

**2 PPD OSEC[®]-BPCT
ON-SITE ELECTROLYTIC
CHLORINATION SYSTEM**

BOOK NO. IM 85.072AA UA ISSUE A

EQUIPMENT SERIAL NO. _____

DATE OF START-UP _____

START-UP BY _____

Prompt service available from nationwide authorized service contractors.

ORDERING INFORMATION

In order for us to fill your order immediately and correctly, please order material by description and part number, as shown in this book. Also, please specify the serial number of the equipment on which the parts will be installed.

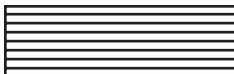
WARRANTY

Seller warrants for a period of one year after shipment that the equipment or material of its manufacture is free from defects in workmanship and materials. Corrosion or other decomposition by chemical action is specifically excluded as a defect covered hereunder, except this exclusion shall not apply to chlorination equipment. Seller does not warrant (a) damage caused by use of the items for purposes other than those for which they were designed, (b) damage caused by unauthorized attachments or modifications, (c) products subject to any abuse, misuse, negligence or accident, (d) products where parts not made, supplied, or approved by Seller are used and in the sole judgement of the Seller such use affects the products' performance, stability or reliability, and (e) products that have been altered or repaired in a manner in which, in the sole judgement of Seller, affects the products' performance, stability or reliability. **SELLER MAKES NO OTHER WARRANTY OF ANY KIND, AND THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS OF THE MATERIAL OR EQUIPMENT FOR ANY PARTICULAR PURPOSE EVEN IF THAT PURPOSE IS KNOWN TO SELLER.** If Buyer discovers a defect in material or workmanship, it must promptly notify Seller in writing; Seller reserves the right to require the return of such defective parts to Seller, transportation charges prepaid, to verify such defect before this warranty is applicable. In no event shall such notification be received by Seller later than 13 months after the date of shipment. No action for breach of warranty shall be brought more than 15 months after the date of shipment of the equipment or material.

LIMITATION OF BUYER'S REMEDIES. The **EXCLUSIVE REMEDY** for any breach of warranty is the replacement f.o.b. shipping point of the defective part or parts of the material or equipment. Any equipment or material repaired or replaced under warranty shall carry the balance of the original warranty period, or a minimum of three months. Seller shall not be liable for any liquidated, special, incidental or consequential damages, including without limitation, loss of profits, loss of savings or revenue, loss of use of the material or equipment or any associated material or equipment, the cost of substitute material or equipment, claims of third parties, damage to property, or goodwill, whether based upon breach of warranty, breach of contract, negligence, strict tort, or any other legal theory; provided, however, that such limitation shall not apply to claims for personal injury.

Statements and instructions set forth herein are based upon the best information and practices known to U.S. Filter/Wallace & Tiernan, Inc., but it should not be assumed that every acceptable safety procedure is contained herein. Of necessity this company cannot guarantee that actions in accordance with such statements and instructions will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.

USFilter
WALLACE & TIERNAN PRODUCTS
1901 West Garden Road, Vineland, NJ 08360



INTRODUCTION

The OSEC®-BPCT described in this manual has been designed for the continuous production of sodium hypochlorite by the electrolysis of brine at 2 lbs/day equivalent chlorine.

This manual has been produced to enable the user to obtain maximum service from the equipment and comprises installation, operation maintenance and spare parts information. Minor changes may be made to the equipment that are not immediately reflected in the manual - if such a change appears to have been made, contact USFilter's Wallace & Tiernan Products for information.

Our guarantee is conditional upon the equipment being used in accordance with the instructions herein and we therefore recommend that they be read and fully understood before the equipment is placed in service.

TABLE OF CONTENTS

Very Important Safety Precautions	SP-1,-2,-3
Anode Warranty Conditions	AW-1,-2
OSEC Operational Log	OSEC-LOG
Notes on Protective Equipment & Clothing	1.010-6
Regional Offices	1.010-1
Technical Data	Section 1
Installation	Section 2
Operation	Section 3
Acid Cleaning Procedure	Section 4
Illustrations	Section 5
Spare Parts List	Section 6
Control Panel.....	Section 7

VERY IMPORTANT SAFETY PRECAUTIONS

This page provides very important safety information related to safety in installation, operation, and maintenance of this equipment.

WARNING

HYDROCHLORIC ACID

Hydrochloric acid is used for cleaning the electrodes of the electro-chlorinator where this is recommended as part of the servicing procedures. The storage of any acid and the associated handling facilities must be completely separate from the sodium hypochlorite storage arrangements. Hydrochloric acid fumes excessively in its concentrated form and great care must be taken when handling carboys of acid. Every possible safeguard must be taken to ensure that the acid does not come into contact with the hypochlorite solution as this will result in chlorine gas being produced. Any spillage of acid, whether dilute or not, should be immediately flushed away with copious quantities of water. Personnel must be made aware of the dangers of handling concentrated acid and the preparation of dilute solutions. The personnel must wear chemical goggles and protective clothing, rubber boots and gloves. Splashes in the eyes must be dealt with immediately by prolonged irrigation with running water. Medical advice should be sought as soon as possible. Similarly, splashes to the skin or clothing should also be immediately washed in running water. Warning notices pointing out the dangers and displaying the previous points should be prominently posted wherever acid is stored or handled.

SODIUM HYPOCHLORITE

The strength of the hypochlorite solution generated by the OSEC unit and stored in the bulk tank is approximately 0.6% w/w. Although this solution is considerably weaker than normal commercial bulk supplies (15% w/w), care should still be taken with handling. The sodium hypochlorite is slightly alkaline and forms an oxidizing and bleaching agent which is corrosive and may cause damage to skin and clothing on contact. Mixing of the chemical with any form of acid must be avoided as highly toxic chlorine gas would be generated. Warning notices similar to those displayed for the acid equipment should be prominently posted in areas where hypochlorite is generated and stored.

ELECTRICAL SAFETY

The electrical power in this equipment is at a voltage high enough to endanger life. Before carrying out maintenance or repair, persons concerned must ensure that the equipment is isolated from the electrical supply and tests made to verify that the isolation is complete. When any of the supplies cannot be disconnected, functional testing, maintenance and repair of the electrical units is to be undertaken only by persons fully aware of the danger, and who have taken adequate precautions.

VERY IMPORTANT SAFETY PRECAUTIONS (CONT'D)

HYDROGEN GAS

The process of converting brine into sodium hypochlorite generates hydrogen gas which is safely exhausted to atmosphere externally from the hypochlorite storage tank, having been diluted with air to reduce its concentration. However, to ensure plant safety, warning notices should be displayed forbidding smoking or any naked flame in the vicinity of the electro-chlorinator unit and any satellite storage tank. The equipment should be regularly checked to ensure that no gas leakages occur. Do not check with a match or naked light, use a specifically sensitive hydrogen detector. No attempt must be made to extract sodium hypochlorite at any point prior to the storage tank, apart from small volume samples taken at the hypochlorite outlet sample valve for purely analytical purposes. This is to prevent the hydrogen, which is contained in the hypochlorite before reaching the tank, from being released into the atmosphere in an undiluted form, with consequent risk of ignition.

GENERAL

TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, OBSERVE THE FOLLOWING:

TO ENSURE PROPER AND SAFE OPERATION OF THIS EQUIPMENT, USE ONLY U.S. FILTER LISTED PARTS, EXCEPT FOR COMMERCIALLY AVAILABLE PARTS AS IDENTIFIED BY COMPLETE DESCRIPTION ON ACCOMPANYING PARTS LIST. THE USE OF UNLISTED PARTS CAN RESULT IN EQUIPMENT MALFUNCTIONS, CAUSING POSSIBLE SEVERE PERSONAL INJURY.

THIS EQUIPMENT SHOULD BE INSTALLED, OPERATED, AND SERVICED ONLY BY TRAINED QUALIFIED PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE ENTIRE CONTENTS OF THE INSTRUCTION BOOK PROVIDED.

DO NOT DISCARD THIS INSTRUCTION BOOK UPON COMPLETION OF INSTALLATION. INFORMATION PROVIDED IS ESSENTIAL FOR PROPER AND SAFE OPERATION AND MAINTENANCE.

ADDITIONAL OR REPLACEMENT COPIES OF THIS INSTRUCTION BOOK ARE AVAILABLE FROM:

USFILTER'S WALLACE & TIERNAN PRODUCTS
1901 W. GARDEN ROAD
VINELAND, NEW JERSEY 08360
PHONE: (856) 507-9000
FAX: (856) 507-4125

VERY IMPORTANT SAFETY PRECAUTIONS (CONT'D)**NOTE**

Minor part number changes may be incorporated into USF/W&T products from time to time that are not immediately reflected in the instruction book. If such a change has apparently been made in your equipment and does not appear to be reflected in your instruction book, contact your local USF/W&T sales representative for information.

Please include the equipment serial number in all correspondence. It is essential for effective communication and proper equipment identification.

USF/W&T ANODE WARRANTY CONDITIONS

The anodes used in the electro-chlorinator are warranted for five calendar years after installation and commissioning unless stated otherwise at the time of tender or unless there is a temperature variance as mentioned under item a, below.

USF/W&T will replace or refurbish the anodes during the period after installation and commissioning, either option at the spare parts price in effect at the time of replacement, less a percentage equal to that portion of the expected life that was not obtained from the anodes being replaced. The warranty and conditions current at the time of replacement will then apply.

Anode life is dependent upon many factors, the warranty is therefore conditional upon correct operation of the equipment in accordance with the Instruction Manual and subject to the following conditions:

- a. Warranty will apply if the temperature of the incoming electrolyte does not fall below 50°F (10°C).
- b. The salinity of the electrolyte must be above 18,000 mg/l chloride (Cl₂) unless otherwise specified by USF/W&T. The sulfate (SO₄) content must be less than 1/7th of the Cl₂ content.
- c. The manganese level in the electrolyte entering the electrolyzer must not exceed 10 µg/L at any time.
- d. The electrolyte must contain less than 2 mg/l fluoride (F).
- e. The electrolyzer, as specified, must not be operated at a current above specified conditions. See Section 1 - Technical Data for specific OSEC system current specifications.
- f. An operational log, as shown in the provided O&M manual, must be maintained with the time period specified.
- g. A monthly log of water analysis must be maintained by water authorities and, in the case of other users, as determined by agreement with USF/W&T.
- h. Salt quality must be to the following specifications:

Water insolubles:	0.01% maximum
Calcium sulfate:	0.14% maximum
Magnesium sulfate:	0.02% maximum
Magnesium chloride:	0.1% maximum
Sodium chloride:	99.8% minimum

- i. Acid cleaning is to be carried out if current efficiency falls below the normal by more than five percent.
- j. Protective current is to be maintained and applied according to the Instruction Manual.
- k. Water hardness leaving the softener must not exceed 17 mg/l of calcium carbonate (CaCO₃).
- l. If it is found that the performance of the anode coatings has been impaired by organic contaminants in the electrolyte, causing (directly or indirectly) blinding or reduced coating life, then the anode coating lifetime guarantee will not apply.

It is recommended that the total organic content in the electrolyte should be less than 10 mg/kg, the actual limit being dependent on the species.

- m. Brine dilution shall normally be a nominal 10:1, this may be increased to a nominal 12:1, providing the incoming electrolyte is always above 50°F (10°C).

USF/W&T ANODE WARRANTY CONDITIONS

Background

The chemistry of the electrolytic generation of sodium hypochlorite is outlined in this section. There are two feeds to the electrolytic cell, saturated brine (NaCl) and dilution water. The saturated brine from the saturator, comprising nominally 35 % (by weight) NaCl, mixes with the dilution water to make a solution approximately 10% of saturation. This concentration is optimum for efficient electrolysis and minimization of carry over of unreacted salt. The salt dissolves in water to form sodium and chloride ions:



On entering the electrolytic cell, the solution reacts as follows:

at the ANODE chloride ions are oxidized to chlorine according to reaction (2):



and at the CATHODE water is reduced to hydrogen gas (which forms bubbles and leaves the solution, as shown in reaction (3):



The reduction of water and resulting evolution of hydrogen results in the formation of hydroxide ions. The hydroxide ions react with the liberated chlorine at the anode to form hypochlorite ions (reaction (4)):



Thus the overall (chemically balanced) reaction for the electrolysis of NaCl solutions in OSEC can be written as:



Important factors in achieving reaction (5) efficiently are brine concentration, current density and anode-cathode spacing. Brine concentration is controlled by the dilution water to saturated brine flow ration and the current density is preset on the power supply. The anode-cathode spacing (~0.8mm) is set by the use of titanium spacers and provides optimum conditions of inter-electrode resistance, space to allow gas bubbles to escape from the electrode surface and to provide mixing of the anode and cathode reaction products, to form sodium hypochlorite.

Because the efficiency of operation is critically affected by the inter-electrode gap, it is important to prevent buildup of deposits in this gap. The primary source of material which might form deposits is hardness in the feed waters. Species which contribute to water hardness (dissolved calcium and magnesium salts) tend to precipitate from solution at high pH. In the electrolytic process the generation of hydroxide at the cathode causes an increase in pH sufficient to cause precipitation of hardness deposits. This has seriously deleterious effects on electrolysis efficiency and also on the service life of the precious metal-coated anodes. For this reason it is essential that all water fed to the electrolyzer has a hardness less than 17 mg/l Ca hardness. In most applications there will be a requirement that water is softened prior to entry to the salt saturator and electrolyzer. Regular monitoring of the feed water hardness is a crucial part of the routine maintenance of OSEC plant.



OSEC OPERATIONAL LOG

OSEC MODEL NO.:..... SITE:..... DATE COMMISSIONED:.....

CAPACITY:..... lb(kg)/day

SETTING FOR NORMAL RUNNING:..... WATER FLOW RATE:.....gal(l)/hr

BRINE FLOW RATE:.....gal(l)/hr

HEAT EXCHANGER FITTED? YES / NO

AMPERES:.....

VOLTS:.....

RECOMMENDED ACID CLEANING FREQUENCY:.....

NOTE: THE TABLE BELOW SHOULD BE COMPLETED MONTHLY

DATE	WATER FLOW gal(l)/hour	BRINE FLOW gal(l)/hr	INLET WATER TEMP°F (°C)	AMPS	VOLTS	INITIALS





NOTES ON PROTECTIVE EQUIPMENT AND CLOTHING

The following Warning appears in several locations in this book. It is general in nature due to the variety of hazardous liquids this equipment is capable of handling.

WARNING: WHEN DEALING WITH HAZARDOUS MATERIAL, IT IS THE RESPONSIBILITY OF THE EQUIPMENT USER TO OBTAIN AND FOLLOW ALL SAFETY PRECAUTIONS RECOMMENDED BY THE MATERIAL MANUFACTURER/SUPPLIER.

It is good general practice to make use of protective equipment when handling any hazardous material.

IT IS RECOMMENDED THAT SUCH PROTECTIVE EQUIPMENT BE USED BY ALL PERSONS SERVICING THIS PUMP, ASSOCIATED PIPING, TUBING, VALVES, AND ACCESSORIES, WHEN THE EQUIPMENT IS HANDLING ANY HAZARDOUS MATERIAL.

1. Goggles, flexible fitting, hooded ventilation (per ANSI Z87.1)	
2. Face Shield (per ANSI Z87.1)	
3. Chemical Apron	
4. Chemical Gloves	

NOTE: (1) ANSI Z87.1 “practice for occupational.....eye and face protection” recommends goggles (#1 above) as the “preferred protection” when handling chemicals that present a hazard from splash, acid burns or fumes; for severe exposure, a face shield (#2 above) over the goggles is recommended.

(2) An eye flushing fountain and a deluge-type shower may be recommended or required by insurance carriers or governmental safety agencies, which should be consulted for specific requirements.

REGIONAL OFFICES**INSTALLATION, OPERATION, MAINTENANCE, AND SERVICE INFORMATION**

Direct any questions concerning this equipment that are not answered in the instruction book to the Reseller from whom the equipment was purchased. If the equipment was purchased directly from USFilter's Wallace & Tiernan Products (USF/W&T), contact the office indicated below.

UNITED STATES

1901 West Garden Road
Vineland, NJ 08360
TEL: (856) 507-9000
FAX: (856) 507-4125

CANADA

If the equipment was purchased directly from USF/W&T Canada, contact the nearest office indicated below.

ONTARIO

250 Royal Crest Court
Markham, Ontario
L3R3S1
(905) 944-2800

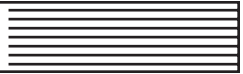
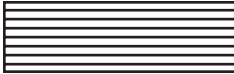
QUEBEC

243 Blvd. Brien
Bureau 210
Repentigny, Quebec
(450) 582-4266

MEXICO

If the equipment was purchased directly from USF/W&T de Mexico, contact the office indicated below.

