

Wallace & Tiernan[®]

an eVOQUA brand

OSEC[®]-BP

ON-SITE ELECTROLYTIC CHLORINATION SYSTEM

BOOK NO. WT.085.070.001.UA.IM.1014

OSEC[®]-BP
ON-SITE ELECTROLYTIC
CHLORINATION SYSTEM

BOOK NO. WT.085.070.001.UA.IM.1014

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 judgment 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 judgment 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 Evoqua Water Technologies, 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.



725 Wooten Road
Colorado Springs, Co 80915

INTRODUCTION

The Evoqua Water Technologies OSEC®-BP system described in this manual has been designed for the continuous production of sodium hypochlorite by the electrolysis of brine at 12, 24, 36 or 48 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 Evoqua Water Technologies 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.

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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 0.8% 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. HYDROGEN IS A FLAMMABLE/EXPLOSIVE GAS WHICH WHEN DILUTED WITH SUFFICIENT AIR, IS SAFELY EXHAUSTED TO ATMOSPHERE FROM THE HYPOCHLORITE STORAGE TANK. HOWEVER, TO ENSURE PLANT SAFETY, WARNING NOTICES SHOULD BE DISPLAYED FORBIDDING SMOKING OR ANY IGNITION SOURCE IN THE VICINITY OF THE ELECTRO-CHLORINATOR UNIT, PRODUCT STORAGE TANK OR TANK VENT DISCHARGE. THE EQUIPMENT SHOULD BE REGULARLY CHECKED TO ENSURE THAT NO GAS LEAKAGES OCCUR. DO NOT CHECK WITH A MATCH OR OPEN FLAME, 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 EVOQUA WATER TECHNOLOGIES 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:

Evoqua Water Technologies
725 Wooten Road
Colorado Springs, CO 80915
Phone: (800) 524-6324

NOTE

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

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

ANODE WARRANTY CONDITIONS

The anodes used in the electro-chlorinator are warranted for seven 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.

Evoqua Water Technologies 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. A seven-year warranty will apply if the temperature of the incoming electrolyte does not fall below 50°F.
- b. The salinity of the electrolyte must be above 16,000 mg/l chloride (Cl^-) unless otherwise specified by Evoqua Water Technologies. The sulfate (SO_4) content must be less than 1/7th of the Cl^- content.
- c. The manganese level in the electrolyte entering the electrolyzer must not exceed 50 ug/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 the figure shown in Section 1 - Technical Data.
- f. The operational log, as shown Section 4 - Service, must be maintained with the time periods 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 Evoqua Water Technologies.
- 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. Water hardness leaving the softener must not exceed 17 mg/l of calcium carbonate (CaCO_3).
- k. 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.

EVOQUA WATER TECHNOLOGIES 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 nominal 26% (w/w) NaCl, mixes with the dilution water to make an approximate 2.8% (w/w) brine solution. This concentration is optimum for efficient electrolysis and to minimize 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 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 |
|------|---------------------------|-------------------------|----------------------------|------|-------|----------|
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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.

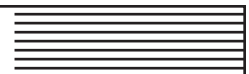
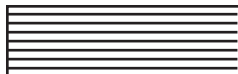
WARNING: WHEN DEALING WITH HAZARDOUS MATERIAL, IT IS THE RESPONSIBILITY OF THE EQUIPMENT USER TO OBTAIN AND FOLLOW ALL SAFETY PRECAUTIONS RECOMMENDED BY THE MATERIAL MANUFACTURER/SUPPLIER.

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 Evoqua Water Technologies, Colorado Springs, CO contact the office indicated below.

UNITED STATES

725 Wooten Road
Colorado Springs, CO 80915
TEL: (800) 524-6324

CANADA

If the equipment was purchased directly from Evoqua Water Technologies, Canada, contact the nearest office indicated below.

ONTARIO

Evoqua Water Technologies Ltd.
2045 Drew Road
Mississauga, Ontario
L5S 1S4
(905) 944-2800

QUEBEC

Evoqua Technologies des Eaux Itée
505 Levy Street
St. Laurent, Quebec
H4R 2N9
(450) 582-4266

SECTION 1 – TECHNICAL DATA

| | |
|--|--|
| Product Concentration | 8 G/L as Cl ₂ (Nominal) |
| Product pH (approx.) | 9 |
| Saturated Brine Concentration (@ 20° C) | 2.65 lb/gal 317 G/L |
| Electrolyte Strength (Inlet, 10:1 dilution) | 2.8% w/w (NaCl/Soln.) 28.8 G/L NaCl 17.5 G/L Cl ⁻ |
| Operating Requirements | |
| Ambient Temperature | 50 to 105° F (10 to 41° C) |
| Water | |
| Supply Pressure | 30 to 75 PSI |
| Temperature | 50 to 80° F (10 to 27° C) |
| Flow | see table |
| Quality | Total Hardness < 17 mG/L (1 grain) Manganese < 50 µG/L |
| Salt | |
| Nominal* | 3.5 lb/lb (NaCl/Cl ₂) |
| Form (preferred**) | Coarse Granular or Pelletized |
| Grade*** | Food Grade/Softener (low hardness) |

*For generation-allow additional 0.5 lb/lb for softener regeneration.

**Performs best in most brine saturators.

***Refer to warranty statement for additional salt specifications.

Power

Control Panel

230 VAC 50/60 Hz., 800 VA
Fuse at 10A

DC Power Supply

see table below

| System Type | Input Voltage 208VAC 60Hz 1Ph | | Input Voltage 230VAC 60Hz 1Ph | | Input Voltage 230VAC 60Hz 3Ph | | Input Voltage 460VAC 60Hz 3Ph | |
|-------------|----------------------------------|------------------|----------------------------------|------------------|----------------------------------|------------------|----------------------------------|------------------|
| | Supply Draw | Circuit Capacity | Supply Draw | Circuit Capacity | Supply Draw | Circuit Capacity | Supply Draw | Circuit Capacity |
| C12 | 12 | 30 | 11 | 30 | 6 | 20 | 3 | 15 |
| C24 | 17 | 30 | 16 | 30 | 10 | 20 | 5 | 15 |
| C36 | 24 | 30 | 23 | 30 | 12 | 20 | 6 | 15 |
| C48 | 30 | 40 | 29 | 40 | 16 | 20 | 8 | 15 |

Operating Settings (nominal*)

| System Type | Capacity (lb/day) | Water (gph) | Brine (gph) | Amps** (dc) | Volts** (dc) |
|-------------|-------------------|-------------|-------------|-------------|--------------|
| C12 | 12 | 6.75 | 0.68 | 35.0 | 30 |
| C24 | 24 | 13.5 | 1.35 | 35.0 | 60 |
| C36 | 36 | 20.0 | 2.00 | 35.0 | 90 |
| C48 | 48 | 27.0 | 2.70 | 35.0 | 120 |

*Can be adjusted to suit special requirements.

**Electrolytic current setting is same for all capacities, operating voltage varies (values indicated are typical/approximate).

The OSEC®-BP generator when used for pool chlorination should be sized to supply no less than 3 lbs chlorine per day, per 10,000 gallons. For additional sizing assistance please contact your local Evoqua Water Technologies sales office.

Product Storage and Salt Supply/Saturator tanks are supplied as specified on order, “standard” offerings are as follows:

Product Storage Tanks

Material Linear, High Density Polyethylene
Color Natural or Black (w/Site Tube as option)
Sizes

| Diameter (in) | Overall Height (in) | Capacity | |
|---------------|---------------------|---------------|--------------------------|
| | | Nominal (gal) | Usable (gal) (estimated) |
| 33 | 69 | 200 | 178 |
| 45 | 63 | 400 | 330 |
| 48 | 77 | 550 | 478 |
| 64 | 90 | 1100 | 975 |

NOTE: Sizes are approximate—to be used for identification and estimation of space requirement.

