GAS FROM THE GAS PRESSURE RELIEF SYSTEM, CAUSING POSSIBLE SEVERE PERSONAL INJURY AND EQUIPMENT DAMAGE, DO NOT CLOSE ANY SUPPLY VALVE WITHOUT FOLLOWING THE EVACUATION PROCEDURE FOR LONG-TERM SHUTDOWN IN PARAGRAPH 3.2.3B.

NOTE: Liquid chlorine has a high coefficient of thermal expansion.

WARNING: DO NOT CLOSE VALVES IN SUCH A WAY THAT LIQUID CHLORINE MAY BE TRAPPED, SINCE DANGEROUS PRESSURES CAPABLE OF RUPTURING THE PIPING SYSTEM MAY BUILD UP WITH A SMALL INCREASE IN TEMPERATURE.

(3) Leave the evaporator outlet valve shut for approximately 30 minutes. Under these conditions, most of the liquid chlorine will be forced back to the supply tank through the inlet nipple and the remaining liquid will be evaporated by the heat of the water bath. At the end of this period, shut the valve at the tank car or the ton container, immediately open the evaporator chlorine outlet valve, and run the chlorinator to exhaust the gas in the evaporator and the gas and liquid in the inlet line. When the evaporator pressure gauge reads zero, the chlorine outlet valve may be closed. If the evaporator pressure gauge shows pressure after the outlet valve has been closed for several minutes, repeat the above procedure until the evaporator pressure gauge reads zero with outlet valve closed. Then turn off power to the control system and alarm units. If no standby evaporator is being used, shut down the chlorinator. Remove the enclosure and the associated hardware.

b. Drain water from the water tank by opening drain valve (17). See drawing 50.200.060.010.

c. Remove cap plug (57) from top of water tank.

d. Through the port hole located on top of the hot water tank, examine the visible exterior of the chlorine cylinder with a flashlight. Inspect the surface. If signs of pitting or corrosion are evident, proceed to paragraph 4.13, Five-Year Inspection.

WARNING: TO AVOID SEVERE PERSONAL INJURY DUE TO INHALATION OF CHLORINE, USE AN APPROVED GAS MASK AND BE PREPARED TO RECONNECT UNION QUICKLY IF THERE IS ANY SIGN OF PRESSURE IN THE GAUGE LINE.

CAUTION: Do not disturb the threaded joint between the pressure gauge and the protecting oil-filled capsule. Any loss of oil will result in a faulty indication by the pressure gauge.

e. Remove the temperature gauge (97) bulb from the well in the cylinder flange (30). Put on an approved-type gas mask before proceeding. Disconnect the pressure gauge (87) and the chlorine inlet and outlet piping through the unions (19) on the top of the cylinder.

f. Remove the upper cylinder flange cover plate from the cylinder (30) and attached parts. Note the orientation of the chlorine inlet and outlet pipes.

CAUTION: Do not lose or misplace any of the nuts or brackets when disassembling the upper flange.

g. Examine the interior of the cylinder. Because residues vary widely, it is not possible to describe exactly what may be found. However, it may be expected that the upper portion of the cylinder will be lined with a reddish-

brown ferric chloride and the lower portion will contain a mixture of ferric chloride and other residue. This mixture may be solid, liquid, or of some intermediate consistency.

h. Disconnect the ammonia union (19) at the bottom chlorine inlet (47).

i. Using the flange W2T18194 with nipple W2T16303, from the W3T109990 drying kit, run a one-inch hose line from the bottom chlorine inlet connection to a drain, as shown in Dwg. 50.200.150.010.

j. Loosen any residual buildup from the internal walls of the cylinder.

k. Remove riser pipe W2T19060 from the bottom chlorine inlet and flush the cylinder with water at a minimum of flow of 5 GPM. Continue to flush until the discharge water is clean.

l. Inspect the interior surface for pitting and corrosion. If pitting exceeds 0.125-inch deep, if deep seated corrosion is apparent, or if cylinder seems to be of questionable condition, either proceed with the five-year inspection procedure (paragraph 4.13) or replace the cylinder and the appropriate components.

m. Thoroughly dry all internal surfaces and items within the cylinder, as any residual moisture will accelerate corrosion once combined with chlorine.