Via Jose López Portillo No. 321
Col. Sta. Ma. Cuauhtepc, Tultitlan
Edo. México 54900
TEL: +52 55 2159 2976 / +52 55 2159 2989
FAX: +52 55 2159 2985



SECTION 1 - TECHNICAL DATA

Product

Capacity	2 lb/day Chlorine Equivalent
Concentration	> 4000 mg/l as Chlorine (upper limit < 8000 mg/l)

Water Supply

Pressure	15 to 75 psi
Temperature	50 to 85 deg F
Flow	18 to 25 gal/lb Chlorine Equivalent
Quality	Total Hardness < 17 mg/L, Mg < 0.05 mg/l

Power Supply

Control Panel	230V \pm 5%, 60 HZ, 5 Amps, Recommended Breaker Rating 10 Amp
---------------	--

Salt/Brine Supply

Salt Spec	Solar Salt
Insoluble content	0.01% max
Calcium Sulfate	0.14% max
Magnesium Sulfate	0.02% max
Magnesium Chloride	0.1% max
Sodium Chloride	99.8% min

Brine/Water Pump Operating Data

Max Head (differential)	5 psi (11.5 ft)
Electrical Power	230V, 60Hz, Supply
Pump Speed	45 RPM
Bellows Size	1/2" x 1" (Brine x Water)
Feed Rate Range	0.07 - 0.38 Brine (GPH) 0.38 - 3.75 Water (GPH)

TECHNICAL DATA (CONT'D)

Operating Settings

Capacity	2 lb/day
Flow rate	120 ml/min
Brine Concentration	2.8%
DC Current	22.5 Amps Regulated
DC Voltage	12 Volts Nominal

Product Storage Tanks

Material	Linear, High Density Polyethylene
Color	Natural
Diameter	23-1/4 in
Height	45-1/2 in (overall)
Capacity	Nominal: 65 gal Usable: 57 gal

Brine/Saturator Tanks

Material	Linear, High-Density Polyethylene
Color	Black
Diameter	19-1/2 in
Height	31 in
Capacity	200 lb (salt)

Softener

See manufacturer information supplied with softener.

Level Switch

Setting

Stop	22" High-High
Start	18" High
Not Used	4" Low
Not Used	0" Low-Low
Output Type	Unpowered contact closure

Storage Tank Ventilation Blower

Power	230V, 60 HZ, 0.7Amps
-------	----------------------

Differential Pressure Switch

Range	0.5 to 1.4 inches of water
Output Type	Unpowered contact closure



SECTION 2 - INSTALLATION

List of Contents

PARA./DWG. NO.

General Installation.....	2.1
Control Panel.....	2.2
Electrolyzer	2.3
Brine Pump	2.4
Softener	2.5
Saturator.....	2.6
Product Storage Tank.....	2.7
Level Switch.....	2.8
Vent System	2.9
Plumbing Interconnection	2.10
Description of Operation.....	2.11
Illustrations	
Electrolyzer and Control Panel Assembly.....	85.072.110.110
Brine Pump	85.072.110.020
Salt Saturator.....	85.072.110.030
Product Tank - Natural.....	85.072.110.040
Blower Assembly	85.070.111.020
Level Switch.....	85.072.110.050
Differential Pressure Switch	85.070.111.040
Installation Wiring	85.072.130.110
Typical Installation.....	85.072.110.160

2.1 General Installation

- Refer to the illustrations at the end of this section for additional detail and to better understand installation requirements.
- Refer to the Typical Installation illustration at the end of this section for overview of installation and for information on the recommended application of the materials included in the electrical, plumbing, and vent system installation kits.
- The following text contains installation details specific to each component as warranted. Review the installation illustrations at the end of this section for depiction of components, as well as interconnection schematics and drawings.



WARNING: HYDROGEN IS PRODUCED AT THE ELECTROLYZER PANEL ASSEMBLY WHEN THE EQUIPMENT IS IN OPERATION AND SO THE PANEL AND THE AREA OVER THE PANEL SHOULD BE TREATED AS HAZARDOUS (POTENTIALLY EXPLOSIVE ATMOSPHERE). THEREFORE, DO NOT INSTALL ELECTRICAL EQUIPMENT ON OR DIRECTLY ABOVE THE PANEL AND DO NOT TERMINATE CONDUIT ON OR ABOVE THE PANEL (CONDUIT MIGHT SERVE AS A PATH FOR HYDROGEN TO ACCUMULATE AND ENTER AN ELECTRICAL DEVICE).

2.2 Control Panel

- It may facilitate installation to read Section 7 - Control Panel to understand the purpose and interrelation of the components supplied.
- The system has safety interlocks and features in its design and logic of operation—the system should be installed as described in order to ensure safe operation.
- The only point of electrical power connection to the system is at the control panel.

NOTE: Installation must conform to local electrical codes.

- Refer to Section 1 - Technical Data for electrical power requirements.

2.3 Electrolyzer

The bi-polar concentric tube electrolyzer (BPCT) is panel mounted.

The piping assembly is supplied with a sight glass, a temperature and flow (float) switch, as well as valving.

The ventilation line must be tied into the product tank exhaust to prevent accumulation of hydrogen.

2.4 Brine Pump

The brine pump assembly is panel mounted. Remove cover to gain access to mounting holes.

Connect water and brine inlet hoses as shown in the brine pump installation illustration.

- Refer to the Typical Installation illustration for overview of installation of pump and connections to the system.
- As stated in Section 1 - Technical Data, the pump is rated for operation against no more than five psi—meaning that the product tank, brine tank, and brine pump must be installed in reasonably close proximity to one another.

2.5 Softener

Refer to the manual provided with the softener for detailed information on its operation and specifications.

If the incoming water to the water softener has a chlorine residual in excess of 1 mg/l, a pre-filter should be installed. Chlorine residual levels greater than 1 mg/l will reduce the service life of resin contained in the softener.

Install the softener as shown on the Typical Installation illustration.

2.6 Saturator

Install the saturator as shown in the Typical Installation illustration.

Ensure that the interior of the tank is reasonably clean prior to installation.

The tank should be installed on a clean, stable, flat, level surface to ensure that it is stable and will not be damaged when supporting the weight of fluid.

A ceramic filter is installed in the base of the tank, as shown, to separate the brine from the salt.

It is recommended, for best function, that the tank should be filled to no more than about half of its height with salt.

Pipe thread sealant compound, suitable for use with plastic fittings, is preferred for making-up threaded joints as salt will creep past other sealants (such as tape).

To facilitate repair of leaks, test the tank and plumbing for leaks by filling with water before adding salt. Observe that the level control valve operates properly on initial filling with water.

On initial filling with water and salt, at least eight hours are required for the brine to reach near saturation—24 hours is preferable. After the brine is saturated, the brine outlet line should be flushed with saturated brine so that the system is receiving saturated brine during initial operation (does not have to purge unsaturated fluid from hose).

2.7 Product Storage Tank

Install the product tank as shown in the Typical Installation illustration.

Ensure that the interior of the tank is reasonably clean prior to installation.

The tank should be installed on a clean, stable, flat, level surface to ensure that it is stable and will not be damaged when supporting the weight of fluid.

Pipe thread sealant compound, suitable for use with plastic fittings, is preferred for making-up threaded joints as salt will creep past other sealants (such as tape).

To facilitate repair of leaks if required, test the tank and plumbing for leaks by filling with water before adding salt.

2.8 Level Switch

Install the product level switch in the bulkhead fitting at the top of the product storage tank as shown in the Typical Installation illustration. Pipe thread sealant compound, suitable for use with plastic fittings, is preferred for making-up threaded pipe joints as salt will creep past other sealants (such as tape). This switch is supplied with 10 feet of cable to be terminated in the control panel or in a nearby junction box.

2.9 Vent System

The ventilation system is designed to ensure that hydrogen is diluted immediately to below the lower explosive limit (LEL). Exhaust from the product tank must be safely discharged from the surrounding structure in this nominally safe diluted form.

2.9.1 Piping

Refer to the Typical Installation illustration for overview information.

The vent line should be run with three-inch PVC pipe and long radius elbows (to minimize restriction).

Any duct joint that is not well-ventilated and readily observable for inspection should be cemented to be secure and gas-tight. No metal ductwork should be used and the vent discharge should be in a well ventilated area away from objects that might be subject to corrosion from potential salt and residual chlorine-bearing vapors discharged from the vent.

The discharge run, after the tank, should be run straight/vertical, because there will be much condensation in this line and it must be allowed to drain off the orifice plate and back to the tank or it will foul the line.

The run into the orifice must be straight, three-inch pipe for at least 24 inches prior to and after the orifice to ensure proper operation of the orifice.

The vent discharge should be at a point away from likely sources of ignition and at least seven feet above areas of public access and at least 10 feet from points of re-entry (i.e., windows, etc.) to a structure.

The discharge should be located and oriented so that it is not likely to be pressurized by winds, which would cause shut-down due to momentary stalling of airflow. A vertical discharge run with a Tee as termination would accomplish this.

2.9.2 Differential Pressure Orifice

The orifice unit is to be installed in the vent line after the product tank as shown in the Product Tank installation illustration. The axis of the unit should be oriented vertically, as should all of the vent line after the tank to cause condensation to drain back to the tank.

2.9.3 Blower

The blower is powered via the system control panel.

It is best to mount the blower on a wall at about two feet off the floor so that it is not subject to damage caused by moisture or chemicals from spills or cleaning.

2.9.4 Differential Pressure Switch

The differential pressure switch must be mounted with the diaphragm in a vertical position. It is wired to the system control panel and is tapped into the system vent line across the inline orifice unit.

The tubing leaving the taps into the vent line should be graded upward so that condensation will tend to return to the vent line rather than run down toward the switch unit; if fluid blocks the tubing, the switch will not function properly.

2.10 Plumbing Interconnection

NOTE: Installation must conform to local plumbing codes.

Connect the system using materials supplied in the plumbing installation kit as shown in the Typical Installation illustration (other materials may be substituted). Not all items shown in the in illustration are supplied with the kit, so they must be supplied by the installer.

The discharge hose or pipe running from the electrolyzer to the product tank should be graded continuously upward as it runs toward the tank (maximum elevation eight feet) so that there are no traps in the pipe. If this is not practical (as when the outlet from the electrolyzer is above the tank), an intermediate gas release line should be tied into the discharge pipework at its highest point—typically the discharge from the electrolyzer would be connected as shown in the Typical Installation illustration.

2.11 Description of Operation

The OSEC-BPCT (On-Site Electrolytic Chlorination–Bi-Polar Concentric Tube) consists of three principal items: electrolyzer, power supply, and control panel. These have been packaged for convenient wall mounting as a complete system.

2.11.1 Electrolyzer

The electrolyzer consists of a concentric tube cell mounted on a back-board to which softened water and saturated brine are fed. The softened (dilution) water and saturated brine are fed by a twin-bellows pump. The cell is furnished with an electrode assembly containing an anode and a cathode. Electrolyte level is verified by a float-operated reed switch mounted in the top of the cell assembly. A temperature switch is also a part of this assembly.

The anode and cathode are indicated by labels. Electrical connection is made to the terminals by bolts that clamp and secure the cables. The cables are covered with a rubber insulating boot.

The saturated brine and dilution water are fed to the inlet at the bottom of the cell. The two flows meet and mix prior to entry to the cell. When the electrolyzer has filled, as detected by the float switch in the cell, and other operating permissives are satisfied, DC power to the electrolyzer is switched on and electrolysis is started.

The electrolyte flows through the cell where it is reacted to form product and is then discharged to the product tank. The product tank must be configured so that the maximum level in the tank is not higher than the height of the inlet to the product tank.

The OSEC product pipework should rise continuously from the electrolyzer to the product tank (maximum 1.0 m head). This is to ensure that no hydrogen traps can form in the pipework. If this is not feasible in the OSEC-BPCT installation, a separate vent must be taken from the electrolyzer and piped to the air discharge of the hydrogen dispersal system or into the top of the product tank, as shown in the Typical Installation illustration.

2.11.2 Power Supply

The power supply is controlled by a 0 to 100%, five-volt PWM (pulse width modulated) signal from the microcontroller. The power supply has a shunt that gives a mV per Amp signal for the microcontroller to

monitor that indicates current. The power supply has an output current limit that prevents over-currents greater than 110% in the event of a low impedance load condition. The power supply is provided in the control panel enclosure.

2.11.3 Control Panel

Refer to Section 7 - Control Panel for a complete description of the functions of the system control panel.

2.11.4 Other Requirements

For normal operation the OSEC-BPCT requires the following essential components:

- **Water Softener**

This provides a softened water supply to the salt saturator to create the brine supply to the electrolyzer and the dilution water supply to the electrolyzer. For optimum operation of the electrolyzer and maximization of the life of the cell assembly, the hardness of the water entering the electrolyzer (both dilution and brine feeds) must not exceed 17 mg/l.

Because the hardness of the water feed to the electrolyzer is critical to efficient operation and the lifetime of the anodes, USF/W&T recommend that the hardness of the softened water supply is monitored weekly (as a minimum) to ensure that hardness does not exceed the recommended minimum. In order to comply with the anode warranty, USF/W&T also require that a monthly record of operational parameters is kept by the Operator. This establishes a baseline for the operation of the system and any variance from this baseline should highlight possible degradation in performance requiring further operator or USF/W&T service attention.

If the chlorine content of the water supply to the softener is in excess of 1 mg/l (1ppm) and no other supply exists, a carbon filter should be fitted to the supply to remove the chlorine and protect the resin. Regular cartridge replacement will be required, the frequency depending on the chlorine content of the feed water.

- **Salt Saturator**

The saturated brine solution is produced by passing softened water through the salt saturator. This is a plastic tank containing commercial

salt, suitable for manual loading (via bagged salt). The salt specification is outlined in the Anode Warranty. The recommended grade of salt for OSEC systems is solar salt with impurities no greater than specified in the Anode Warranty.

The softened water enters the tank at high level via a float-operated valve. Saturated brine is removed from the bottom of the tank through a ceramic filter that prevents undissolved solids passing out of the saturator tank into the brine pump suction line. As a result, the water passes through the bed of salt, becoming saturated by the time it leaves the tank. The saturated brine is removed from the tank by the brine pump. The dilution water is also drawn from a fresh water well mounted in the salt saturator.

It is recommended that a calibration column/sight glass be mounted in the pipeline from the saturator to the brine pump. This indicates the level of liquid in the saturator and enables the brine flow rate to be calibrated during commissioning of the system.

- **Air Blower**



WARNING: IT IS CRITICAL FOR SAFE OPERATION OF THE ELECTROLYZER THAT HYDROGEN IS REMOVED FROM THE TANK AND DISPERSED INTO A SAFE AREA.

The air blower is a safety critical component of the OSEC system. As noted above, the main by-product in the electrogeneration of NaOCl is hydrogen gas. (For every kilogram of chlorine equivalent produced, there is 9ft³ (or 9 cu.ft.) of hydrogen produced.) Mixed with air (oxygen), this results in a potentially explosive mixture. Therefore, in addition to removing sources of ignition from the vicinity of the electrolyzer, it is essential that the hydrogen is dispersed/diluted to prevent build-up of the explosive gas mixture.

The lower explosive limit (LEL) for hydrogen/air mixtures is 4% in air. To minimize the risk of explosion, the hydrogen must be diluted to less than 25% of the LEL. This achieved by blowing air into the head space of the product storage tank and exhausting the diluted hydrogen/air mixture to a safe zone outside the building where the OSEC installation is located.

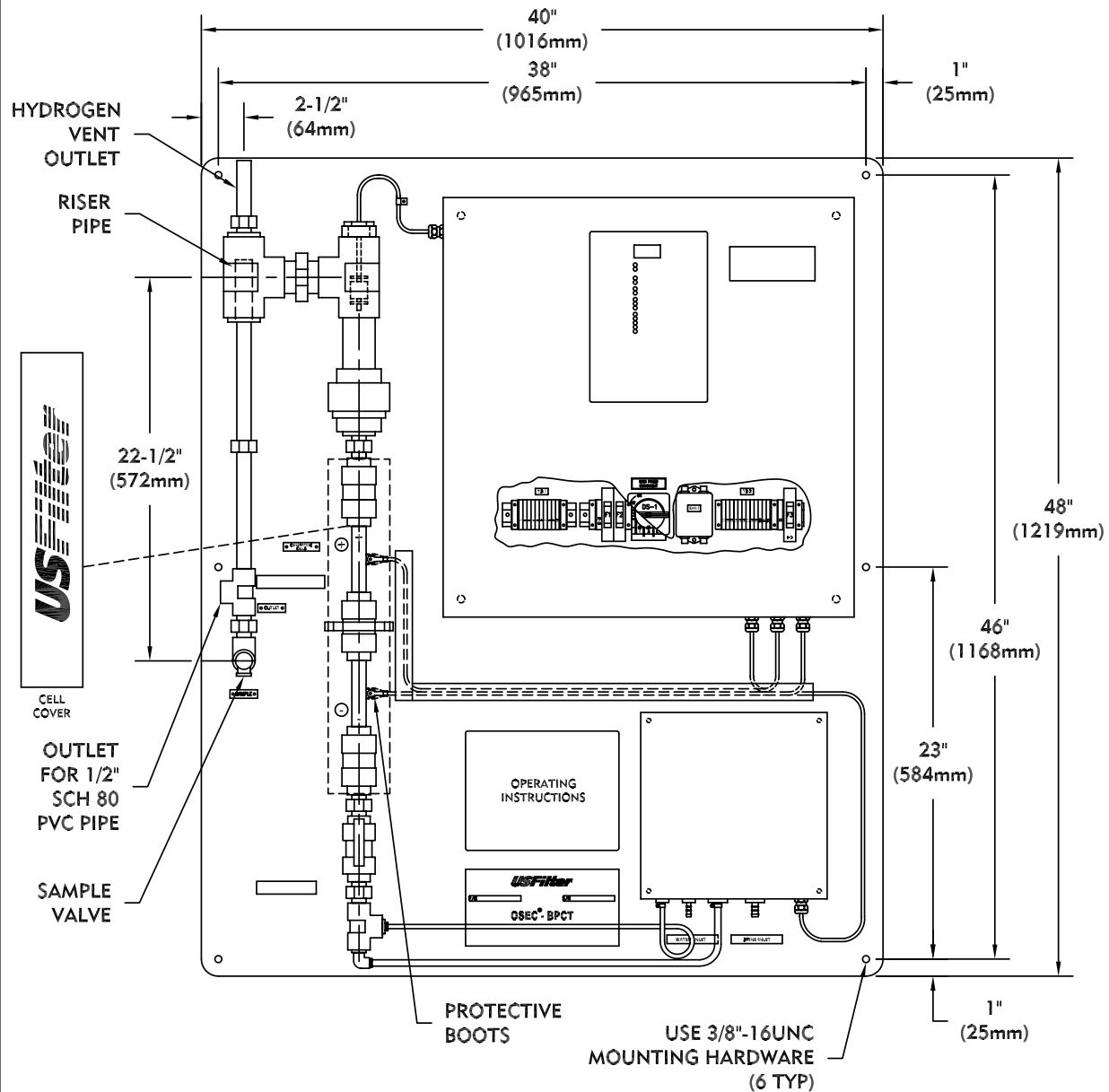
The pipe on the exhaust side of the tank is fitted with a differential airflow switch and orifice plate. On this installation, the air flow generates a differential pressure across the orifice, which is monitored by the differential pressure switch. The status of the differential pressure

switch is monitored at the control panel and the loss of differential pressure (absence of air flow) results in the shut down of the system.