Brine/Saturator Tanks

Material Linear, High-Density Polyethylene
Color Black
Sizes

| Diameter (in) | Height (in) | Capacity (lb) (salt - estimated) |
|---------------|-------------|----------------------------------|
| 25-5/8 | 36-7/8 | 400 |
| 32-1/8 | 43-1/2 | 800 |
| 40-5/8 | 50-1/2 | 1500 |
| 52-1/4 | 50 | 2800 |

NOTE: Sizes are approximate—to be used for identification and estimation of space requirement.

Softener

Automatic twin-tank compact water softener with non-electric control valve is supplied standard. See installation illustrations for representation and dimensions. Refer to softener manual for detailed technical specifications.

Level Transducer

| | |
|-----------------|---------------------------------------|
| Range | 25 Ft of water |
| Signal | 4 - 20 mA |
| Power | Loop powered via system control panel |
| Accuracy | ± 0.75 inches of water |

Storage Tank Ventilation Blower

| | |
|---------------|--|
| Power* | 115/230V, 50/60 HZ, 1.4/0.7Amps (60 Hz), Supply* fused at 1A. |
|---------------|--|

***NOTE:** Wire for 230V. Supply derived from system control panel.

Differential Pressure Switch (measuring airflow across orifice)

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

SECTION 2

SECTION 2 – INSTALLATION

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| Blower Assembly..... | 85.070.111.020 |
| Level Transducer | 85.070.111.030 |
| Differential Pressure Switch | 85.070.111.040 |
| Softener | 85.050.110.075 |
| Installation Wiring | 85.070.130.010 |
| Typical Installation - OSEC-BP System | 85.070.111.050 |

2.1 General Installation

When selecting a location for installation, the following requirements should be considered:

- The location should have adequate water and drainage to allow for wash down of hypochlorite or brine spills and system maintenance.
- The location should be in an area protected from direct sunlight. Heat and ultraviolet exposure can cause deterioration of components and reduced performance.
- Ambient temperature should be 50° F to 105° F.
- The area around the electrolyzer panel and product storage tank should be treated as potentially hazardous. Ignition sources (open flame or electrical) are to be avoided.
- 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.
- There are typically two electrical supply connections to the system: one to the Control Panel and a second to the DC Power Supply.
- Installation must conform to local electrical and plumbing codes.
- The Control Panel, Brine Feed Panel, and Electrolyzer Panel are wall mounted. They must be securely mounted to a surface suitable to support their weight.
- Convenient access is needed for operation, salt replenishment, preventative maintenance, and service of each of the system components.

The following paragraphs contain 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).



WARNING: WHEN THE OSEC®-BP GENERATOR IS USED FOR POOL CHLORINATION IMPROPER DOSING INTO THE MAIN POOL LINE CAN RELEASE HIGH LEVELS OF SODIUM HYPOCHLORITE THAT MAY ENDANGER BATHERS.

2.2 Control Panel

The control panel should be located adjacent to the electrolyzer panel. Care should be taken to avoid locations subject to brine, water, or chemical splashes. Refer to Dwg. 85.070111.050, OSEC-BP System – Typical Installation, for additional information and notes regarding control panel location.

The control panel is designed to be wall mounted using the brackets supplied with the enclosure. The mounting surface and fasteners (lag bolts, anchors) must be suitable to support its weight (approximately 60 lb). It should be mounted level and at a convenient height for operation and service. See Dwg. 85.070.110.070, Control Panel – Typical Installation, at the end of this section for details and standard power requirements.

- Refer to the Interconnection Wiring diagram at the end of this section for information on field wiring installation.
- Refer to the Typical Installation illustration for information on installation materials supplied with the Electrical Installation Kit and for installation notes.

2.3 DC Power Supply

The standard DC power supplies are floor mounted and are available with a choice of supply voltages and enclosure types. The unit should be placed to minimize cable length to the electrolyzer but in an area away from potential spills or chemical handling. Refer to Dwg. 85.070111.050, OSEC-BP System – Typical Installation for additional information and notes regarding DC power supply location.

- Refer to Section 1 – Technical Data for DC Power Supply electrical data.
- Refer to the Interconnection Wiring diagram at the end of this section for information on field wiring installation.
- Refer to the Typical Installation illustrations for information on installation materials supplied with the Electrical Installation Kit and for installation notes.
- Refer to the manual and technical documentation supplied with the power supply for detailed information on its installation and specifications.

2.4 Electrolyzer Panel

The electrolyzer panel should be located adjacent to the control panel to facilitate operation. Care should be taken to avoid locations where service or maintenance may result in brine, water or chemical splashes on other equipment. The electrolyzer panel is designed to be wall mounted. The mounting surface and fasteners (lag bolts, anchors) must be suitable to support its weight (approximately 100 lbs). The surface must be flat with no protrusions that could bow the panel. Washers or spacers should be used to compensate for any irregular surface. It should be mounted level (use panel edges as a guide) and at a convenient height for service and maintenance. Refer to Dwg. 85.070111.050, OSEC-BP System – Typical Installation for additional information and notes regarding electrolyzer panel location.

- Refer to the Interconnection Wiring diagram at the end of this section for information on field wiring installation.
- Refer to the Typical Installation illustration for information on installation materials supplied with the Electrical Installation Kit and for installation notes.

2.5 Brine Dilution Unit

Electrolyte is made by diluting saturated brine to the proper brine concentration. This is produced by a separate wall-mounted assembly. The unit is supplied with a pump for metering of brine and solenoid/flow control valves for control of dilution water flow.

The panel should be located adjacent to the electrolyzer panel and below the brine level in the saturator to maintain a flooded suction. The feed rate is sensitive to moderate variations in discharge head. Installation must not restrict discharge to or from Electrolyzer Panel—ensuring stable head of less than 5 psi (less than 5 ft of water preferred).

- Mounting the panel with fasteners (lag bolts, anchors) suitable to support its weight.
- Refer to Dwg. 85.070.111.050, OSEC-BP System – Typical Installation for an overview of connection to other system components and additional information regarding brine panel location.

2.6 Softener

NOTE: Refer to the manual provided with the softener for detailed information on its operation and specifications. Following are some points to be highlighted and modifications to the standard installation guidelines.

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

The dual-tank automatic (based on treated volume) softener requires no electrical connection. The control valve mechanism is driven by the flow of treated water. The standard softener is sized and pre-configured for a maximum hardness of 42 gpg. The water should be tested to confirm that the hardness does not exceed this level. If sand/silt or turbidity is present, a separate prefilter should be installed before the softener.

- The unit should be installed on a flat, level surface and properly secured to prevent tipping and overstressing of the valve head and piping connections.
- Plumbing connections should be made following the softener manufacturer's installation manual and Dwg. 85.070.111.050, OSEC-BP System – Typical Installation, later in this section.
- The check valve supplied with the softener must be installed in the softener brine inlet line as shown.

2.7 Saturator

The saturator requires a stable, flat, and level base suitable to support its maximum salt capacity and fluid weight. It should be located apart from the electrolyzer panel in an area easily accessible for manually loading bags of salt. Provisions for maintenance and cleanup of spilled salt and brine should be considered. The selection of the saturator is determined by system capacity and customer requirements. Refer to Dwg. 85.070.110.080, OSEC-BP System – Salt Saturator – Typical Installation, for specifications and dimensions.

- Plumbing connections should be made following the saturator manufacturer's installation manual and/or Dwg. 85.070.111.050, OSEC-BP System – Typical Installation, later in this section.
- Ensure that the interior of the tank is reasonably clean prior to installation.
- 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.
- It is recommended, for best function, that the tank should be filled to no more than about half of its height with salt.