<u>WARNING</u>: ANY MOISTURE, INCLUDING ATMOSPHERIC, IS HIGHLY CORROSIVE WHEN COMBINED WITH CHLORINE. TO AVOID SEVERE PERSONAL INJURY AND EQUIPMENT DAMAGE FROM EXTREME CORROSION, AND POSSIBLE FAILURE OF THE CYLINDER, IT MUST BE ABSOLUTELY DRY AFTER CLEANING IS COMPLETED.

n. Unbolt (23) and remove the bottom chlorine inlet pipe and flange (47). Remove as much water as possible from the bottom of the cylinder with a rag or sponge to reduce drying time. Dry the bottom chlorine inlet pipe (47) thoroughly by baking or other means.

o. After the cylinder and other parts have been dried thoroughly, replace the riser pipe and the cylinder flange cover plate using a new gasket W2T18796. Tighten the bolts uniformly to 270 ft lb.

<u>NOTE</u>: When replacing the cylinder flange cover plate, it is necessary to observe the orientation of the inlet and outlet as stamped on the top of the flange and install accordingly.

<u>WARNING</u>: IF USER OUTLET PIPING IS CONNECTED TO THE EVAPORATOR INLET PIPE, LIQUID CHLORINE WILL DISCHARGE FROM THE EVAPORATOR, CAUSING EQUIPMENT DAMAGE AND POSSIBLE SEVERE PERSONAL INJURY. THEREFORE, ENSURE THAT USER PIPING IS CONNECTED TO THE EVAPORATOR OUTLET PIPE.

p. Replace the bottom chlorine inlet pipe (47) using a new gasket W2T16384. Connect the injector, W3T107574 from the W3T109990 drying kit, to the bottom chlorine inlet per Dwg. 50.200.150.010. Install vacuum gauge W2T19897 into the top flange of the cylinder (30).

q. Turn on the evaporator controls and raise the temperature in the tank to 180°F. Pull a vacuum via the injector and maintain for 1/2 hour at a minimum of 22 inches of mercury.

r. Shut off the vacuum line and observe the vacuum gauge. If a vacuum of 22 inches of mercury or more can be held for one minute, and all parts of the system being dried are heated by the 180°F water bath, no further evacuation is necessary. If not, continue to pull a vacuum until 22 inches of mercury can be held for 1/2 hour.

s. Disconnect the injector and restore the bottom chlorine inlet piping (47). Use a new gasket W2T16384 in the ammonia-type union on the inlet piping (47).

t. Remove the vacuum gauge and reconnect the chlorine pressure gauge in the top flange using a new O-ring W2T11775.

u. Refer to paragraph 4.14, Operational Inspection of the Pressure Relief Systems, to test both the gas pressure relief system and the liquid line pressure relief system.

v. Refer to paragraph 3.1, Preparation For Initial Operation, to put the evaporator back into service.

w. Replace the enclosure and put the evaporator into service.

4.13 Five-Year Inspection of Evaporator Cylinder

This inspection is conducted either every five years, after 12 “in-place” cleanings, or when indicated by step d or l, paragraph 4.12.

NOTE: Canadian owners of evaporators must comply with local regulations governing periodic inspection and testing of the pressure vessel.

a. Complete steps "a" through "l" of the “In-Place” Cleaning of the Evaporator Cylinder Procedure (paragraph 4.12).

b. Remove the silicone bead surrounding the top of the cylinder (30) and the hot water tank (29).

c. Install the top flange and lifting brackets back into the evaporator cylinder. Bolt the brackets securely in place, making sure the brackets are 180 degrees apart.