- **Hypochlorite Storage Tank**

The storage tank is fitted with level switches. During normal operation product level will be between L3 and L4.

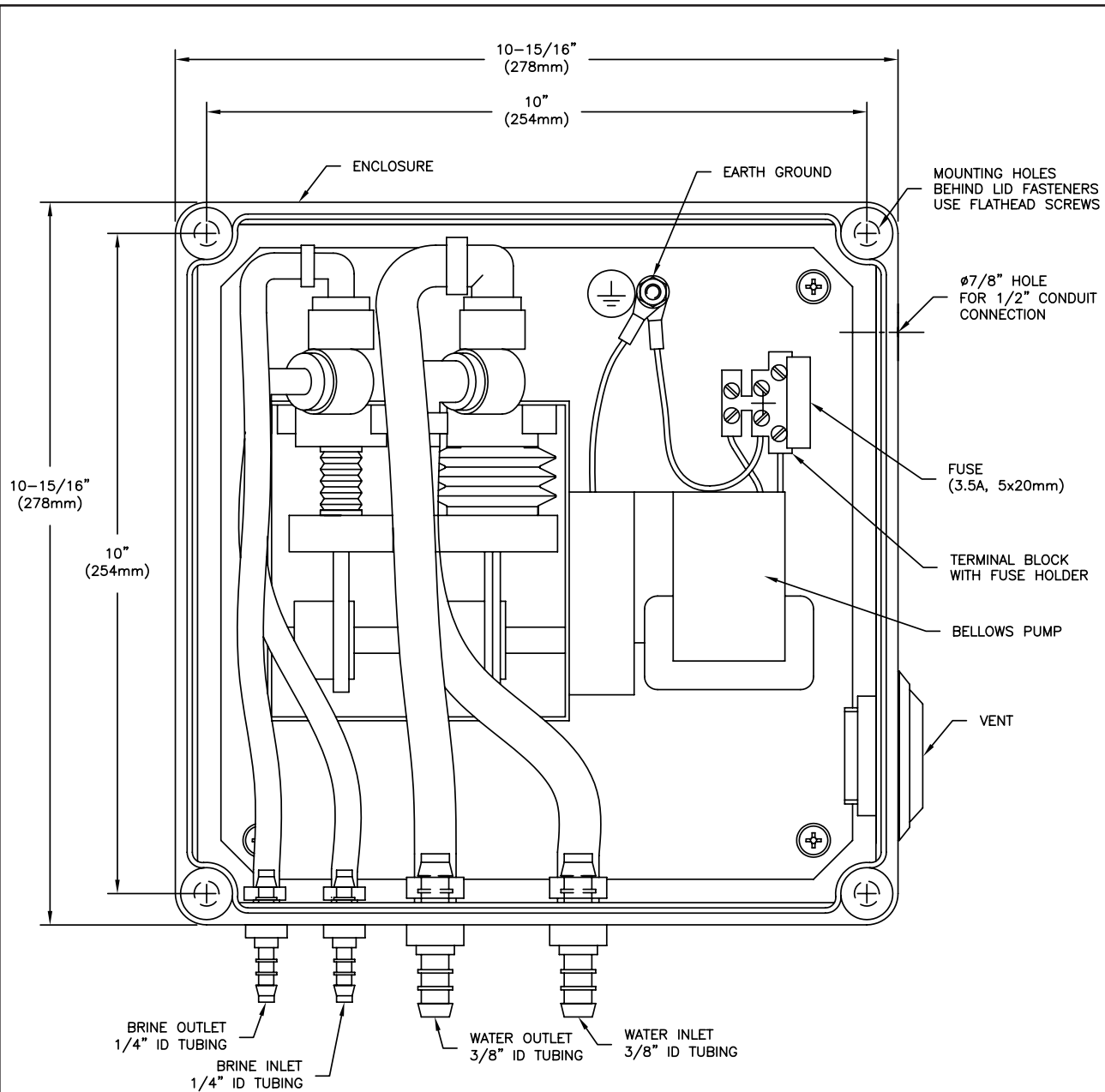
The storage tank is also equipped with an overflow drain and anti-siphon vent assembly.



OSEC®-BPCT SYSTEM - ELECTROLYZER AND CONTROL PANEL ASSEMBLY

85.072.110.110

ISSUE 0 5-03

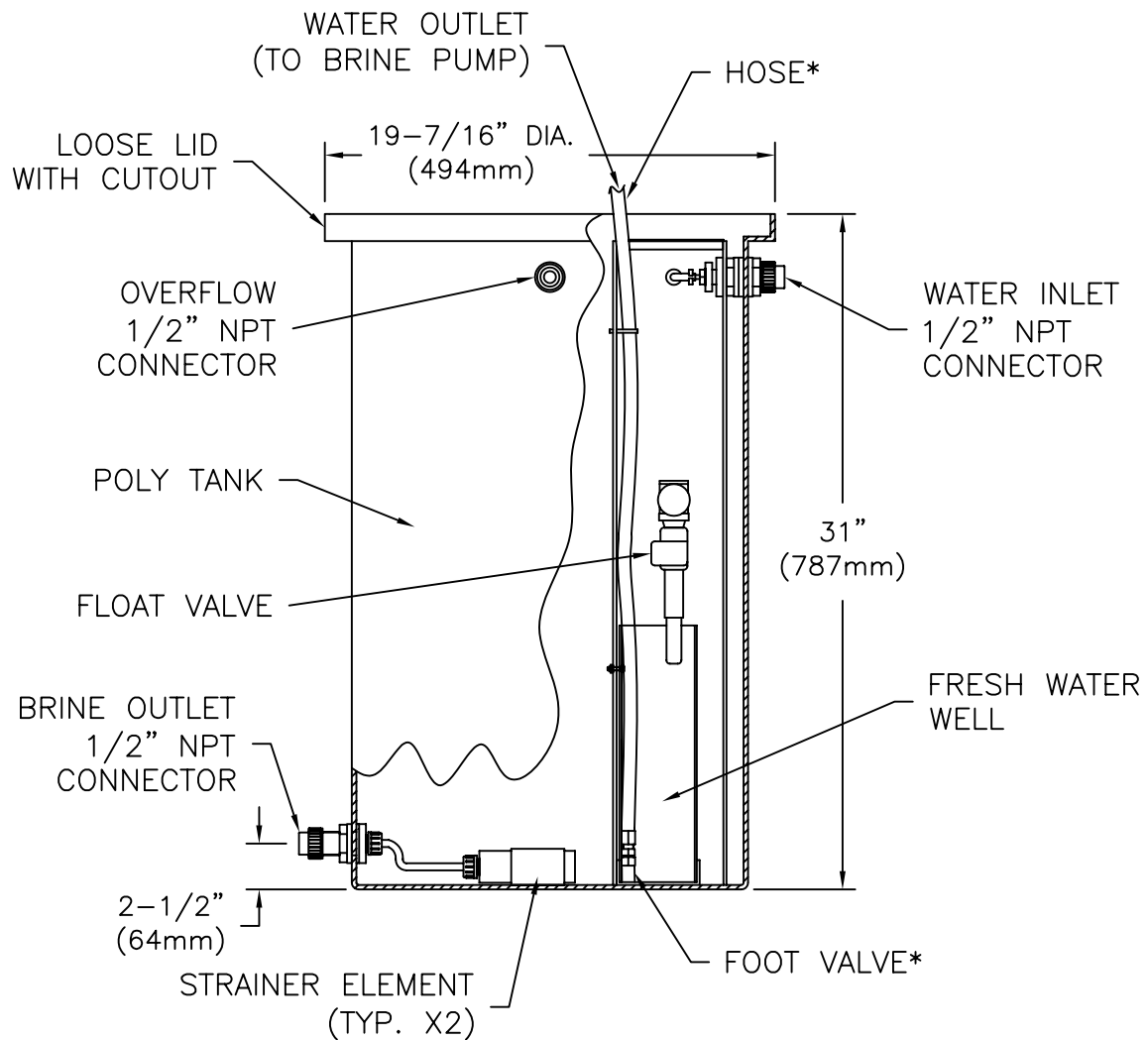


POWER: 230VAC, 60Hz (VIA SYSTEM CONTROL PANEL)

OSEC®-BPCT SYSTEM - BRINE PUMP (AAB6224)

85.072.110.020

ISSUE 1 7-04



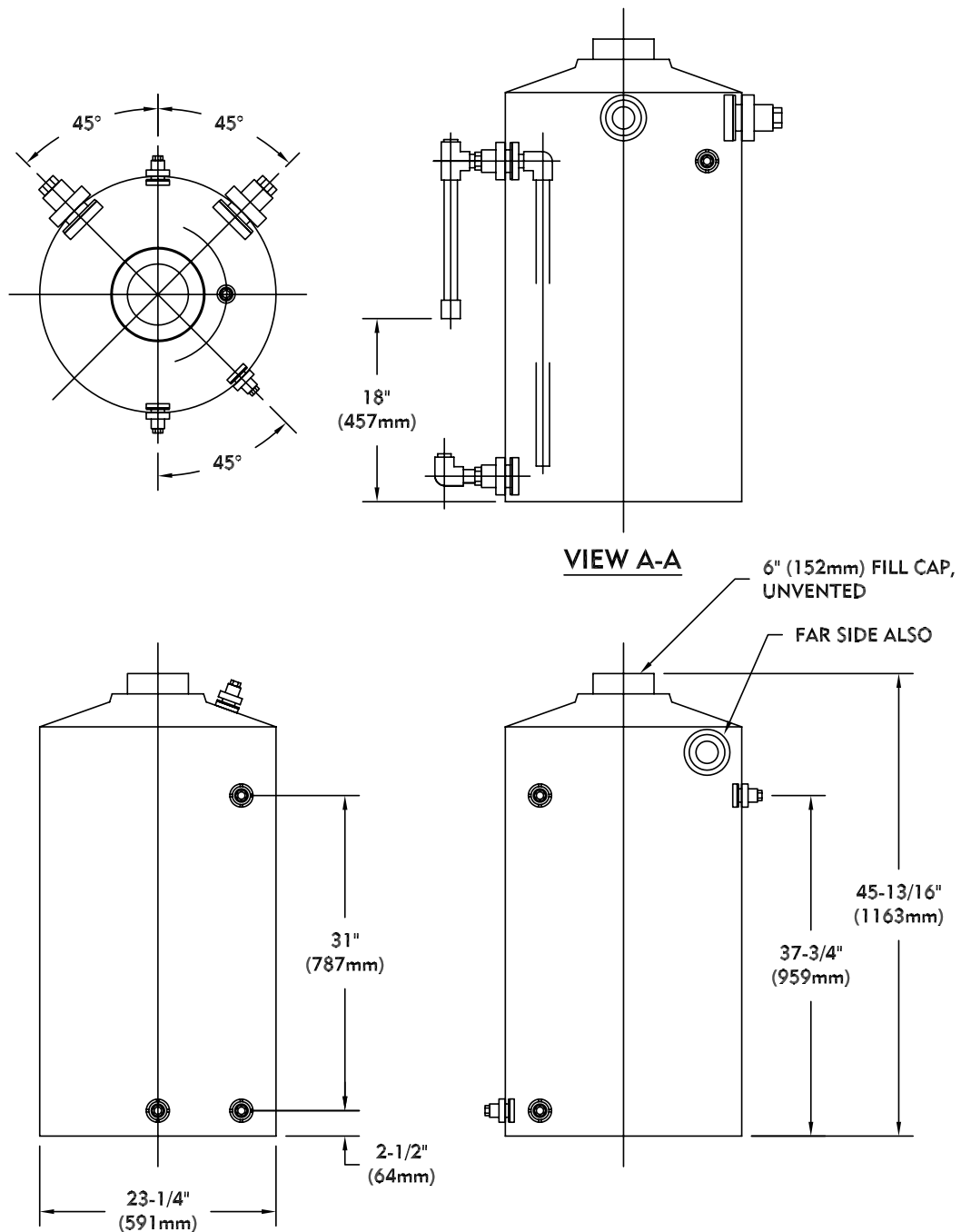
NOTES:

- *1. CONTINUED IN INSTALLATION PLUMBING KIT
- 2. NOMINAL CAPACITY IS 200LBS.

OSEC®-BPCT SYSTEM - SALT SATURATOR (AAB6236)

85.072.110.030

ISSUE 1 7-04



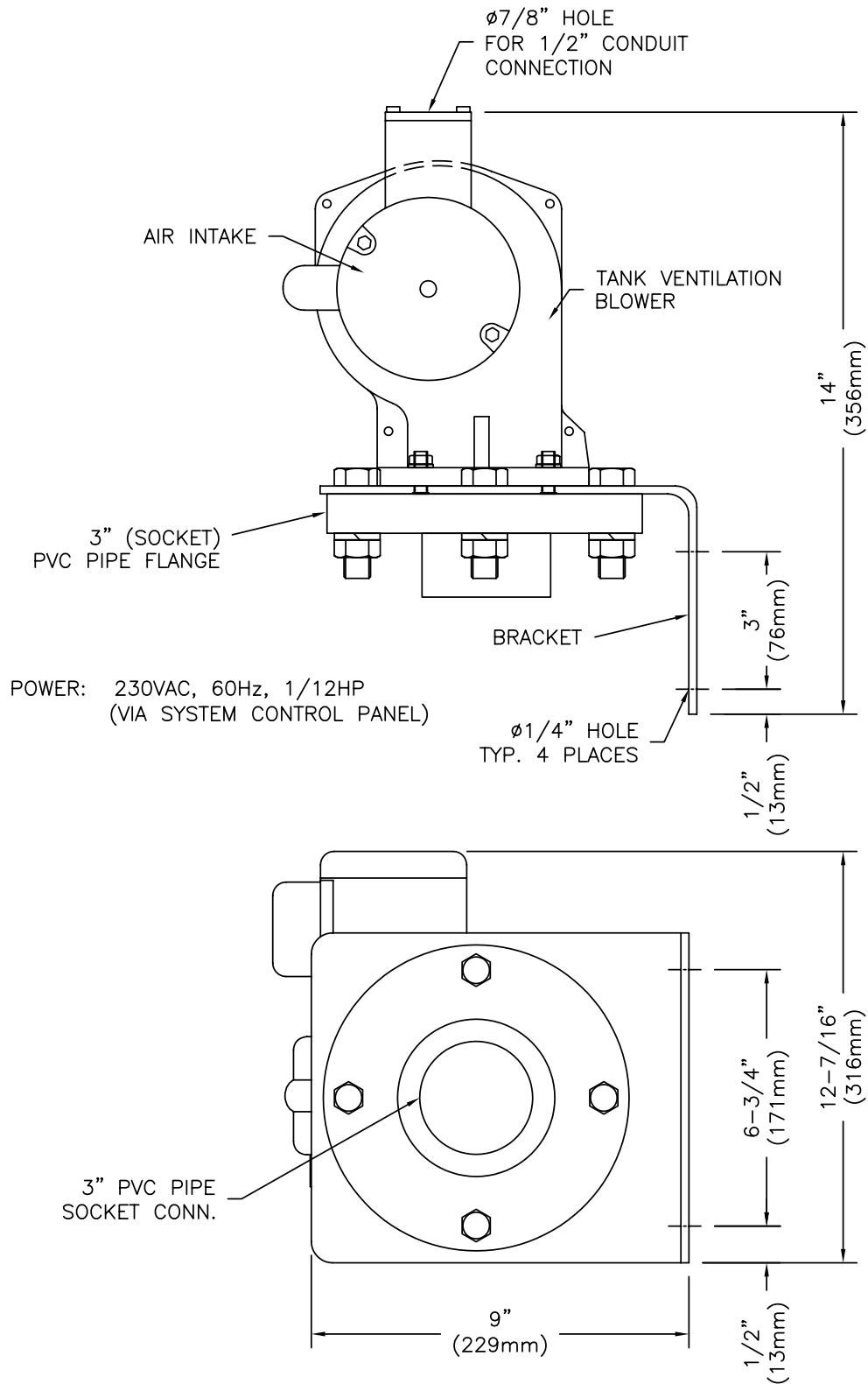
NOTES:

1. TANK: LINEAR HDPE, 65 GALLON CAPACITY
2. SEALS: EPDM
3. FITTINGS: PVC, TYPE 1, GRADE 1
4. SUITABLE THREAD SEALANT COMPOUND (NOT TAPE) TO BE USED ON ALL THREADED CONNECTIONS.
5. APPLY CEMENT/ADHESIVE TO ALL SOCKETED CONNECTIONS

**OSEC®-BPCT SYSTEM
- NATURAL COLOR PRODUCT TANK**

85.072.110.040

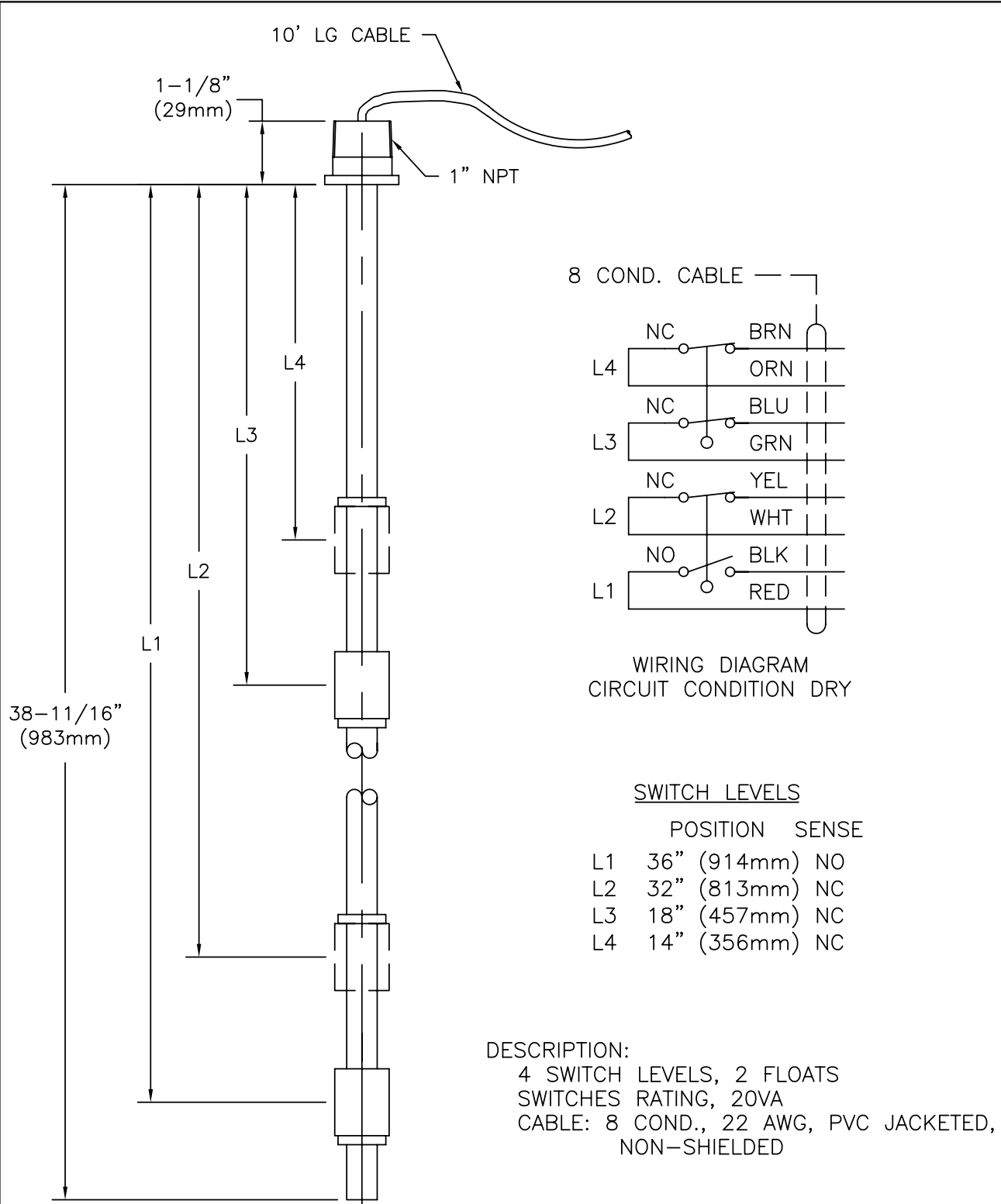
ISSUE 0 11-02



OSEC®-BP SYSTEM - BLOWER ASSEMBLY - TYPICAL INSTALLATION

85.070.111.020

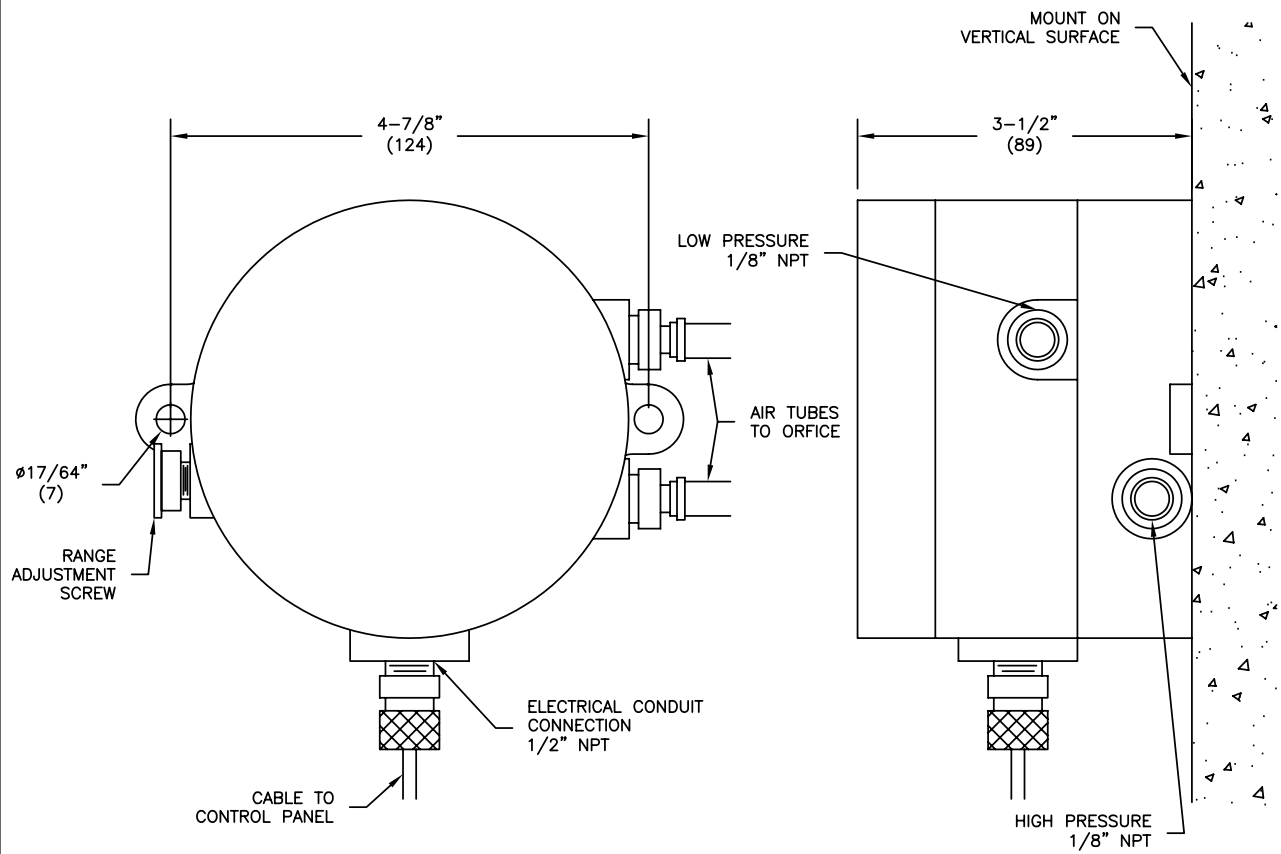
ISSUE 1 6-01



OSEC®-BPCT SYSTEM - LEVEL TRANSDUCER - TYPICAL INSTALLATION

85.072.110.050

ISSUE 0 9-02

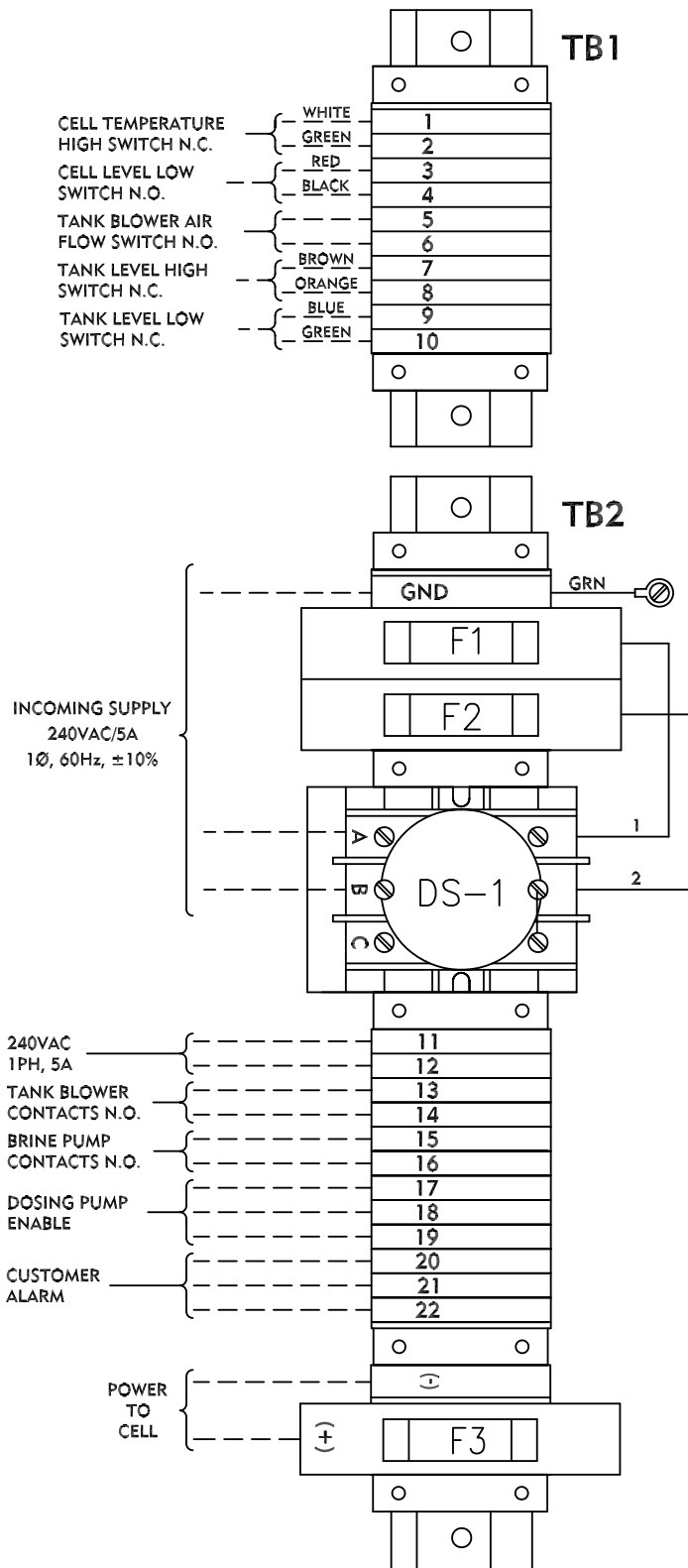


NOTE: DIFFERENTIAL PRESSURE ACTUATION POINT TO BE SET AS DESCRIBED IN INSTRUCTION MANUAL.

OSEC®-BP SYSTEM - DIFFERENTIAL PRESSURE SWITCH - TYPICAL INSTALLATION

85.070.111.040

ISSUE 0 1-01



OSEC®-BPCT SYSTEM - INSTALLATION WIRING

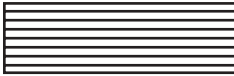
85.072.130.110

ISSUE 0 5-03



1.) ALL PIPING, VALVES AND FITTINGS NOT SPECIFICALLY LISTED ON BILL OF MATERIAS ARE NOT FURNISHED BY USFILTER/WALLACE & TIERNAN.

ISSUE 0 7-04



SECTION 3 - OPERATION

List of Contents

	PARA. NO.
Preparation for Operation	3.1
Checking for Leaks	3.1.1
Fill Brine Tank With Salt and Water and Let Stand	3.1.2
Preparation of the Softener	3.1.3
Check Safety Interlocks	3.1.4
Set Brine and Water Feedrates	3.1.5
Start-Up	3.2
Routine Operation	3.3
Operating Instructions	3.3.1
Check Salt Reserve in the Saturator	3.3.2
Check Hardness	3.3.3
Check Product Strength	3.3.4
Chlorine Production	3.3.5
Checking for Leaks	3.3.6
Checking Operating Voltage and Current	3.3.7
Saturator	3.3.8
Responding to Alarms	3.3.9

3.1 Preparation for Operation

Ensure that installation plumbing and electrical work are complete before beginning operation.

3.1.1 Checking for Leaks

With all connections made and before adding salt to the saturator, each of the elements of the system can be tested for leaks as follows (this might have been done during installation):

- a. Close the shut-off valve at the inlet to the saturator.
- b. Apply water pressure (see Section 1 - Technical Data for supply limits) and check for and correct leaks in the softener and plumbing up to the shut-off valve.
- c. With any unmade connections plugged, run water into the saturator under control of the level control valve and into the product tank via temporary hose—run until full.
- d. Run the brine/water pump to fill the electrolyzer (the bellows stroke adjustments may be set to maximum stroke to speed this process).



CAUTION: Do not apply pressurized water supply to the electrolyzer inlet—this might result in damage to the internal components of the cells due to excessive pressure drop across (excessive flow through) the cells.

- e. Observe that the saturator level control valve shuts off fully. Once the system is full of fluid, let stand for observation for several hours—small leaks may take time to become evident.
- f. Once the system is tested and leaks resolved, drain out the water—the electrolyzer must be primed with a correct mixture of brine and water before starting operation.

3.1.2 Fill Brine Tank With Salt and Water and Let Stand

Once it is ensured that the fitted saturator does not leak and that the level control valve and internal fittings function properly and do not leak, the saturator may be filled to the recommended level (about half full) with salt. It is important to ensure against leaks before adding salt because it is messy and difficult to remove wet salt to resolve leaks.

After adding salt and allowing the tank to fill with water, let stand for at least eight hours to allow the brine to saturate.

After the brine has saturated, flush the brine discharge line briefly with brine to ensure that the line is filled with saturated brine. Flushed brine may be returned to the saturator.

3.1.3 Preparation of the Softener

Refer to the manual supplied with the softener for detailed instructions on the installation, operation, and service of the water softener.

3.1.4 Check Safety Interlocks

NOTE: Refer to Section 7 - Control Panel for information regarding the operation and monitoring of the system via the control panel interface.

Perform the following checks with DC power supply isolated from the electrolyzer and with the control panel powered.

- **Cell Level**

The cell level (/temperature) switch is mounted on the electrolyzer at the outlet and is a normally open float type switch—closing when the fluid level reaches the actuation level. Prior to beginning operation of the system, the function and field wiring of this switch should be checked by observing the reported state of the switch (open or closed) on the control panel when the electrolyzer is drained down (or empty) and then is filled to discharge by the brine/water pump. This verifies that the switch is operating (not damaged or stuck) and is correctly wired to the control panel input.

- **Cell Temperature**

The cell temperature (/level) switch is incorporated in the level switch assembly mounted at the electrolyzer outlet. This is a “normally” closed switch—opening when the measured temperature rises above 122° F (50° C). It is sufficient to break the temperature switch connection in the junction box on the electrolyzer panel while observing the reported state of the temperature switch.



CAUTION: Do not test the temperature switch in hot water. The switch is made of materials that are readily distorted and damaged at temperatures not much greater than the actuation temperature. The switch function has been tested by the supplier.

- **Airflow Switch**

The airflow (differential pressure) switch is tied into the vent line, monitoring the airflow across the inline orifice unit.

The normally open contacts of the switch are connected to the system control panel. Refer to the wiring schematic in Section 2 - Installation. When properly adjusted, the normally open contacts will close when the blower is operating and open when the blower is not operating. If the airflow switch input to the control panel does not open when the blower is off, the system will alarm with a vent system failure.

Make adjustments after the installation of the vent system is complete and check that all openings, from which air might escape, are closed.