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.

2.8 Product Storage Tank

The product storage tank should be located in an area away from other equipment and potential ignition sources. The tank's interior, when operational, should be considered as containing a potentially explosive gas (hydrogen and air).

Prior to positioning the tank, review Dwg. 85.070.111.050, OSEC-BP System – Typical Installation, later in this section. Review the location of tank piping, hydrogen venting, blower, and especially the installation notes before installation.

- 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.
- Install the Product Tank as shown in the Product Storage Tank installation illustration.
- 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 placing in service.

2.9 Level Transducer

The product Level Transducer should be installed in a fitting near the bottom of the product storage tank, as shown in the Product Tank 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 transducer is supplied with nine feet of cable to be terminated in the control panel or in a nearby junction box. A breather tube is incorporated in the extension cable—the cable may be cut as required, but ensure that the vent tube is exposed at the cable end (not obscured or blocked) and do not allow liquids or dirt to enter this tube as it would impede operation of the transducer. The cable end must be terminated in an enclosure to protect from dirt and moisture. While the junction box may be of a sealed, watertight construction, it will generally breathe enough to expose the vent tube to ambient atmospheric pressure.

2.10 Vent System

The ventilation system (blower, vent line, orifice, and differential pressure switch tied into the system control panel) is designed to ensure that hydrogen is diluted immediately to below the Lower Flammable Limit (LFL) and safely vented.

2.10.1 Vent Piping

Refer to Dwg. 85.070.111.050, OSEC-BP System – Typical Installation, later in this section for an overview of the vent piping requirements.

The vent line should be run with three-inch PVC pipe and long radius elbows (to minimize restriction). All PVC pipe joints should be cemented to be secure and gas-tight. No metal ductwork should be used.

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

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 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 should be away from likely sources of ignition, 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 is recommended.

2.10.2 Differential Pressure Orifice

The orifice unit is to be installed inline with the vent line after the product tank as shown in Dwg. 85.070.111.050, OSEC-BP System – Typical Installation. The axis of the unit should be oriented vertically, as should all of the vent line after the tank to allow condensation to drain back to the tank.

2.10.3 Blower

Refer to Dwg. 85.070.111.020, OSEC-BP System – Blower Assembly-Typical Installation, for blower specifications.

The blower is powered via the system control panel. Refer to Dwg. 85.070.130.010, OSEC-BP System – Installation Wiring, for details on connection of the blower.

The blower should be wall mounted approximately two feet off the floor so that it is not subject to damage caused by moisture or chemicals from spills or servicing.

2.10.4 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 connected 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.

Refer to Dwg. 85.070.111.040, OSEC-BP System – Differential Pressure Switch – Typical Installation, and Dwg. 85.070.111.050, OSEC-BP System – Typical Installation, for details.

See Dwg. 85.070.130.010, OSEC-BP System – Installation Wiring, for details on electrical connections.

2.11 Electrical Interconnection

NOTE: Installation must conform to local electrical codes.

Connect the system as indicated in the Interconnection Wiring diagram and using the materials supplied in the Electrical Installation Kit as shown in the Typical Installation drawing (other approved materials may be substituted). Not all items shown in the in installation drawing are supplied with the kit and those must be supplied by the installer.

2.12 Plumbing Interconnection

NOTE: Installation must conform to local plumbing codes.

Connect the system as shown in the Plumbing Interconnection schematic and using the materials supplied in the Plumbing Installation Kit as shown in Dwg. 85.070.111.050, OSEC-BP System – Typical Installation, at the end of this section (other approved materials may be substituted). Not all items shown in the installation drawings are supplied with the kit; some are site specific and 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 pipe work at its highest point—typically the discharge from the electrolyzer would be connected as shown in the Typical Installation illustration.

2.13 Description of Operation

The OSEC-BP (On-Site Electrolytic Chlorination - Bi-Polar) consists of five principal items: electrolyzer panel, brine dilution unit, power supply, control panel, and product tank with ventilation blower.

2.13.1 Electrolyzer Panel

The Electrolyzer Panel consists of one to four electrolyzers mounted horizontally and hydraulically connected in series. Electrolyte (diluted brine mixture) enters at the bottom of the first electrolyzer and passes through each in succession. The electrolyzers are wired in series via terminals at each end to a DC power supply. The application of a DC current results in the formation of hydrogen gas at the cathodes and chlorine (as hypochlorite) at the anodes.

A separate level and temperature switch is mounted at the outlet of the (top-most) electrolyzer; these units return intrinsically safe signals to the system control panel, preventing application of power to electrolyzers when the float is not in the “full” position or when the temperature switch indicates the fluid temperature has exceeded the high temperature setpoint (122° F/50° C). Either fault will terminate system operation and trigger an alarm requiring acknowledgement at the system control panel. These signals are monitored as safety interlocks because application of power with electrodes exposed in hydrogen gas could result in an explosion. Application of power under abnormal conditions can result in over-heating and damage to equipment.

The OSEC-BP product pipe work should rise continuously from the electrolyzer to the product tank (maximum 4 ft head). This is to ensure that no hydrogen traps can form in the pipe work. If this is not feasible, 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 Dwg. 85.070.111.050, OSEC-BP System – Typical Installation, later in this section.

2.13.2 Brine Dilution Unit

The brine dilution unit consists of a pump for drawing brine from the saturator, and metering components for dilution water to produce the specified brine flow and concentration required by the generation process. Feed rate settings for brine and water are given in the operating setting chart in Section 1 – Technical Data. Water-to-brine feed ratios are generally about 10:1 but might be varied to suit specific conditions.

Brine feed rate can affect efficiency and anode life. Lower than specified brine feed and is evidenced by higher operating voltage while excess brine feed lowers voltage and uses more salt. Brine feed and current properly set water flow rate and temperature are the major determining factors in total product volume and concentration.

2.13.3 Power Supply

The DC power supply provides electric power required to drive the electrolytic process—forcing the conversion of brine to chlorine solution (hypochlorite) and hydrogen (by-product).

The power supply is connected to (AC) line power, with control and monitoring signals to the system control panel. These signals are indicated in the system interconnection wiring installation diagram.

The DC output is activated by a remote signal from the system control panel—operator controls at the power supply include a disconnect switch for the AC line power and an adjustable potentiometer that sets the regulated output current. The supply nominally operates at about 88% of rated current (typically 35 Amps) with an allowance made for increasing output if required to obtain specified capacity.

2.13.4 Control Panel

The system control panel monitors and controls system components. It monitors storage tank level—activating the system (on/off) as required to maintain storage between low and high setpoints (system start/stop points). It monitors various system signals, deactivating the system should failure or hazard be indicated, and provides remote (if wired) and local indication of alarm.

The control panel includes a PLC for system control logic and a front-mounted operator terminal. The operator interface contains an alpha-numeric display with keypad for operator input, system messaging, and monitoring.

Refer to Section 3 – Operation of the OSEC-BP Control Panel Supplement (Supplement 1 located at the end of this book) for a complete description of the functions of the system control panel.

2.13.5 Water Softener

The water softener provides a softened water supply to the salt saturator to create the brine and 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 (1 grain).

The hardness of the water fed to the electrolyzer is critical to efficient operation and the lifetime of the anodes. Evoqua Water Technologies recommends that the hardness of the softened water supply be monitored weekly to ensure that the hardness does not exceed the recommended level. In order to comply with the anode warranty, Evoqua Water Technologies also requires 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 Evoqua Water Technologies service attention.

If the chlorine content of the water supply to the softener is in excess of 1 mg/l (1 ppm) 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.

The standard softener supplied is a dual-tank automatic (based on treated volume) softener requiring no electrical connection because the control valve mechanism is driven by the flow of treated water. The softener is supplied pre-configured with control cams that determine the regeneration parameters. It has no set-up requirements beyond installation, but the cams supplied must be suitable for site water supply (based on maximum anticipated hardness). A check valve must be installed in the “brine draw” line of the softener to block the return of fresh water to the saturator—this is the method of saturator refill in usual softener applications, but it is not desirable with the saturator configuration used in this system.

Full details of softener operation, configuration, and service are contained in the manual provided by softener manufacturer.

2.13.6 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 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 filter that prevents undissolved solids from 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

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.

2.13.7 Storage Tank Ventilation 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 by-product of main concern in the electrolytic generation of NaOCl is hydrogen gas. (For every pound of chlorine equivalent produced, there is 6 ft³ of hydrogen produced.) Mixed with air (oxygen) in the proper proportions, this can produce 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 an explosive gas mixture.

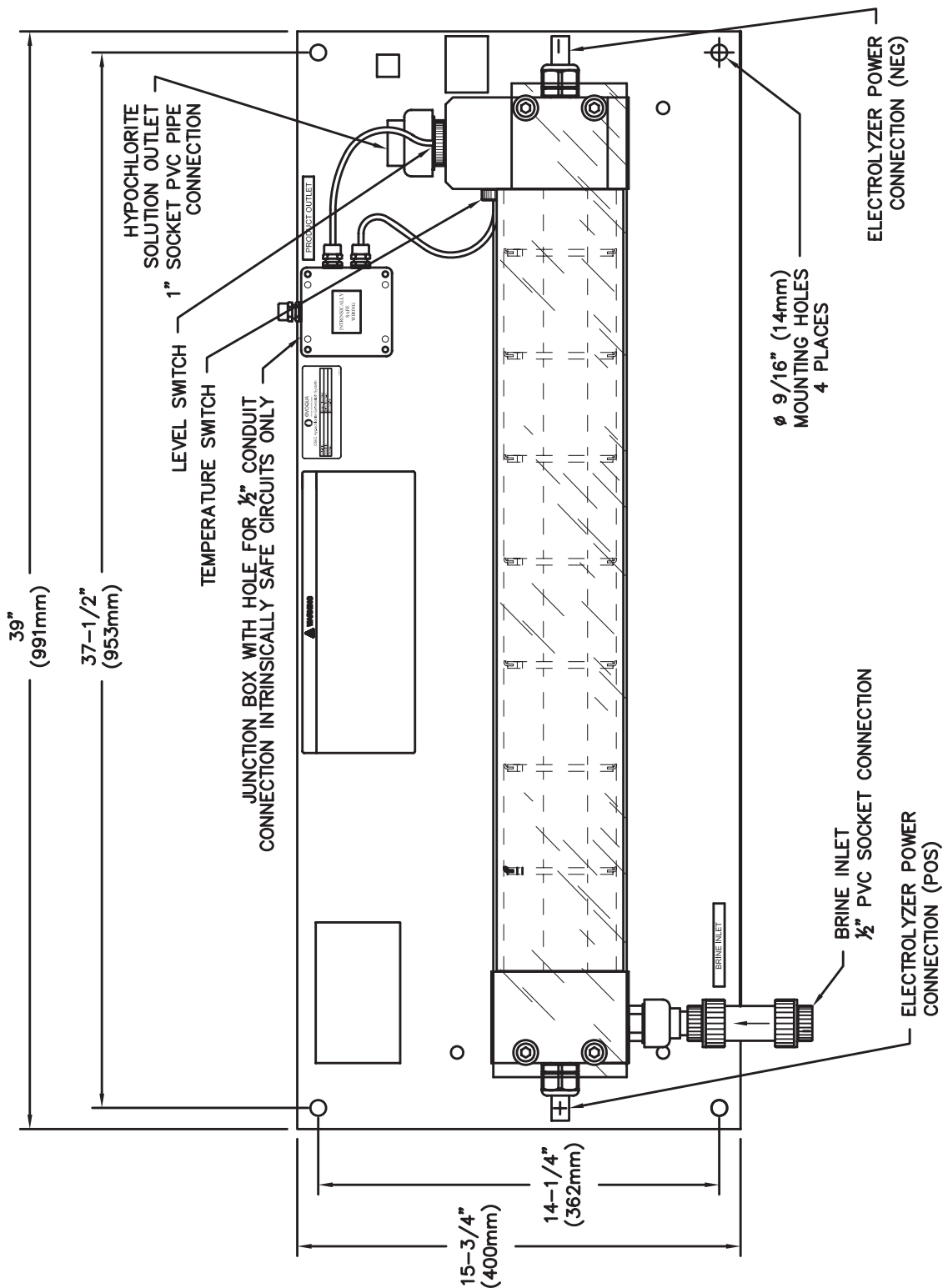
The lower explosive limit (LFL) for hydrogen/air mixtures is 4% in air. To minimize the risk of explosion, the hydrogen is diluted to less than 25% of the LFL. This is achieved by blowing air into the head space of the product storage tank and exhausting the diluted hydrogen/air mixture to a safe zone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

The vent pipe on the exhaust side of the product tank is fitted with an orifice plate for sensing air flow. During blower operation the air flow generates a differential pressure across the orifice, which is sensed by the differential pressure switch. The status of the differential pressure switch is monitored at the control panel and the loss of differential pressure (drop in air flow) results in the shut down of the system. The control panel also monitors the status of the air flow switch, to check that it returns to an open state after shut down.

2.13.8 Hypochlorite Storage Tank

This tank stores the hypochlorite generated by the electrolyzers for later use. It also receives some or all of the hydrogen that is discharged with the product. Hydrogen is essentially insoluble in water and is quickly released to the tank headspace. Here it is diluted with air from the blower and safely exhausted.