- **Adjusting Airflow Switch Setting**

Adjustment of the Airflow switch is made by turning the set point screw at the top of the switch unit—clockwise to increase the set point and counter-clockwise to decrease the set point. The full range of adjustment is approximately 30 turns. The switch is set so that a substantial decrease in airflow will shut-down the system. The response time of the switch is in the range of 15 to 30 seconds, so there is some lag in response to adjustments.

With the blower operating, verify that the airflow from the vent outlet is strong (i.e., normal). Check for and correct any substantial openings in the ventilation system (including the storage tank) from which a major portion of air might escape (small leaks are not a safety concern as the gas flow through the vent line is nominally a safe ratio of hydrogen in air though bearing condensation and an odor of chlorine) and for blockages.

With the airflow normal, adjust the switch setting until the switch contact changes state—clockwise until it opens or counter-clockwise until it closes. Then adjust the setting more gradually (one turn at a time with pauses) until it changes state again. Then again in half turns with pauses to watch for change of state. This should leave the switch—open or closed—within one half-turn of the actuation point.

Finally, turn the switch three full turns clockwise to close the switch and allow some margin for moderate decrease in airflow while in operation.

■ **Testing Airflow Switch Function**

Check that the switch input is open when the blower is off.

Operate the blower and observe that the switch closes within 30 seconds of start of blower operation.

With the blower operating and switch closed, block the blower inlet and observe that the switch opens.

• **Set Brine and Water Feedrates**

The brine/water pump is a reciprocating motion, dual “head” (bellows) pump with separate adjustment for stroke of the brine feed head and water feed head. The stroke is increased to increase feedrate and decreased to decrease feedrate; the pump speed is fixed.

The stroke adjustment is made by turning an adjusting screw (the Phillips-head screw not the set screw) on the eccentric on the pump shaft. The screw is turned clockwise to increase the stroke or counter-clockwise to decrease the feedrate. An indicating needle shows the stroke setting relative to range of adjustment but cannot be used to estimate feedrate. The feedrate must be measured while under operating conditions by measuring delivered volume at the outlet while drawing brine and water from the saturator. Reasonable effort should be made to adjust the brine and water feedrates accurately, requiring several iterations of adjustment and measurement, after which the feedrate will remain stable.

In summary, the feedrate is set by disconnecting the discharge hoses at the tee where the brine and water are combined, and separately measuring the volume of brine and water discharged over a measured time period. The flowrate is then calculated as gallons per minute or liters per minute. Each of the settings can be adjusted with reference to the initial setting versus measured feedrate versus desired feedrate, and readjusted and tested until feedrates are satisfactory. Refer to Section 1 - Technical Data for proper feedrate settings with regard to system capacity.

3.2 Start-Up

Having prepared the system for operation, as described in the previous paragraphs, start-up is simply a matter of turning the system on. Energize the system by turning the disconnect switch to the ON position. After a brief self-test, it will begin operation.

3.3 Routine Operation

On start-up and during initial operation (first month) it is critical to ensure that set-up parameters are correct. Check that the system starts and stops as expected. Also check that the electrolytic voltage and current are as specified, and that the softener and bellows pump are performing correctly. Once operation is proven and stable, it is the nature of the equipment that operation is stable and reliable - it may be sufficient to maintain salt level in the saturator, watch for leaks or visible deterioration and monitor for shut-downs due to alarms.

Preventive maintenance is generally limited to replacement of pump bellows every six months (or at least annually), possible replacement of hose if it shows sign of deterioration, and acid cleaning of the cell.

Monitoring of salt usage, hardness, product strength, and hours of operation will provide a record of performance and help to anticipate the need for service.

3.3.1 Operating Instructions

3.3.1.1 Quick Start

Quick start assumes that the complete system is installed, the Brine Tank is charged with salt, and the system is ready to operate.

- Prior to Starting check for the following:
 - Sample valve closed.
 - Inlet valve open.
 - Visual check that the gas vent is unobstructed.
- Turn the main power switch on.

3.3.1.2 Control Panel

When normally operating, the Electrolyzer Control Panel monitors system performance and controls the:

- Tank Blower
- Brine Pump

- Product Storage Tank fill cycle
- Electrolyzer Cell power.

During Normal Operation, the Control Panel observes the following conditions and controls the system accordingly:

- After the product storage tank drains to the low level, the control panel initiates a fill cycle. During the fill cycle the storage tank blower, brine pump, and electrolyzer cell are energized while generating sodium hypochlorite. Once the product storage tank is full, the brine pump, blower, and electrolyzer cell will be de-energized after a purge and vent period. High- and low-level switches are monitored by the control panel to initiate and terminate fill and drain cycles as necessary.
- The product storage tank blower must be operating. This is checked by means of an explosion proof airflow switch at the tank airflow outlet. If the storage tank blower is not running the brine pump will run but the electrolyzer cell will not be allowed to generate sodium hypochlorite.
- The electrolyzer cell must be full of brine solution to generate sodium hypochlorite. The electrolyzer cell level is monitored by means of a float level switch. If the cell level is low the storage tank blower and brine pump will continue running but the electrolyzer cell will not be allowed to generate sodium hypochlorite.
- The electrolyzer cell must have adequate flow of brine solution to generate sodium hypochlorite. The brine solution flow rate is monitored by means of a cell high temperature switch in the flow stream. The electrolyzer cell and brine solution in the cell heats up when there is inadequate flow. If there is a high temperature condition the storage tank blower and brine pump will continue to operate but the electrolyzer cell will not be allowed to generate sodium hypochlorite.

3.3.1.3 Monitoring Normal Operation

- System Power On - The System Power On LED will be illuminated.
- Cell Power On - The Cell Power On LED will illuminate during the Product Storage Tank fill cycle. The lamp will be off when the electrolyzer cell is idle.
- Bubble Sight Glass - Many streams of bubbles will be present in the Sight Glass while the Electrolyzer Cell is generating sodium hypochlorite.

- Alarm LEDs - Blower Air Flow Low, Cell Voltage High, Cell Current Low, Cell Temp High, and Cell Level Low will all be off during normal operation.
- Electrolyzer Voltage and Current - When the Electrolyzer Cell is generating sodium hypochlorite the current is regulated at 22.5 amps depending on brine solution and Brine Pump flow rate settings. Voltage will vary between 8 and 14 Volts.
- Sample Valve - A sample of sodium hypochlorite can be taken at the Sample Valve while the Electrolyzer Cell is energized to check for sodium hypochlorite concentration.

3.3.2 Check Salt Reserve in the Saturator

The saturator should not be allowed to be depleted of salt. This will result in loss of production and shut-down. Keep the saturator topped up to recommended level so that a reserve of salt is available to maintain saturation.

3.3.3 Check Hardness

As stated in Section 1 - Technical Data, regarding Water Quality, the total hardness of the water supply must be not greater than 17 mg/l (one grain per gallon). Hardness above this level will result in scaling within the cell assembly(s), which will reduce the production of the system or may reduce the production of the electrolyzer and can result in a hazardous condition due to interference with the operation of the electrolyzer level switch.

To prevent fouling of the cells by scale, the performance of the softener should be monitored by making regular measurements of water hardness in the supply to the system. As described in paragraph 3.1, Preparation for Operation, the softener is programmed for regeneration at regular time intervals and the time-of-day of regeneration may be set on the softener so that it is possible to make regular checks of the hardness shortly before regeneration (when the softener capacity is nearly expended), which verifies regeneration function and frequency.

3.3.4 Check Product Strength

The first step in determining system production is the measurement of product strength.

Hypochlorite strength is determined by conducting a titration on a sample taken from the sample valve at the hypochlorite outlet manifold of the electrolyzer or from the product tank. If the sample is to be taken from the cell discharge, the system must be allowed to run for at least 30 minutes before taking the sample, and must be running while the sample is taken. The following formulae will enable the efficiency to be calculated.

The reagents required to determine hypochlorite strength include potassium iodide, sodium thiosulphate solution (0.1N), and acetic acid (50%) or citric acid crystals.

Procedure for testing product strength:

- a. Place approximately 50ml distilled water in a flask.
- b. Add 1 gram potassium iodide.
- c. Add 20ml of 50% acetic acid or approximately 10 grams of citric acid to the flask.
- d. Using a pipette, take 5ml of product sample and place it in the flask.
- e. Titrate with sodium thiosulphate solution, slowly adding the solution in small, measured doses until all the color has been removed. Note the quantity of solution used in ml. For a more accurate end point determination, add one or two drops of starch solution or a similar indicator to the cleared solution and then add more thiosulphate until the solution clears again, noting the quantity of thiosulphate used.
- f. Calculate the product strength as follows:

$$T \times 709.2 = \text{mg/l (or PPM) chlorine}$$

(T = Titration result in ml)

Nominal value is 8000 mg/l.

3.3.5 Chlorine Production

Having determined the strength in mg/liter, the chlorine per hour rate can be calculated:

$$\text{Total flow (water and brine) GPH} \times \% \text{ chlorine} \times 8.345 = \text{lbs./hr}$$

$$(\% \text{ chlorine} = \text{mg/L Cl}_2 \div 1 \times 106)$$

3.3.6 Check for Leaks

Watch for and repair leaks that develop or become apparent over time and for damaged or deteriorating piping or hoses. If allowed to continue unchecked, leaks may cause premature deterioration of the equipment or site due to corrosion or may release hazardous chemicals.

3.3.7 Check Operating Voltage and Current

If routine checks are being made or logged, it is recommended to monitor the operating voltage and current indicated at the control panel. Voltage will increase with decreasing supply water temperature, brine feed rate, or brine concentration

3.3.8 Saturator

- **Monitor Salt Level**

Ensure that there is always an excess of salt in the saturator—fill to the indicated recommended level.

Allowing the salt to be depleted will result diminished performance and may cause shut-down with alarm, requiring that the salt be added and time allowed for saturation and the system re-primed with the proper dilution of brine.

- **Log Salt Usage**

Logging the salt usage versus run hours on the system is an ultimate measure of performance. Usage is nominally about 3.5 pounds of salt per pound of chlorine produced. The system should be producing a nominal amount of chlorine per hour of operation.

- **Check Brine Concentration**

The saturator is designed to produce saturated brine (approximately 2.5 pounds of salt per gallon of solution), which has a specific gravity of approximately 1.2. Specific gravity can be measured using a hydrometer; saturation of brine (0 - 100%) may be measured directly with a hydrometer made for the purpose (possibly described as a brineometer or a salinometer). It is far simpler to use the more purpose-made brineometer. Detailed instructions for use would be included with the device, but, in short, it involves floating the brineometer in a sample of saturated brine and noting the point on the scale (the depth) at which the brineometer floats.

- **Observe Operation**

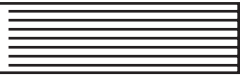
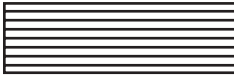
Occasionally observe the system while operation to see that any anomaly in operation is not being missed due to lack of alarm or lack of other evidence of a problem.

3.3.9 Responding to Alarms

If the system has shut down with an alarm, it will be indicated on the control panel display.

An output is available for remote indication of an alarm—for permissive to a remote alarming device or for connection to an alarm telemetry system.

Refer to Section 7 - Control Panel for discussion of probable causes of alarms.



SECTION 4 - ACID CLEANING PROCEDURE



WARNING: THE ACID CLEANING PROCEDURE REQUIRES THE HANDLING OF BOTH CONCENTRATED AND DILUTE HYDROCHLORIC ACID. PERSONNEL SHOULD REFER TO THE SAFETY WARNINGS AT THE BEGINNING OF THIS MANUAL AND TO MANUFACTURER'S HAZARD INFORMATION TO BE MADE AWARE OF THE SAFE HANDLING PROCEDURES FOR THESE MATERIALS. DISPOSAL OF THE HYDROCHLORIC ACID USED IN THE CLEANING PROCEDURE MUST BE CARRIED OUT ACCORDING TO LOCAL REGULATIONS. UNDER NO CIRCUMSTANCES SHOULD THE ACID ENTER A DRAIN WHERE SODIUM HYPOCHLORITE MAY BE OR HAVE BEEN DISPOSED, AS CHLORINE GAS WILL BE LIBERATED.

When a consistent decrease (~10%) in the equivalent Cl_2 production rate is observed in a series of determinations (over several weeks), this is an indication that there is a build-up of deposits or other factors are negatively affecting the electrolyzer. The first step to remedy this is to acid clean the electrodes. If necessary, refer to USF/W&T for advice on the acid cleaning.

Prior to carrying out any work on the electrolyzer, ensure that the disconnect switch on the control panel is set to OFF and the power supply is also switched off at the main power supply. Acid cleaning is then carried out as follows:

- a. Slide the insulation boot off both DC power terminals on the electrolyzer.
- b. Unscrew both of the DC power connectors and remove the cables; retain bolts.
- c. Disconnect brine/water pump connections.
- d. Flush the cell with soft water until all sodium hypochlorite is removed.
- e. Disconnect product line pipework. Install the acid clean return pipework assembly to the outlet of the electrolyzer. Return the tubing from this line to the container of hydrochloric acid.



CAUTION: Ensure that any tubing cannot become detached once acid cleaning has started.

- f. Feed a 10% hydrochloric acid solution into the electrolyzer assembly.
- g. Once the bubbling action in the cell has ceased, flush and drain twice with soft water.
- h. Disconnect the acid clean return pipework assembly from the outlet of the electrolyzer. Reinstall brine/water pump lines and the product line to the storage tank.
- i. Reconnect the DC power cables.

NOTE: Particular care must be taken when reconnecting the DC power cables to ensure that polarity is correct. Contacting surfaces must be clean and fully tightened to prevent excessive voltage drop.

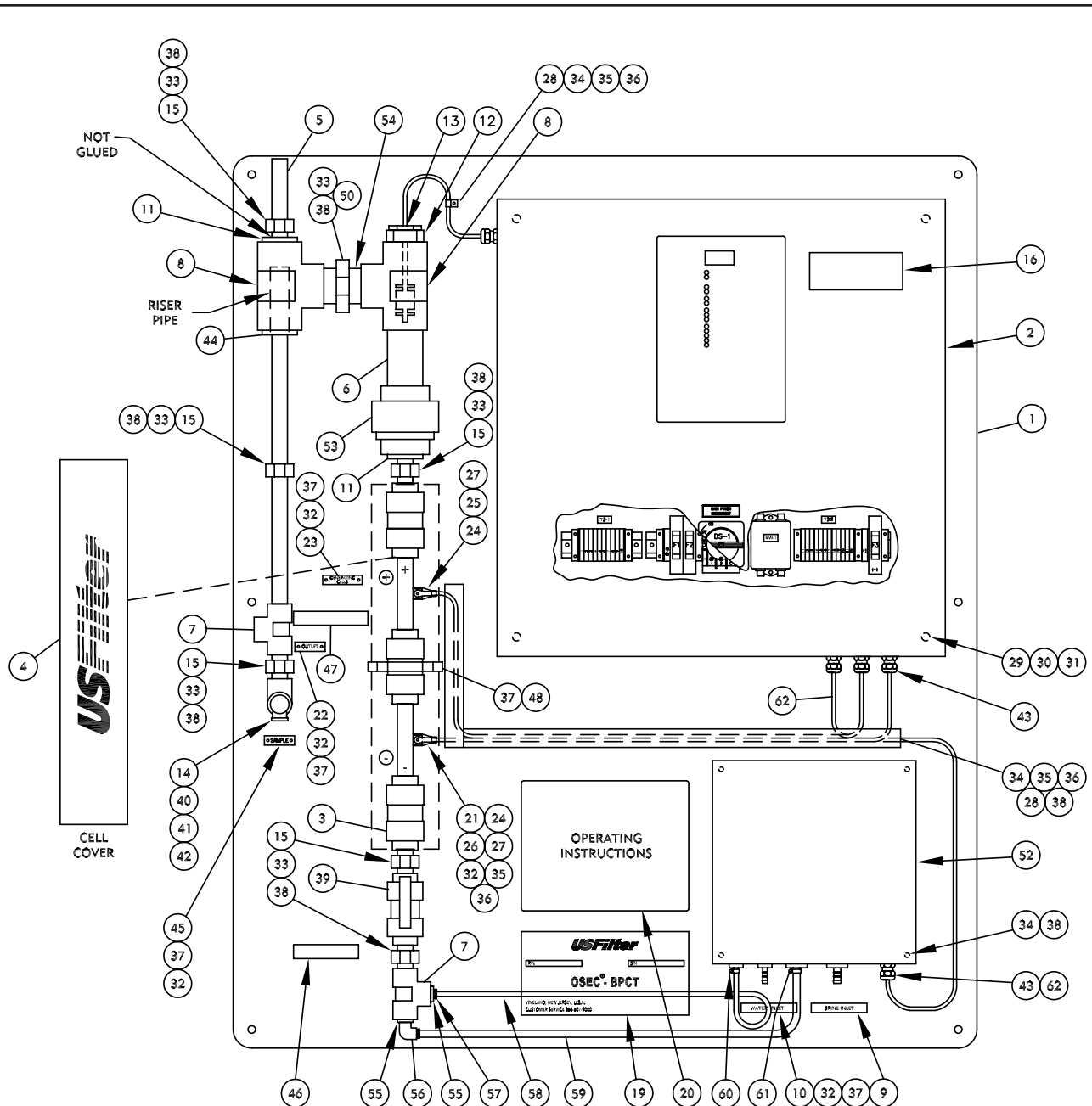
NOTE: Acid cleaning may be carried out using a USF/W&T acid cleaning kit (refer to USF/W&T for information).