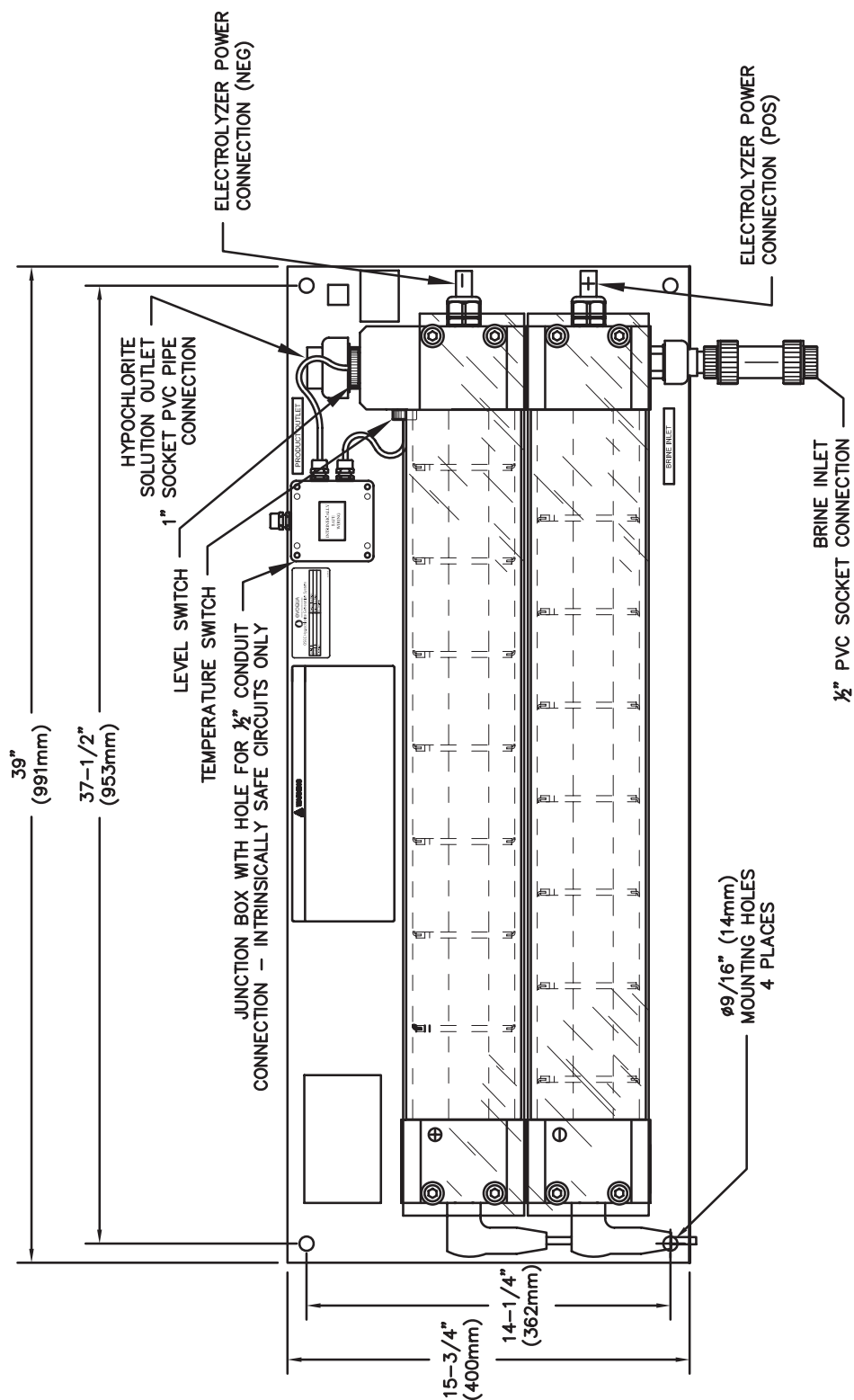
The storage tank is fitted with a hydrostatic pressure transmitter giving an analog electrical level signal to the system control panel. This signal is used to start/stop the batch generation of product by tank level.



OSEC®-BP SYSTEM - ELECTROLYZER, C12 (AAC8216)
- TYPICAL INSTALLATION

85.070.110.020

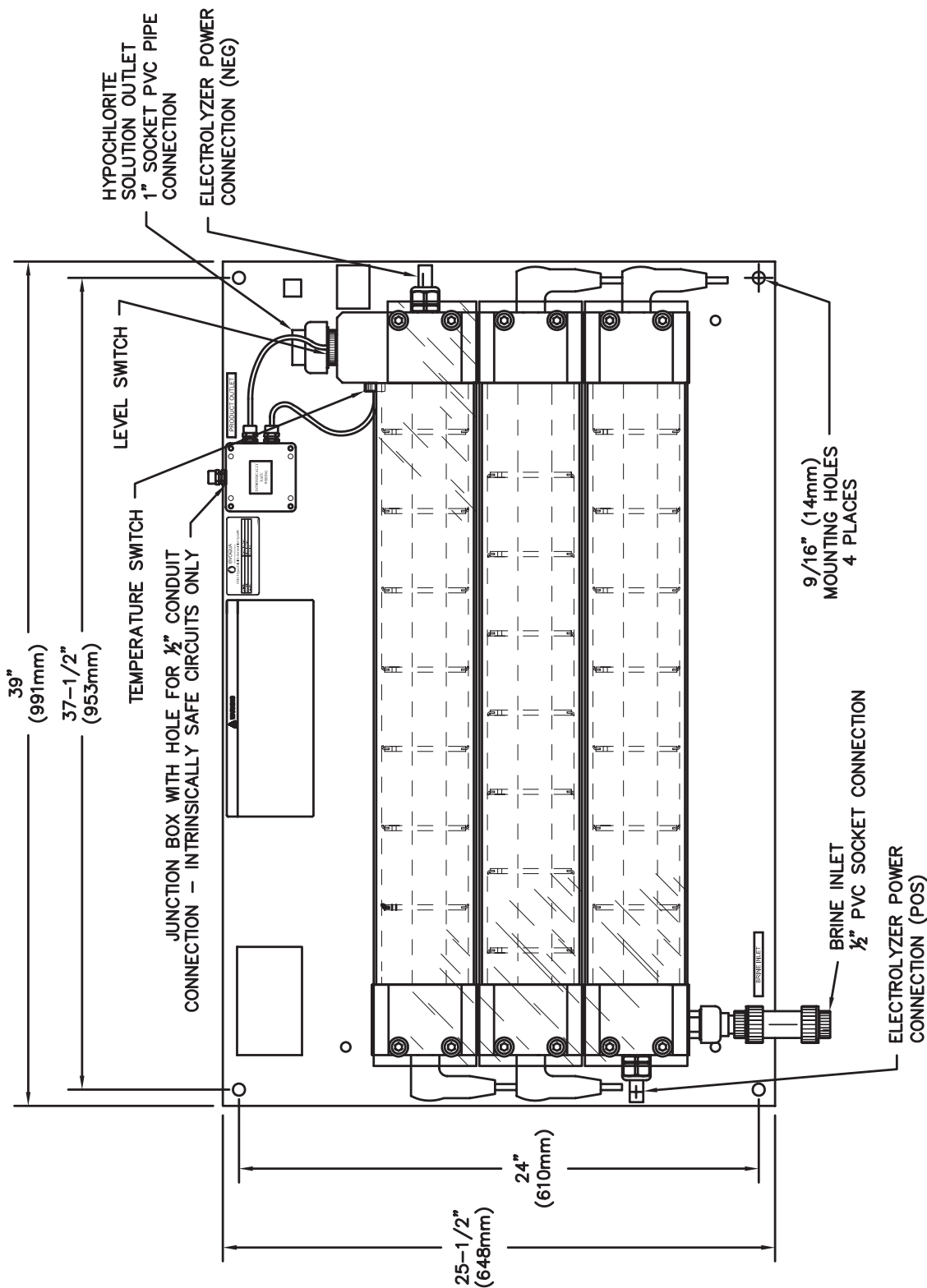
ISSUE 6 10-14



OSEC®-BP SYSTEM – ELECTROLYZER, C24 (AAC8219)
– TYPICAL INSTALLATION

85.070.110.030

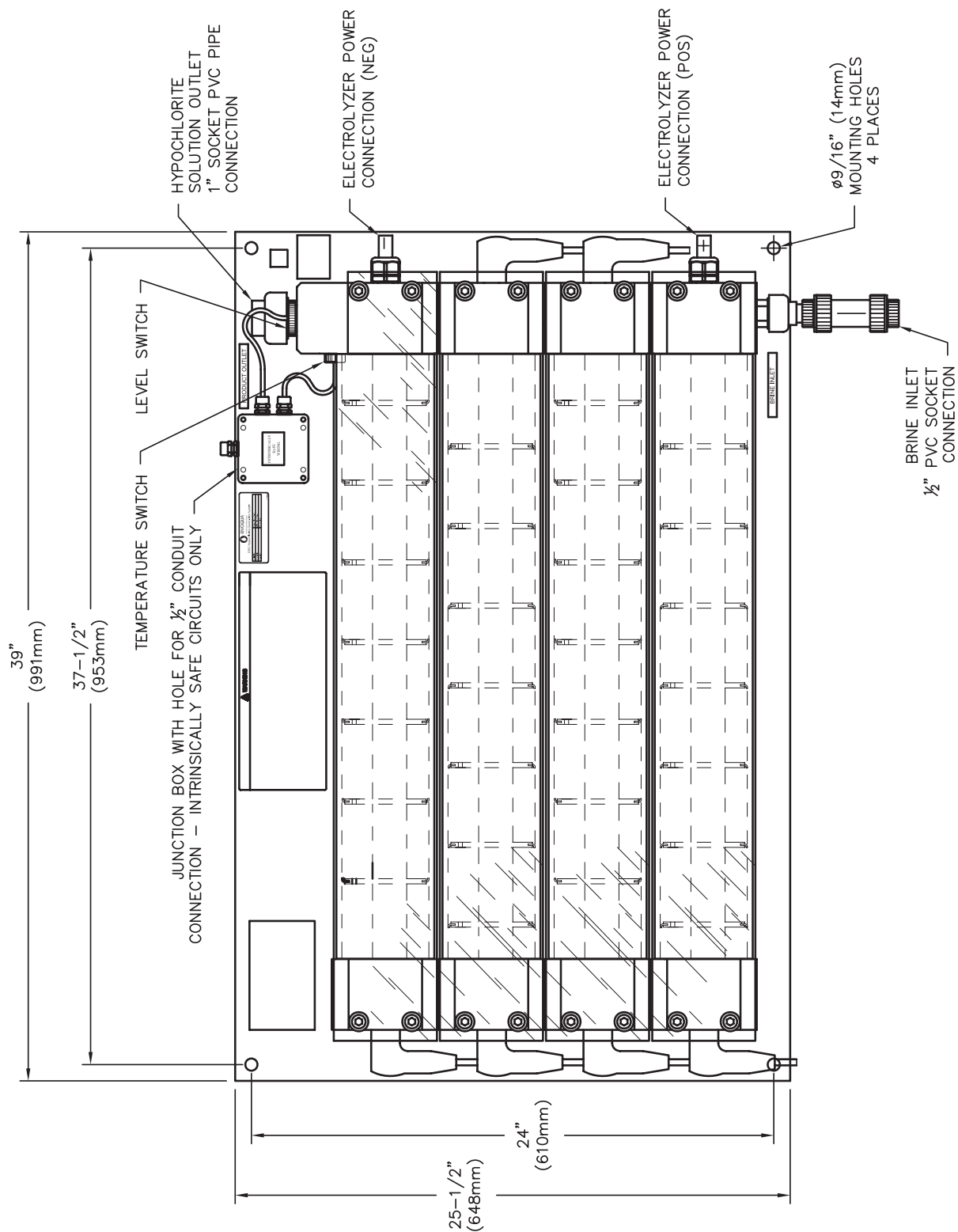
ISSUE 5 10-14



OSEC®-BP SYSTEM – ELECTROLYZER, C36 (AAC8222)
– TYPICAL INSTALLATION

85.070.110.040