SECTION 5 - ILLUSTRATIONS

List Of Contents

	DWG. NO.
Parts	
Electrolyzer Assembly	85.072.000.110A-C
Brine Pump	85.072.000.020A&B
Salt Saturator.....	85.072.000.030A&B
Ventilation Hardware Kit	85.070.000.110
Electrical Hardware Kit	85.070.000.115
Plumbing Hardware Kit	85.070.000.120
Control Panel.....	85.072.170.210A-D
Control Panel Schematic	85.072.155.210



NOTE: FOR PARTS LIST, SEE DWG. 85.072.000.110B&C.

OSEC®-BPCT SYSTEM - ELECTROLYZER PANEL - PARTS

85.072.000.110A

ISSUE 0 5-03

KEY NO.	PART NO.	QTY.	DESCRIPTION
1		1	REWORK, SYSTEM BASEPLATE, POLYPROPYLENE
2	AAC2906	1	ASSEMBLY, OSEC CONTROL PANEL, 2 LB/DAY, FRP
3	AAC2909	1	CELL ASSEMBLY, MLF50, UNION
4	AAC2912	1	COVER, CELL ASSEMBLY, POLY
5	AAC2915	3FT	PIPE, SCHED.80, 1/2", PVC
6	AAC2918	1FT	PIPE, CLEAR, SCHED.80, 1-1/2", PVC
7	AAC2921	2	TEE, SCHED.80, SOC., 1/2", PVC
8	AAC2924	2	TEE, SCHED.80, SOC., 1-1/2", PVC
9		1	NAMEPLATE, "BRINE INLET", PHENOLIC
10		1	NAMEPLATE, "BRINE OUTLET", PHENOLIC
11	AAC2999	2	REDUCER, SCHED.80, 1-1/2"/1/2", PVC
12	AAB3492	2	ADAPTER, LEVEL SWITCH, 1-1/2", PVC
13	AAB3147	1	SWITCH, LEVEL, PVC
14	AAC2984	1	VALVE, SAMPLE, PVC
15	AAC2993	6	CLIP, PIPE, 1/2", PVC
16	AAB6899	1	LABEL, WARNING
17			CEMENT PVC
18			PRIMER - CEMENT
19		1	NAMEPLATE, EQUIPMENT, LAM
20	AAC2978	1	OPERATING INSTRUCTIONS, LAM
21		2	NUT, HEX, #10-32, 316SS
22	AAC2972	1	NAMEPLATE, "OUTLET", PHENOLIC
23	AAC2969	1	NAMEPLATE, "GENERATING CELLS", LAM
24	AAC2966	2	BOOT, VYL
25		4FT	WIRE, 10# AWG, RED, CU
26		4FT	WIRE, 10# AWG, BLACK, CU
27	AAC2963	2	LUG, RING #10-12, #10 STUD, CU
28	AAC2960	1	CLIP, CABLE, 1/4" NOM., NYL
29	AAC2957	4	SCREW, FH, 3/8-16 X 1-1/4" LG., 316SS
30	AAC2954	4	WASHER, FLAT, 3/8", 316SS
31	AAC2951	4	WASHER, LOCK, SPLIT, 3/8", 316SS
32	AAC2948	10	SCREW, #6-32 X 1/4" LG., 316SS
33	AAC2945	9	SCREW, FH, #10-32 X 7/8" LG., 316SS
34	AAC2942	12	SCREW, PAN HD, # 10-32 X 1/4" LG., 316SS
35	AAC2939	8	WASHER, FLAT, #10, 316SS
36	AAC2936	8	WASHER, LOCK, SPLIT, #10, 316SS
37	AAC2933	12	INSERT, #6-32 X 0.23" LG., 316SS
38	AAC2930	19	INSERT, #10-32 X 0.265" LG., 316SS
39	AAC2927	1	VALVE, BALL, 1/2", PVC
40	AAC2987	1	REDUCER, SCHED.80, 1/2" SOC. TO 1/4" FPT, PVC
41	AAC2990	1	NIPPLE, SHORT, 1/4", PVC
42	AAC2996	1	ELBOW, SCHED.80, SOC., 1/4", PVC
43	AAC5243	5	CONNECTOR, STRAIGHT, LIQUID TIGHT (.079-.197)
44		1	REDUCER, SCHED.80, REWORK, PVC
45		1	NAMEPLATE "SAMPLE", PHENOLIC

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

OSEC®-BPCT SYSTEM - ELECTROLYZER PANEL - PARTS LIST

85.072.000.110B

ISSUE 0 6-03

OSEC®-BPCT

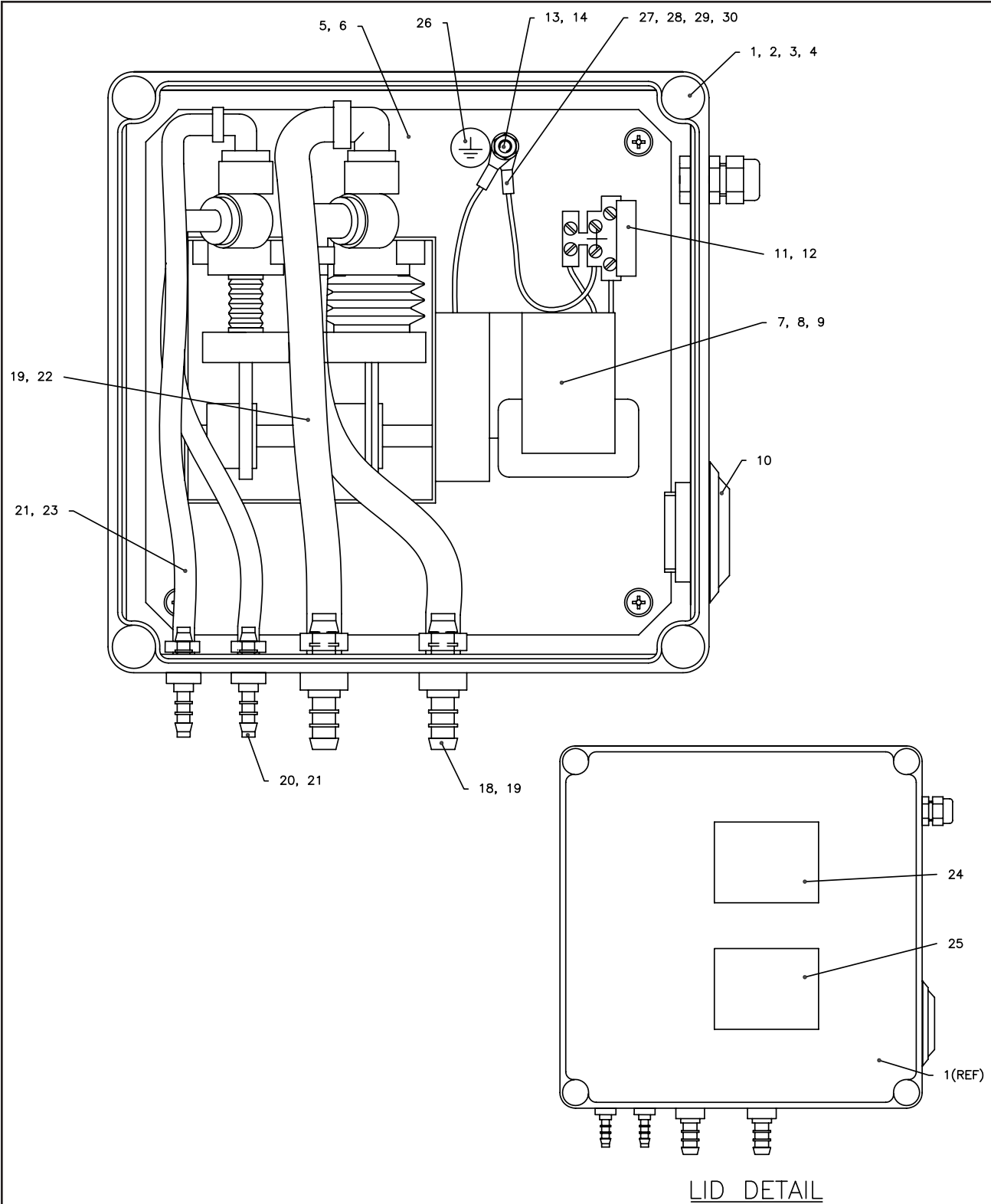
KEY NO.	PART NO.	QTY.	DESCRIPTION
46	AAB6224	1	LABEL WARNING, LAM
47		1	LABEL WARNING, LAM
48		1	BRACKET, COVER SPACER
49		2	SCREW, PAN HD, #6-32 x 1/2" LG., 316SS
50		1	CLIP, 1-1/2" PIPE SUPPORT
51		3FT	DUCT, WIRING, 1" x 1.25"
52		1	PUMP, BELLOWS
53		1	UNION, 1-1/2", PVC
54		1	PIPE, 1-1/2", PVC
55		2	REDUCER, SCHED. 80 1/2" SOC. x 3/8"NPT, POLY
56		1	ELBOW, 3/8"NPT x 1/4" TUBE, POLY
57		1	FITTING, 3/8"NPT x 3/8" TUBE, POLY
58		2FT	TUBING, 1/4", POLY
59		2FT	TUBING, 3/8", POLY
60		1	HOSECLAMP, 3/8" OD, SS
61	AAB9702	1	HOSECLAMP, 1/2" OD, SS
62	AAB6212	2FT	WIRE, 3-CONDUCTOR #16 AWG SJO, CU

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

OSEC®-BPCT SYSTEM - ELECTROLYZER PANEL - PARTS LIST

85.072.000.110C

ISSUE 0 6-03



NOTE: FOR PARTS LIST, SEE DWG. 85.072.000.020B.

OSEC®-BPCT SYSTEM - BRINE PUMP (AAB6224) - PARTS

85.072.000.020A

ISSUE 1 7-04

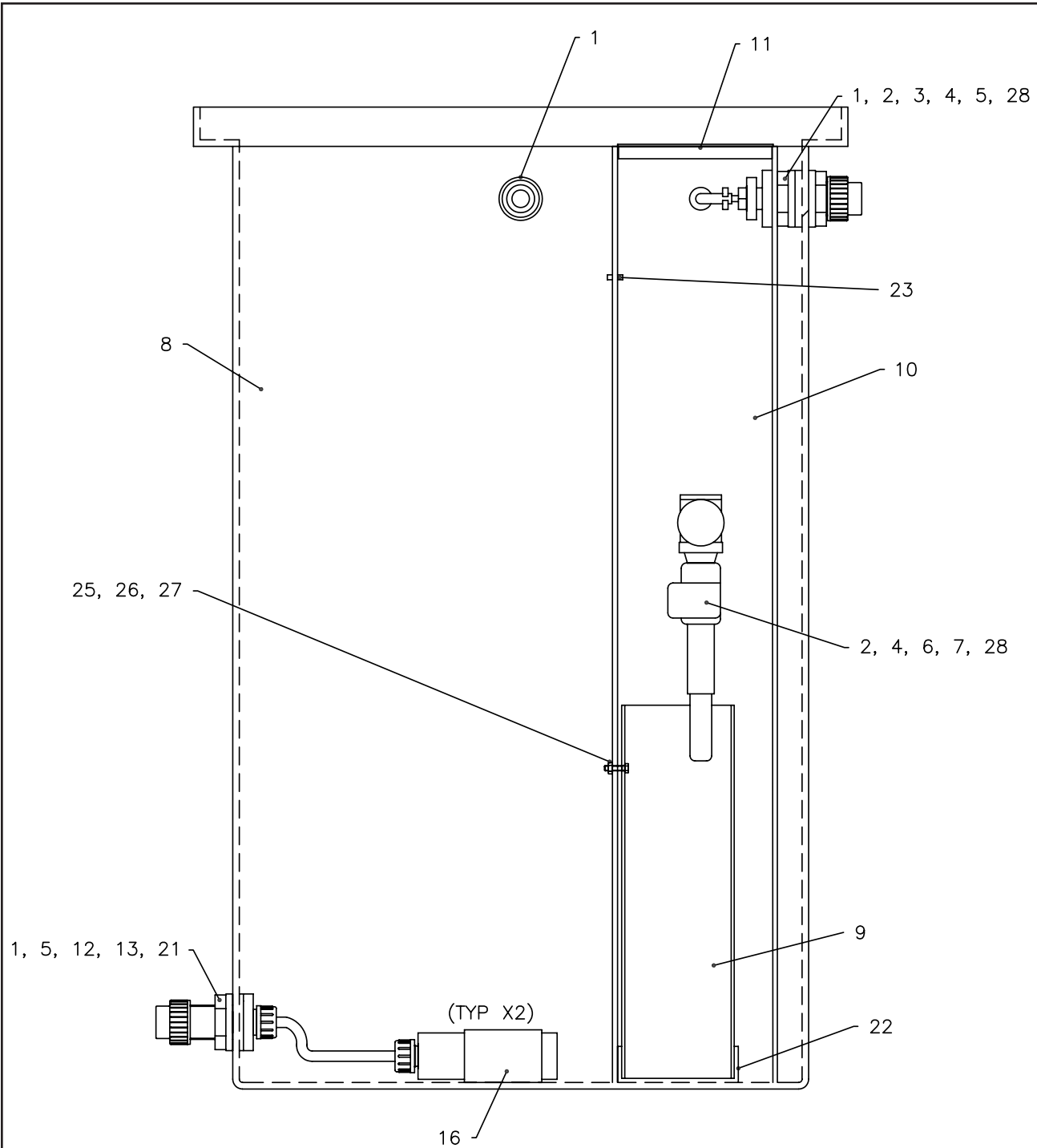
KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAB3531	1	ENCLOSURE
2	PXK89046	1	COVER
3	PXB89086	4	FASTENER
4	AAA2262	4	BUSH
5	AAB3534	1	BACKPLATE
6	AFM3005	4	SCREW
7	AAB3513	1	BELLOWS PUMP
8	AXS4261	2	NUT M4
9	ASG4388	2	WASHER M4
10	AAA7791	1	VENT
11	AAA8755	1	TERMINAL BLOCK
12	AAA1138	1	FUSE 3.15AMPS
13	AAA1713	2	NUT M6
14	AAA1146	2	WASHER M6
18	AAB3567	2	BARBED HOSE FITTING
19	AAB6212	6	HOSE CLAMP
20	AAA9702	6	HOSE CLAMP
21	AAB3564	2	BARBED HOSE FITTING
22	RP154507	20 IN.	3/8" ID HOSE
23	RP154464	20 IN.	1/4" ID HOSE
24	AAC4203	1	WARNING LABEL
25	AHS4038	1	WARNING LABEL
26	AAB9077	1	LABEL, P.E.
27	P36492	2	TERMINAL LUG, 1/4" RING
28	P31220	.5 FT.	WIRE, 16 AWG, GREEN
29	P50657	1	TERMINAL LUG, #8 RING
30	P43747	1	WASHER, SERRATED

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

OSEC®-BPCT SYSTEM - BRINE PUMP (AAB6224) - PARTS LIST

85.072.000.020B

ISSUE 1 7-04



NOTE: FOR PARTS LIST, SEE DWG. 85.072.000.030B.

OSEC®-BPCT SYSTEM - SALT SATURATOR (AAB6236) - PARTS

85.072.000.030A

ISSUE 1 7-04

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAB7001	4	TANK CONN., 1/2 NPT X 1/2 SOCK, PVC
2	AAB5777	2	BUSHING, 1/2 SPG x 1/4 NPT, PVC
3	P88537	1	NUT, BACKNUT (SPACER)
4	AAB9155	2	HOSE CONNECTOR, 1/4 NPT x ID HOSE, BRASS
5	RP534473	6 FT	HOSE, 1/4 ID, BRAIDED
6	AAB1299	1	FLOAT VALVE
7	P88517	1	ELBOW, 1/2 SOC x 1/2 NPT, PVC
8	AAB6875	1	TANK, SALT SATURATOR, 30 GAL. NAT.
9	RP23 4112	A/R	PIPE, 4", SCHD 40
10	RP234218	A/R	PIPE, 6", THINWALL, SCHD 40
11	AAB8672	1	PLUG, POLY, 6"
12	P86563	2	COLLET
13	P100738	2	NUT
16	AAB9143	2	STRAINER, SUB-ASSEMBLY
21	JP83536	2	ADAPTER, TUBING
22	AAB8675	1	CAP, POLY, 4" PIPE
23	AAB2480	1	LOCKING CLAMP
25	AAB7007	2	NYLON WASHER
26	AAB7004	1	NUT, NYLON
27	AAB7010	1	SCREW, NYLON
28	AAB6212	2	HOSE CLIP, SNP6

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

OSEC®-BPCT SYSTEM - SALT SATURATOR (AAB6236) - PARTS LIST

85.072.000.030B

ISSUE 1 7-04

PART NO.	QTY.	DESCRIPTION
AAB6986	1	ASSEMBLY, BLOWER
AAB5519	1	DP SWITCH, 0.4-1.2" H ₂ O
AAB6998	1	ORIFICE ASSY, 3" PIPE
RP684441	20 FT.	TUBING, LDPE, 1/4" ID x 3/8" OD
AAB5522	2	FITTING, TUBE, 3/8" OD x 1/8" NPT
AAB5525	4	FITTING, TUBE, 3/8" OD x 1/4" NPT
AAB5528	1	ORIFICE VENT
AAB1667	3	LABEL, WARNING, HYDROGEN
P42926	1	TEE, PVC PIPE, 3"
AAB7076	2	COUPLING, PVC PIPE, 3"
AAB7079	2	RED. COUPLING, PVC PIPE, 2" x 3"
RP234114	2	NIPPLE, PVC, THREAD x P.E., 6" LONG
P56006	2	ELBOW, PVC PIPE, 3"
AAB7073	3	PLACARD, NO SMOKING

NOTE: THIS KIT APPLIES TO SEVERAL OSEC SYSTEMS. SOME ITEMS MAY NOT BE REQUIRED.