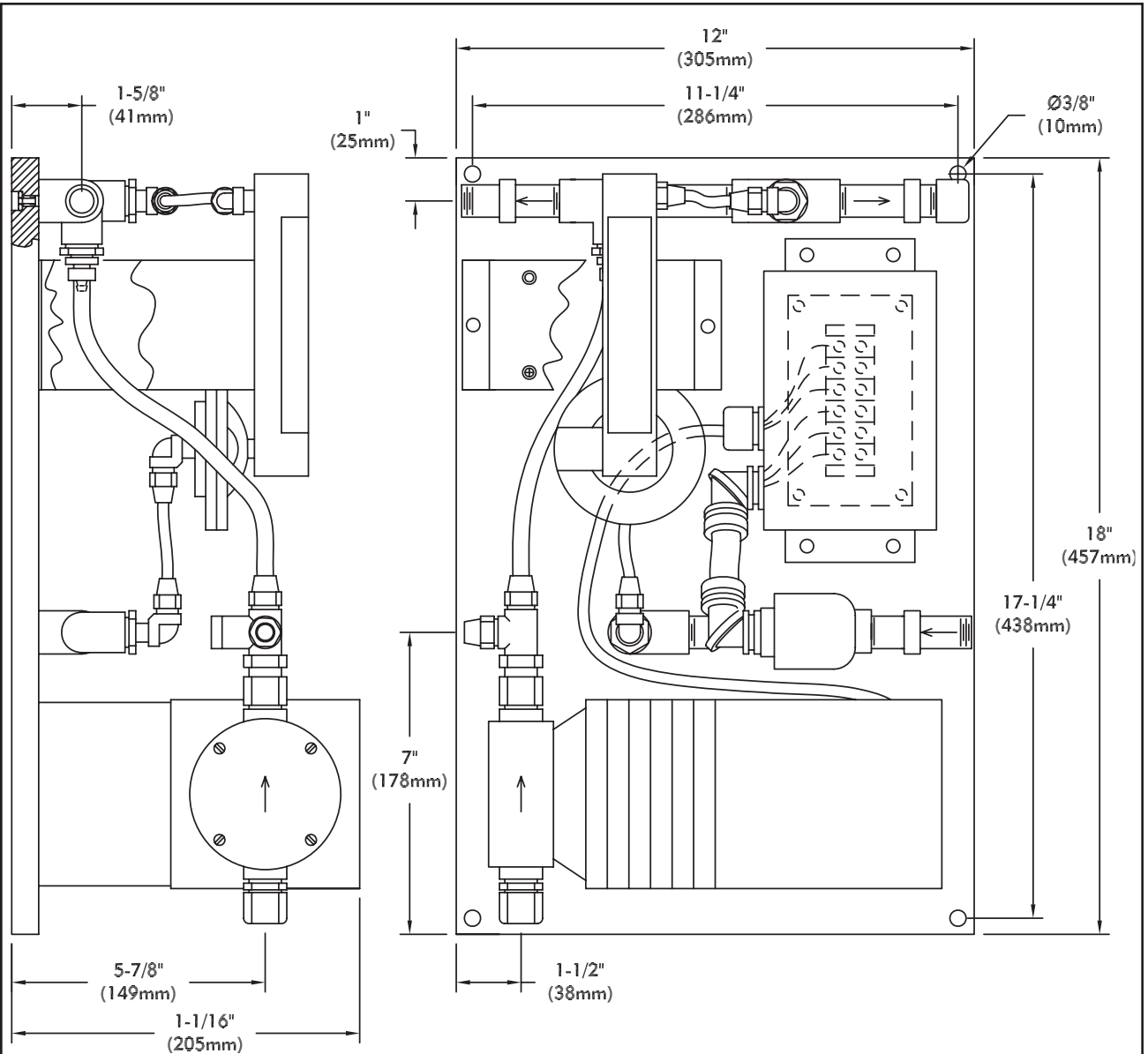
ISSUE 6 10-14



OSEC®-BP SYSTEM – ELECTROLYZER, C48 (AAC8225)
– TYPICAL INSTALLATION

85.070.110.050

ISSUE 5 10-14



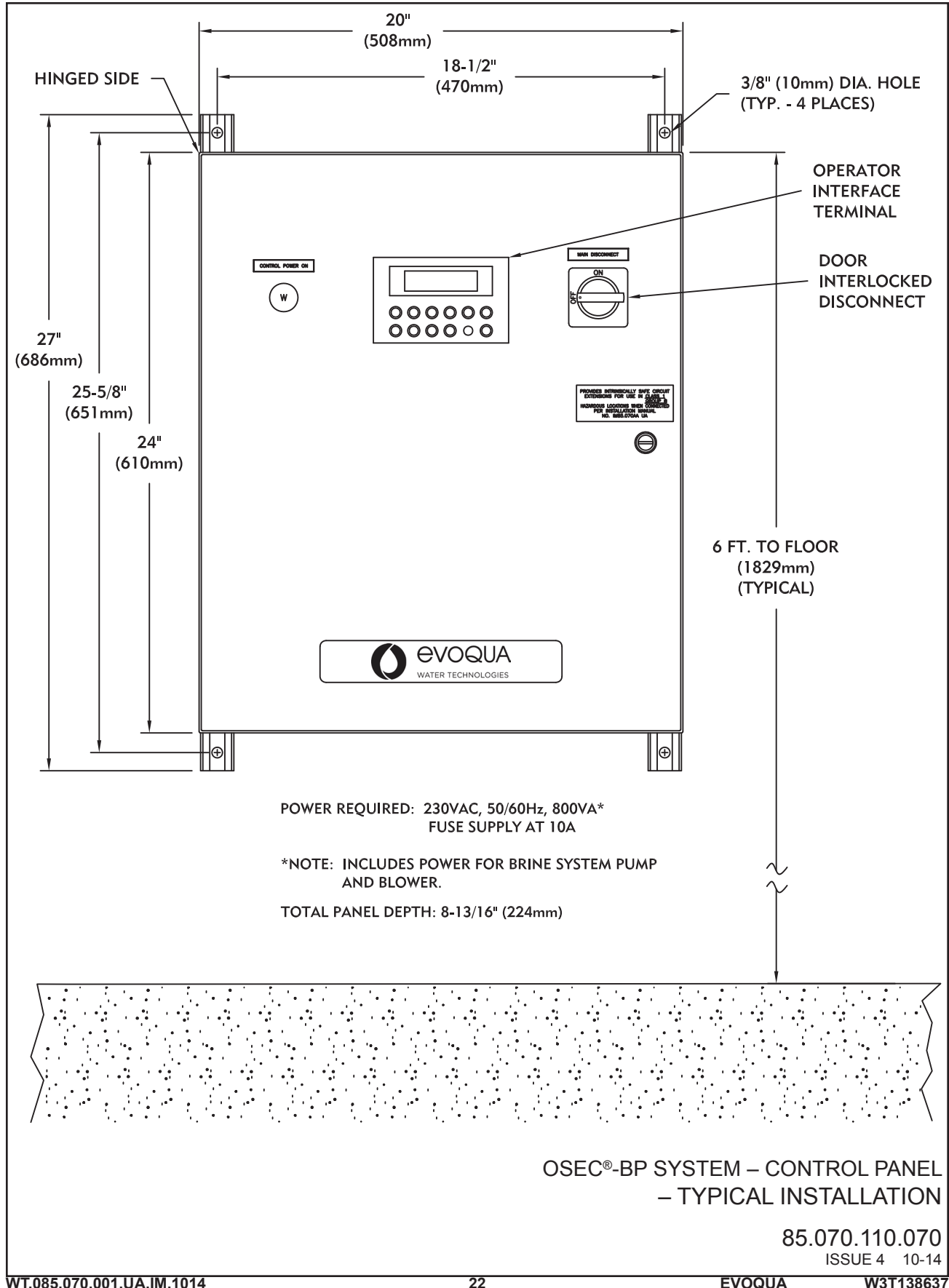
| PART No. | FOR SYSTEM TYPE |
|----------|-----------------|
| AAC2858 | C12 |
| AAC4097 | C24 |
| AAC4100 | C36 & C48 |

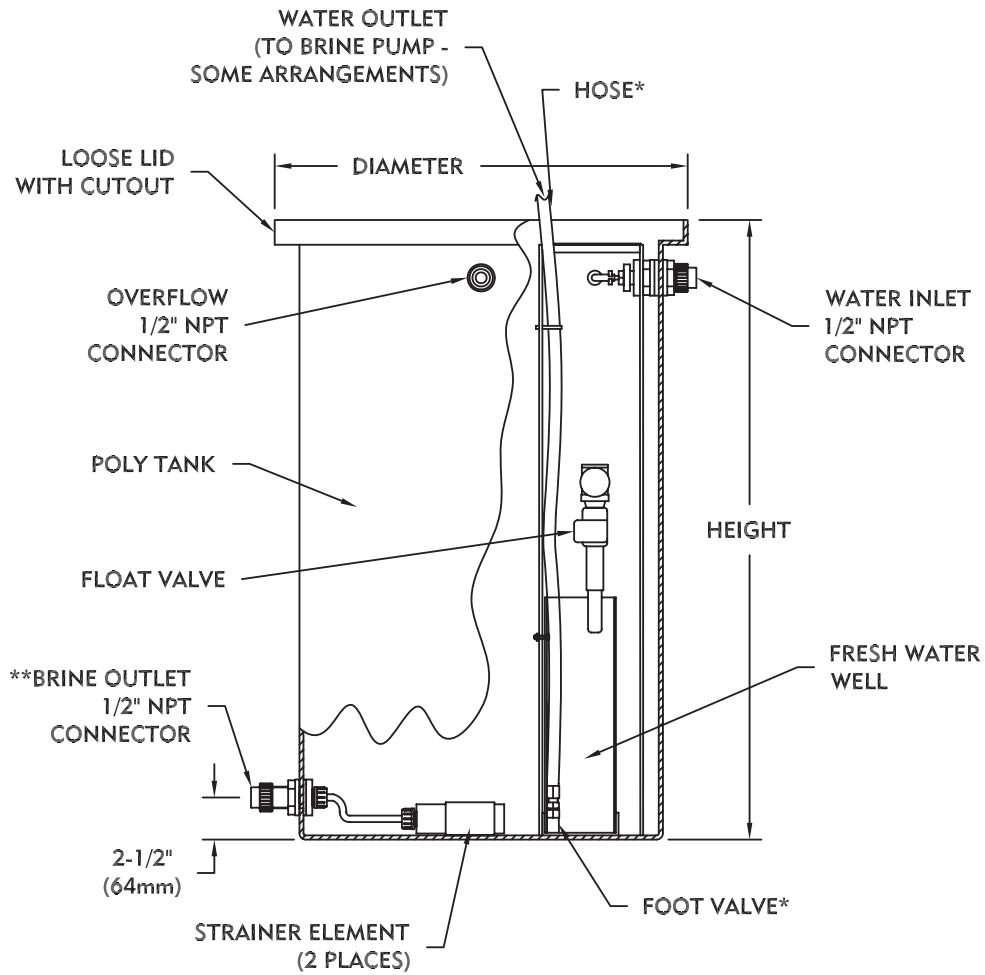
POWER: 230VAC, 60Hz (VIA SYSTEM CONTROL PANEL)