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

OSEC®-BP SYSTEM - AAB6215 VENTILATION HARDWARE KIT
- PARTS LIST

85.070.000.110

ISSUE 1 8-03

PART NO.	QTY.	DESCRIPTION
AAB1319	2	COVER, JUNC BOX
AAB2039	4	CABLE, CONN, 1/4" SPT, PLASTIC
AAB3432	2	CABLE, CLAMPS, CELL CONN
AAB5504	40 FT.	CABLE, 2 COND, 18 AWG, SHIELDED
AAB6947	1	JUNC BOX, 2 WAY
AAB6944	20 FT.	CABLE, 4 COND, 18 AWG, SHIELDED
AAB6938	20 FT.	8 AWG STRANDED COPPER WIRE, RED
AAB6935	20 FT.	8 AWG STRANDED COPPER WIRE, BLK
AAB6950	1	JUNC BOX, 3 WAY
AAB5777	4	RED. BUSH, 1/2 SPG x 1/4 NPT, PVC
P12655	4	NUT, COND. CONN, 1/2 SPT
RB934104	55 FT.	FLEX, CONDUIT, 1/2"
U16116	9	CONDUIT CONN.S, 1/2" COND. x 1/2" SPT
U19808	4	CABLE, CONN. SEAL, 1/8-1/4 x 1/2 SPT
U22760	13	CONDUIT, CONN. SEAL, 1/2"
U85553	1	ELECTRICAL JOINT COMPOUND
AAA8346	1	BOOT, RED, CELL CONN.
AAA8349	1	BOOT, BLACK, CELL CONN.

NOTE: THIS KIT APPLIES TO SEVERAL OSEC SYSTEMS. SOME ITEMS MAY NOT BE REQUIRED.

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

OSEC®-BP SYSTEM - AAB6221 ELECTRICAL HARDWARE KIT
- PARTS LIST

85.070.000.115

ISSUE 1 8-03

OSEC® -BPCT

PART NO.	QTY.	DESCRIPTION
AAA2528	1	FOOT VALVE
AAB6056	2	FITTING, STRAIGHT, BARBED
AAB6212	6	HOSE CLAMPS, NYLON, 1/2"
AAB4169	7	ADPTR, HOSE 1/2" NPT x 1/2" ID HOSE
AAB6926	1	ADPTR, HOSE 1/4" NPT x 3/8" ID HOSE
AAB6923	1	ADPTR, HOSE ELB, 1/2" NPT x 1/2" ID HOSE
AAB6932	1	ADPTR, HOSE TEE, 3/8" x 1/4" x 3/8" HOSE
AAB6920	6	HOSE CLAMPS, NYLON, 11/16"
P42694	7	NIPPLE, 1/2" NPT x 1-1/2" LONG
P42700	2	TEE, 1/2" NPT
P44138	1	TEE, 1" PVC, SOCKET
AAB3953	1	RED. BUSH, 1" SPG x 1/2" NPT
AAB5777	2	RED. BUSH, 1/2" SPG x 1/4" NPT
RP234104	1	NIPPLE, PVC PIPE, 1/2", 6" LONG
RP234206	2	NIPPLE, PVC PIPE, 1", 6" LONG
RP234503	20 FT.	HOSE, 3/8 ID, BRAIDED VINYL
RP234534	30 FT.	HOSE, 1/2 ID, BRAIDED VINYL
RP534473	20 FT.	HOSE, 1/4 ID, BRAIDED VINYL
U10119	4	HOSE CLAMPS, SS
UXA21673	3	VALVE, BALL, PVC, 1/2 NPT
P35108	2	BUSHING, REDUCING, 1/2" NPT x 1/4" NPT, PVC
P38254	1	BUSH., RED., 1" NPT x 1/2" NPT, PVC
AAB2027	1	STRAINER, LINE
AAB3836	2	BUSHING, 1" SOC x 1/2" SOC
AAB8072	1	COUPLING 1" SOC PVC
RP524484	10 FT.	TUBING, .357 ID x .0625 WL, PVC

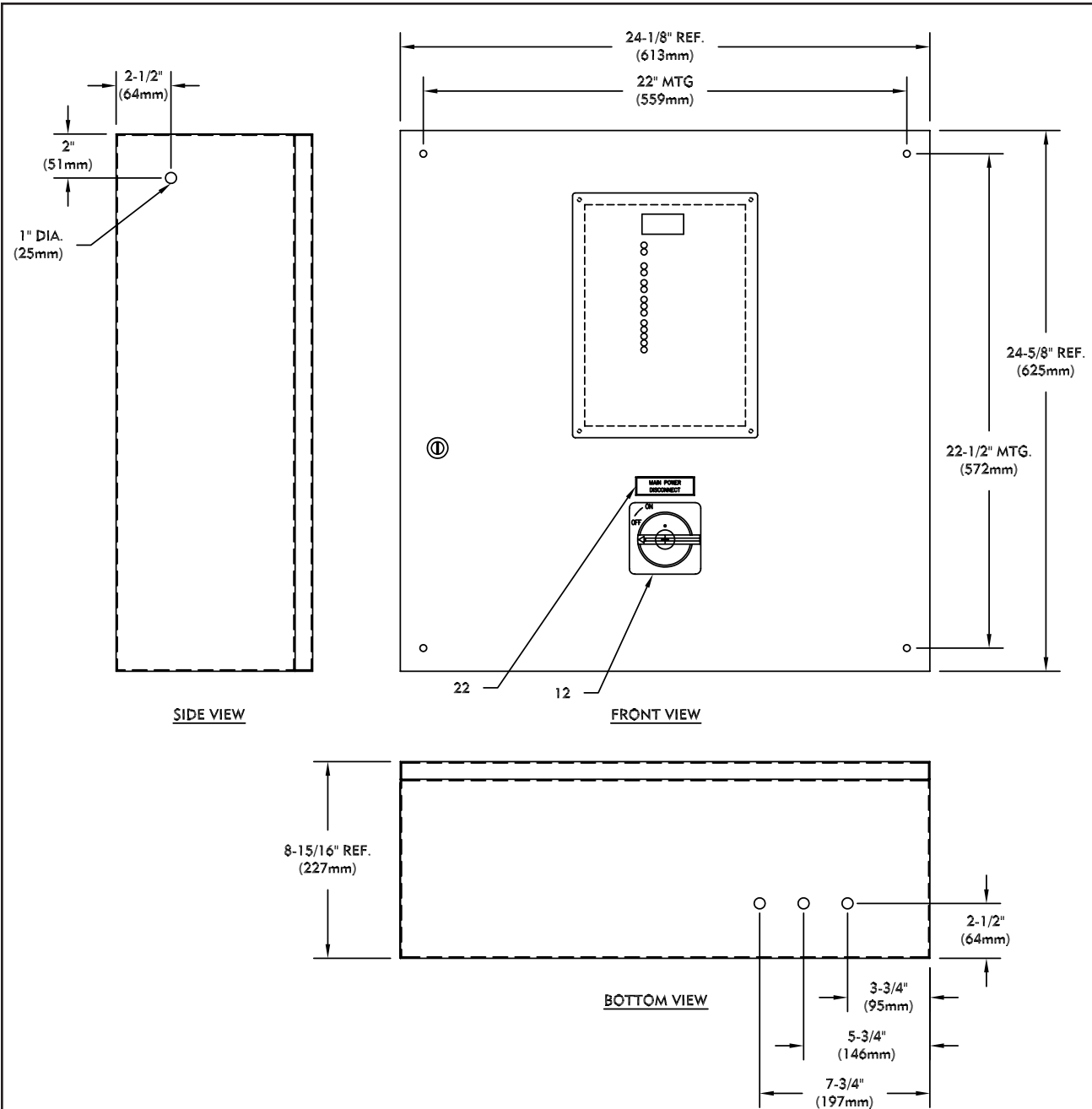
NOTE: THIS KIT APPLIES TO SEVERAL OSEC SYSTEMS. SOME ITEMS MAY NOT BE REQUIRED.

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

**OSEC®-BP SYSTEM - AAB6218 PLUMBING HARDWARE KIT
- PARTS LIST**

85.070.000.120

ISSUE 2 8-03

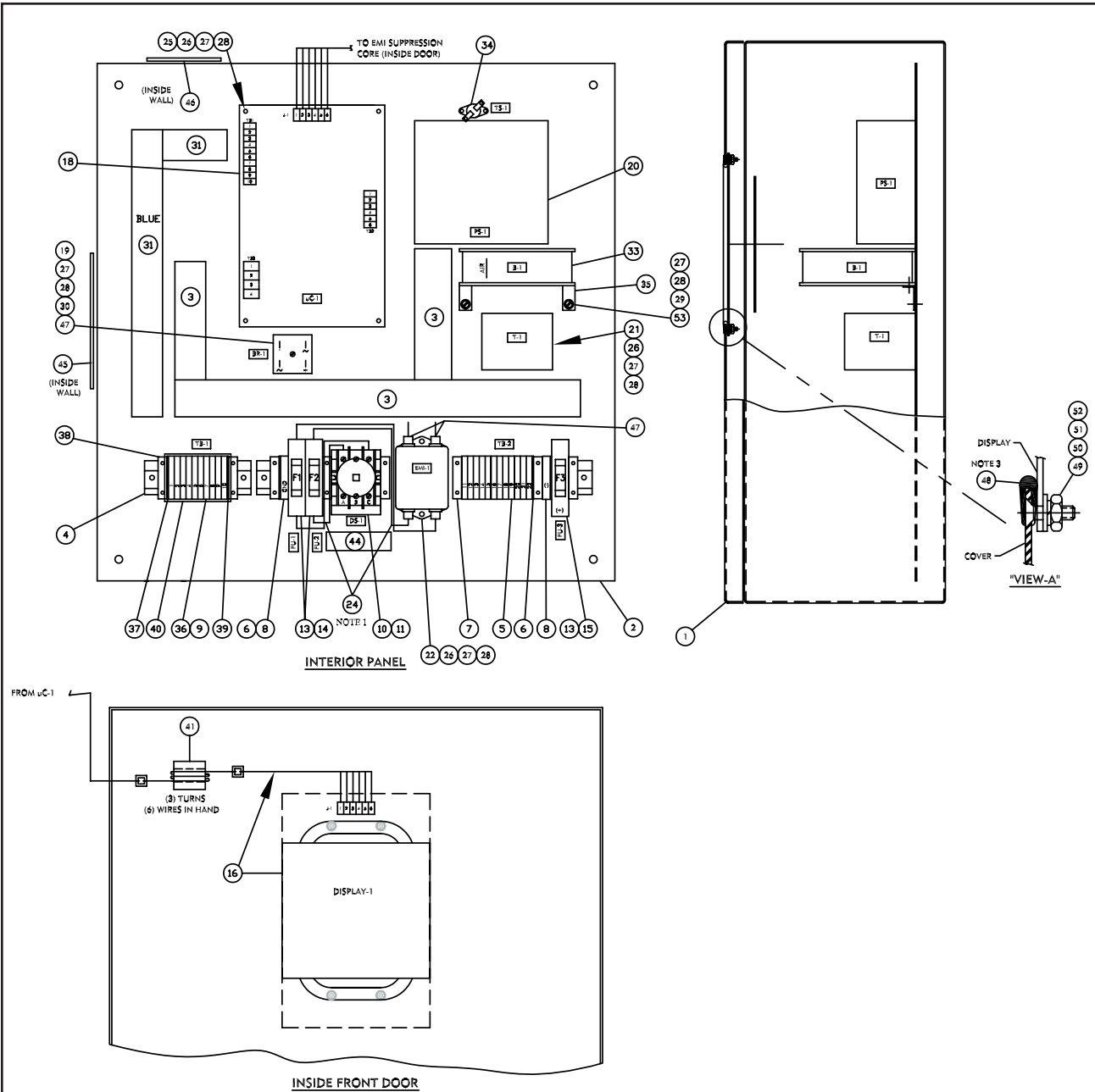


NOTE: FOR PARTS LIST, SEE DWG. 85.072.170.210C&D.

OSEC®-BPCT SYSTEM - CONTROL PANEL - PARTS
Front Panel Detail

85.072.170.210A

ISSUE 0 12-02



NOTE: FOR PARTS LIST, SEE DWG. 85.072.170.210C&D.

OSEC®-BPCT SYSTEM - CONTROL PANEL - PARTS Inside Detail

85.072.170.210B
ISSUE 0 5-03

KEY NO.	PART NO.	QTY.	DESCRIPTION
1		1	REWORK, ENCLOSURE, FRP
2		1	INNER PANEL
3	AAC5252	5ft	DUCT, WIRING W/COVER, 1-1/2 x 2, PVC
4	AAC5255	1.5ft	TRACK, TERMINAL MTG., ALUM
5	AAC5258	12	TERMINAL, M4/6
6	AAC52-61	3	END SECTION, TERMINAL, M4/6, M6/8
7	AAC5264	6	END BRACKET, TERMINAL
8	AAC5267	2	TERMINAL, M6/8
9	AAC5270	1	MARKER, TERMINAL, (100/PKG)
10	AAC5273	1	SWITCH, DISCONNECT
11	AAC5276	1	SHAFT, DISCONNECT SWITCH
12	AAC5279	1	OPERATOR, DISCONNECT SWITCH
13	AAC5282	3	TERMINAL, FUSE
14	AAC5285	2	FUSE CARTRIDGE, 13/32 x 1-1/2 (5A)
15	AAC5288	1	FUSE CARTRIDGE, 13/32 x 1-1/2 (30A)
16		1	DISPLAY OVERLAY & HARNESS ASSEMBLY
17			
18	AAC5297	1	CONTROLLER, LOGIC BOARD
19	AAC5300	1	RECTIFIER, F.W. BRIDGE
20	AAC5303	1	POWER SUPPLY
21	AAC5306	1	TRANSFORMER
22	AAC5309	1	FILTER, EMI
23	AAC5312	1 SET	NAMEPLATES, ENGRAVED
24		100FT	WIRE, #14 AWG, GRAY, CU
25	AAC5315	4	STANDOFF, .25 HEX x #8-32 x 1/2"LG., ALUM
26	AAC5318	6	SCREW, PAN HD, #8-32 X 3/8"LG., 316SS
27	AAC5321	26	WASHER, FLAT, #8, 316SS
28	AAC5324	14	WASHER, LOCK SPLIT, #8, 316SS
29	AAC5327	12	NUT, HEX, #8-32, 316SS
30	AAC5330	4	SCREW, PAN HD, #8-32 X 1"LG., 316SS

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

OSEC®-BPCT SYSTEM - CONTROL PANEL - PARTS LIST

85.072.170.210C

ISSUE 0 6-03

OSEC®-BPCT

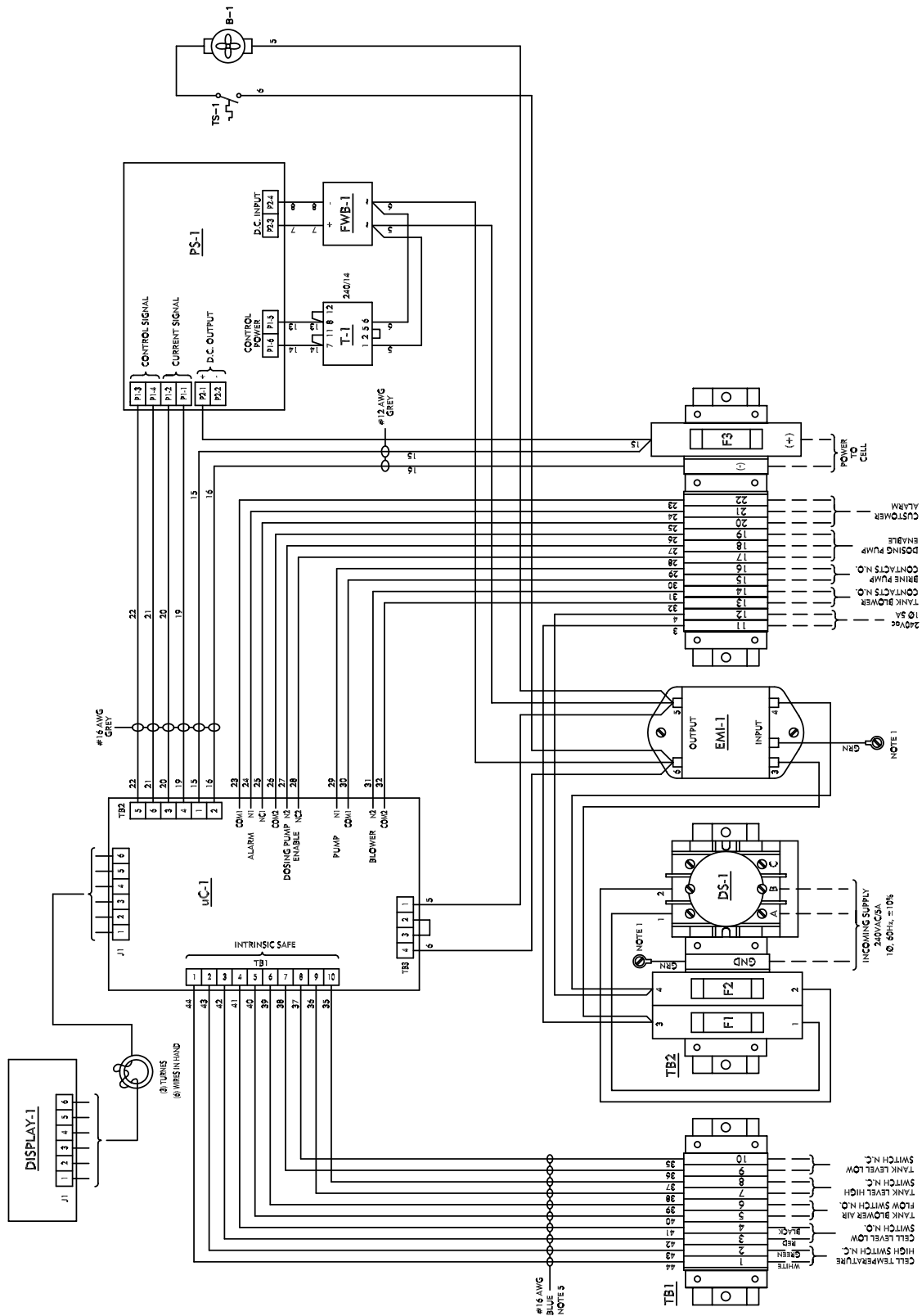
KEY NO.	PART NO.	QTY.	DESCRIPTION
31	AAC5333	1.5ft	DUCT, WIRING W/COVER, 1 x 2, BLUE I.S., PVC
32	AAC5336	1	CARD SCHEMATIC
33	AAC5339	1	BLOWER
34	AAC5342	1	THERMOSTAT, DISC
35		2	BRACKETS, FAN
36		10	TERMINAL, M4/6 (BLUE)
37		2	END SECTION, TERMINAL, M4/6 (BLUE)
38		2	END BRACKET TERMINAL
39		2	END SECTION, COVER HOLDER (BLUE)
40		.25	COVER, TERMINALS
41		1	EMI SUPPRESSION CORE
42		50FT	WIRE, #16 (BLUE)
43		25FT	WIRE, #16 (GREY)
44		1	LABEL, POWER
45		1	LABEL, WARNING
46		1	LABEL, WARNING
47		6	TERMINAL, PUSH-ON, PIGGY BACK, #14 AWG., .250 TAB
48		3FT	EDGE TRIM, RUBBER (X1013)
49		10	SCREW, F.H., #6-32 x 5/8"LG., 316SS
50		10	WASHER, FLAT, #6, 316SS
51		10	WASHER, LOCK, SPLIT, #6, 316SS
52		10	NUT, HEX, #6-32, 316SS
53		4	SCREW, PAN HD., #8-32 x 1/2"LG., 316SS

WHEN ORDERING MATERIAL, ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

OSEC®-BPCT SYSTEM - CONTROL PANEL - PARTS LIST

85.072.170.210D

ISSUE 0 6-03



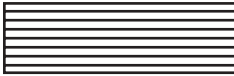
OSEC®-BPCT SYSTEM - CONTROL PANEL SCHEMATIC

85.072.155.220

ISSUE 0 6-03

SECTION 6 - SPARE PARTS LIST

<u>QTY.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
1	Blower	AAB6992
1	Brine Pump, C2	AAB1138
1	Electrolyzer, C2	AAC2912
1	Float Valve (Saturator)	AAB1299
1	D.P. Switch (Air Flow)	AAB5519
1	Float/Temperature Switch	AAB3147
1	Level Switch (Product Tank)	112196-S76
A/R	Hose, Braided Vinyl, 1/4" ID	RP534473
A/R	Hose, Braided Vinyl, 3/8" ID	RP234503
A/R	Hose, Braided Vinyl, 1/2" ID	RP234534
<u>Control Panel Fuses</u>		
1	Fuse, 5 Amp	AAC5285
1	Fuse, 30 Amp	AAC5288





SECTION 7 - CONTROL PANEL

List Of Contents

	PARA. NO.
Introduction.....	7.1
Installation	7.2
Connection Details.....	7.3
Operation	7.4
Initial Power Up or Re-Power	7.4.1
Start of Fill Cycle	7.4.2
Fill Cycle Sodium Hypochlorite Generation.....	7.4.3
End Fill Cycle - Generation Shutdown	7.4.4
Display Definitions	7.5
Alarm Conditions.....	7.6
Blower Air Flow Low	7.6.1
Cell Voltage High.....	7.6.2
Cell Current Low	7.6.3
Cell Level Low	7.6.4
Cell Temp High	7.6.5
Power Supply Alarm	7.6.6
Tank Level Malfunction.....	7.6.7
Illustrations	
Operator Interface	85.072.170.130

7.1 Introduction

The OSEC-BPCT control panel monitors and controls the sodium hypochlorite generation process described in the earlier sections of the manual. Housed in a fiberglass-reinforced plastic, NEMA-4X enclosure, the OSEC-BPCT control panel utilizes a microcontroller to manage the system. A Human Machine Interface (HMI) fitted to the front of the panel enables the operator to monitor system status. This HMI has a display that alternately indicates output voltage and amperage to the electrolyzer. Additionally, LED indicators provide status of major system components.

Using signals from the storage tank high- and low-level switches, the control panel maintains a working volume of sodium hypochlorite in the storage tank. At all times, the status of the electrolyzer, D.C. power supply, storage tank, and ventilation system is automatically monitored for correct and safe operation. If any faults are detected they are displayed on the HMI and safe corrective action is taken.

The control philosophy of the OSEC-BPCT is intended to be simple. Turn power ON and the system automatically runs. Turn the power OFF and the system is secured.

Whenever power is turned on, the system fills the tank with product. Once the tank is full, the system waits for the tank to drain. Once drained, the system automatically refills the tank. This process repeats itself on an ongoing basis.

It is intended that there be no requirement for adjustment during normal operation of the system.

While operating, the system controls and monitors its own performance. If any abnormality is detected, the system will shut itself down, display the problem on the diagnostics panel, and wait for the system operator to correct the problem. A set of dry contacts for remote alarm indication is provided. Should a system alarm occur, the dosing pump is permitted to continue operation.

7.2 Installation

The OSEC-BPCT is designed to be wall mounted. It should be in a readily accessible position. Care should be taken to avoid locations subject to water or chemical splashes. The ambient temperature should not be lower than 41°F (5°C) or greater than 104°F (40°C).

Where a circuit is designated as “intrinsically safe” the cables must be run separate from all other cables and installed in accordance with the local requirements for intrinsic safety.

Areas within the installation may be classified as “hazardous;” any cable, conduit, or trunking within these areas should be installed accordingly.

7.3 Connection Details

The control panel requires a 230V, 60Hz single phase main power supply.



WARNING: TO AVOID ELECTRICAL SHOCK, ENSURE THAT THE SOURCE POWER SUPPLY IS ISOLATED BEFORE MAKING THE CONNECTIONS.

The control panel should be connected as shown on the Installation Wiring diagram, this includes connections to:

- Storage tank level switches
- Storage tank blower
- Storage tank air flow switch

7.4 Operation

The following operation description is intended to provide the system operator with an understanding of all the operating sequences.

7.4.1 Initial Power Up or Re-power

Upon initial power up or re-power of the OSEC-BPCT control panel the microcontroller will perform the following actions:

- Microcontroller flash tests all LED's and the digital display.
- A system self check is performed.
- Microcontroller energizes the alarm relay.
- The Power On indicator is illuminated.
- A fill cycle is begun if necessary.

7.4.2 Start of Fill Cycle

Once the power up process is complete the microcontroller determines tank level status. Depending on state of the high level tank switch and the low level tank switch there exist four possible conditions.

- Tank Level High: Indicates the product tank is full. A fill cycle is not initiated (electrolyzer operation is idle).
- Neither Tank Level High nor Tank Level Low: Indicates product level is between the high and low level setpoints. A fill cycle is initiated.
- Tank Level Low: Indicates product level is low. A fill cycle is initiated.
- Both Tank Level High and Tank Level Low: Indicates a level switch malfunction. Refer to paragraph 7.6, Alarm Conditions, for more information.

7.4.3 Fill Cycle Sodium Hypochlorite Generation

When the tank level falls below the Tank Level Low setpoint the corresponding LED will illuminate and a fill cycle will initiate. The microcontroller initiates a run contact for both the blower and the brine/water pump. The system is not yet producing sodium hypochlorite as DC power has not been supplied to the electrolyzer. Operating permissives for positive tank air flow, electrolyzer temperature not high, and electrolyzer cell level full must ALL be satisfied prior to application of power to the electrolyzer. Once these permissives are satisfied the microcontroller initiates a run contact to the transformer/rectifier allowing DC power to be applied to the electrolyzer. At this point sodium hypochlorite will be generated.

NOTE: When normally filling, the System Power On, Blower Power On, Pump Power On, Cell Power On and either Amperes or Voltage LEDs will be illuminated. Any other illuminated LEDs will refer to tank level conditions or alarm condition(s).

While the power supply is operating, the four-digit display alternately indicates volts and amps measured at the power supply output. Typical regulated current will be 22.5 amps. Typical voltage will range between 8 and 14 volts, depending on brine concentration. The volts and amps LED indicators located directly below the four-digit display illuminate alternately depending on the displayed reading. When the power supply is not running the indicators will read zero.

If the product tank level was low at power up, the Tank Level Low indicator is initially illuminated. The Tank Level Low indicator turns off once the tank level has risen above the switch setpoint.

If the fill cycle represents the initial fill or follows a re-power, the microcontroller allows the fill cycle to continue with a low tank level condition for 180 minutes. This should provide sufficient time to fill the tank volume beneath the Tank Level Low setpoint. If however, the fill cycle occurs in the normal course of operation i.e. successive fill and drain cycles, then the microcontroller will only allow the fill cycle to continue with a low level indication for one hour.

The fill cycle process is permitted to continue until a Tank Level High condition is achieved, or until an alarm condition necessitates a shutdown.

7.4.4 End Fill Cycle – Generation Shutdown and Standby

When the tank level reaches the Tank Level High setpoint the corresponding LED will illuminate and the microcontroller initiates the shutdown sequence. Hypochlorite generation is halted as the microcontroller adjusts the transformer rectifier output to zero. The brine/water pump operates for five minutes after the shut down sequence begins. The blower operates for 20 minutes after the shut down sequence begins. At such time, the product tank is full and the electrolyzer operation is idle. The system will remain in Standby Mode until the process repeats itself after the storage tank is again drained down to its low level setpoint.

7.5 Display Definitions

RED LED: Alarm indicators representing:

- Blower Air Flow Low
- Cell Voltage High
- Cell Current Low
- Cell Level Low
- Cell Temp High

All red LEDs represent alarm conditions. Alarm indicating LEDs may be illuminated with either a solid or blinking display. When an alarm initially occurs the corresponding LED will provide a solid illumination (non-blinking). The LED will remain in the solid state until a prescribed

off delay expires and the microcontroller initiates a shutdown. Upon shutdown, the LED corresponding to the alarm condition will switch from solid to blinking. Note: Other alarm LEDs may illuminate but are the result of the initial alarm condition indicated by the blinking red alarm LED.

The blinking alarm LED provides immediate operator recognition that the system has been shutdown due to an alarm condition

AMBER LED: Tank level indicators representing:

- Tank Level High
- Tank Level Low

Tank level LEDs illuminate to alert the operator of either a high level or low level tank condition. Subsequent to a low level illumination the electrolyzer fill cycle is initiated. System shutdown follows the illumination of the high level LED. If neither a high level or a low level LED is illuminated but the system Power On and Stand By Mode LED is illuminated, product level is between setpoints.

If both the high level and low level LEDs are illuminated they will blink simultaneously indicating an equipment malfunction. If this situation occurs while in the fill cycle, the microcontroller will initiate a shutdown.

GREEN LED: Operational status indicators representing:

- Voltage
- Amperes
- System Power On
- Stand By Mode
- Blower Power On
- Pump Power On
- Cell Power On

DIGITAL DISPLAY: Four-digit indicator alternating between cell current and voltage:

The digital LED displays the DC current and voltage applied to the electrolyzer. During the fill cycle the display toggles between the current and voltage values with the corresponding LED illuminated to indicate which value is displayed.

7.6 Alarm Conditions

7.6.1 Blower Air Flow Low

During a fill cycle blower operation is confirmed by monitoring differential pressure across an orifice plate located in the product tank vent line. Positive airflow is required for sustained fill cycle operation. If insufficient airflow is present to satisfy the differential pressure switch the Blower Air Flow Low alarm is initiated (solid red LED). If airflow is not restored within 60 seconds, a shutdown sequence is initiated. The LED will then switch to blinking mode indicating the unit has been shutdown due to a low airflow alarm condition.

Additionally, a blower airflow low alarm can be realized if the micro-controller receives airflow confirmation while the blower power relay is de-energized. A faulty differential pressure switch or condensation in the impulse line may cause this condition. This alarm is inhibited for 5 minutes after a fill cycle is started.

7.6.2 Cell Voltage High

If an over voltage ($>15\text{V DC}$) condition occurs during a normal fill cycle a Cell Voltage High alarm is initiated. The alarm triggers the corresponding LED to illuminate indicating the condition has occurred. The system is permitted to operate for 15 minutes with this condition. If the condition persists, a shutdown is initiated and the LED will begin blinking. The digital display will indicate the voltage value at time of shutdown. If the condition clears before the 15 minutes have expired, the LED clears and the fill cycle continues normally. This condition is normally indicative of low brine strength or brine/water pump malfunction.

NOTE: For the first 15 minutes from the start of a fill cycle the voltage is allowed to go 50% higher than 15 VDC to allow the electrolyzer production to stabilize.

7.6.3 Cell Current Low

If a low current ($< 75\%$ normal) alarm occurs during a normal fill cycle a Cell Low Current alarm is initiated. The alarm triggers the corresponding LED to illuminate indicating the condition has occurred. The system is

permitted to operate for 15 minutes with this condition. If the condition persists, a shutdown is initiated and the LED will begin blinking. The digital display will indicate the current value at time of shutdown. If the condition clears before the 15 minutes have expired the LED clears, and the fill cycle continues normally. This condition is normally indicative of low brine strength or brine/water pump malfunction.

NOTE: For the first 15 minutes from the start of a fill cycle the current is allowed to go less than 75% full value to allow the electrolyzer production to stabilize.

7.6.4 Cell Level Low

The brine level within the electrolyzer cell is monitored whenever the unit is in a fill cycle. If the cell level falls below the required position the Cell Level Low alarm is initiated (solid red LED). If cell level is not restored within seven minutes, a shutdown sequence is initiated. The LED will switch to blinking mode indicating the unit has been shutdown due to a low cell level condition. This condition is indicative of leaks or a brine/water pump malfunction.

7.6.5 Cell Temp High

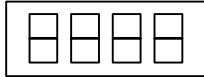
The solution temperature at the outlet of the electrolyzer cell is monitored whenever the unit is in a fill cycle (generating hypochlorite). If the temperature exceeds the maximum allowable value the Cell Temp High alarm is initiated (solid red LED) and a shutdown is initiated immediately. Once shutdown the alarm LED switches to blinking mode.

7.6.6 Power Supply Alarm

If the system is idle, not in the fill mode and the processor detects voltage greater than 5VDC or current greater than 2 amps the Power On LED will begin blinking. This condition prompts the processor to initiate a shutdown.

7.6.7 Tank Level Malfunction

If the both the high and low tank level LED's blink simultaneously the processor has detected a malfunction with the tank level equipment.



- Ⓒ VOLTAGE
- Ⓒ AMPERES
- Ⓒ SYSTEM POWER ON
- Ⓒ STAND BY MODE
- Ⓒ BLOWER POWER ON
- Ⓒ BLOWER AIR FLOW LOW
- Ⓒ PUMP POWER ON
- Ⓐ TANK LEVEL HIGH
- Ⓐ TANK LEVEL LOW
- Ⓒ CELL POWER ON
- Ⓒ CELL VOLTAGE HIGH
- Ⓒ CELL CURRENT LOW
- Ⓒ CELL LEVEL LOW
- Ⓒ CELL TEMP HIGH

OSEC® BPCT

System Control & Power Supply

USFilter

OSEC®-BPCT SYSTEM - OPERATOR INTERFACE

85.072.170.130

ISSUE 0 5-03