OSEC®-BP SYSTEM – BRINE PUMP
– TYPICAL INSTALLATION

85.070.110.065

ISSUE 0 07-05



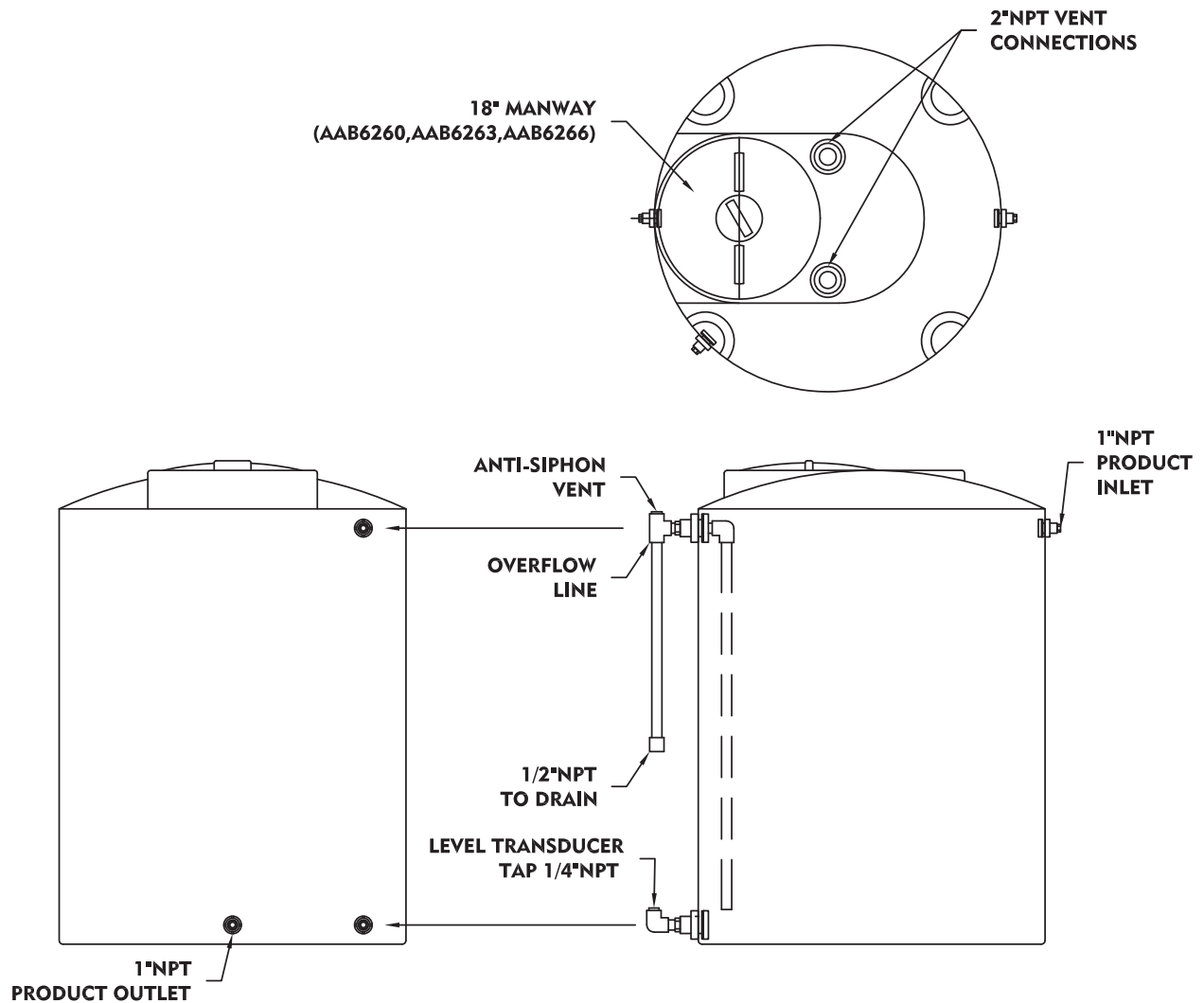


NOTES: *CONTINUED IN INSTALLATION PLUMBING KIT.
 **TWO OUTLET CONNECTIONS/STRAINERS.

| PART NO. | NOMINAL SALT CAPACITY | DIAMETER | HEIGHT |
|----------|-----------------------|---|---|
| AAB6239 | 400 LB. | 25- ⁵ / ₈ " (651mm) | 36- ⁷ / ₈ " (937mm) |
| AAB6242 | 800 LB. | 32- ¹ / ₈ " (816mm) | 43- ¹ / ₂ " (1105mm) |
| AAB6245 | 1500 LB. | 40- ⁵ / ₈ " (1032mm) | 50- ¹ / ₂ " (1283mm) |
| AAB6248 | 2800 LB. | 52- ¹ / ₄ " (1327mm) | 50" (1270mm) |

OSEC®-BP SYSTEM – BRINE SATURATOR
 – TYPICAL INSTALLATION

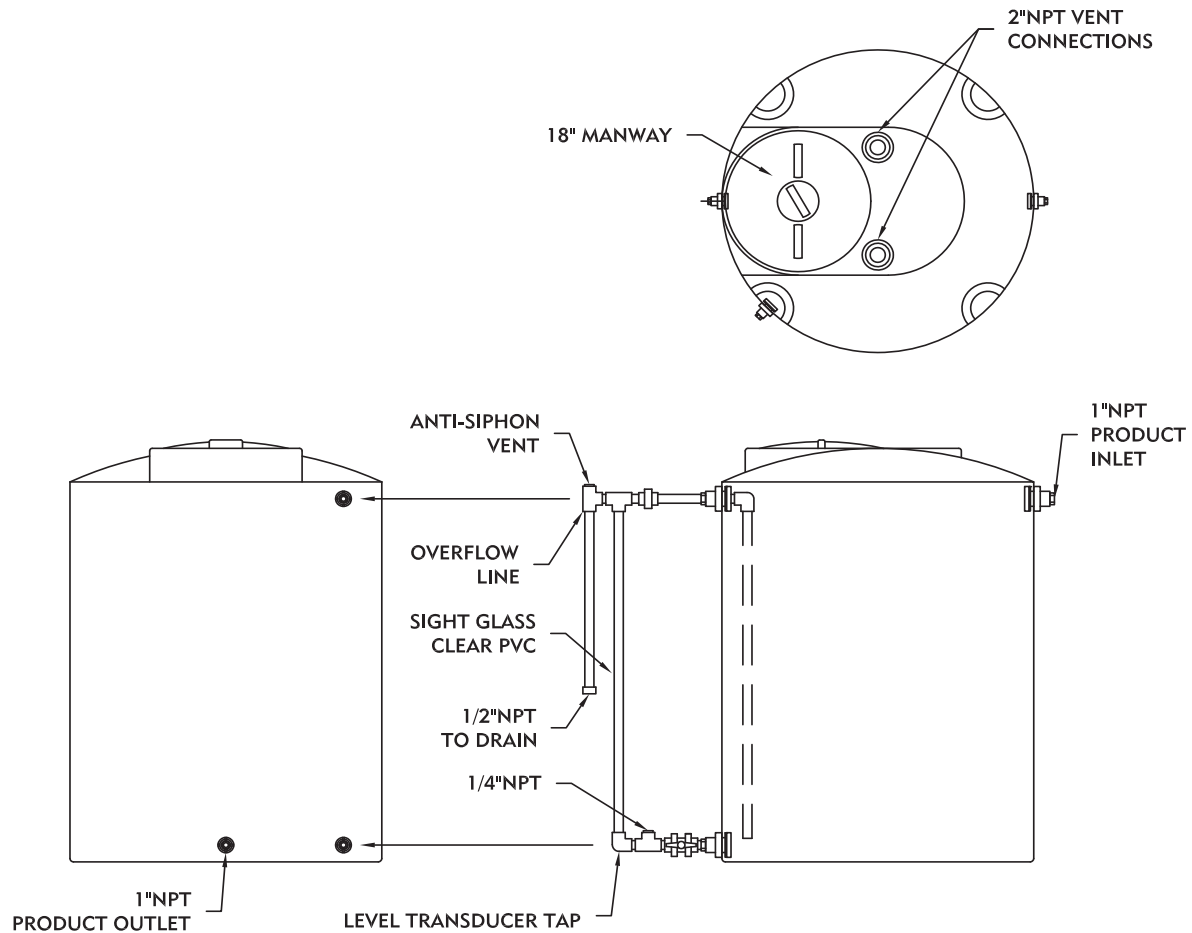
85.070.110.080
 ISSUE 2 07-05



| PART NO. | NOMINAL CAPACITY | DIAMETER | HEIGHT |
|----------|------------------|-----------------|-----------------|
| AAB6257 | 200 GAL. | 33" (838mm) | 69" (1753mm) |
| AAB6260 | 400 GAL. | 45" (1143mm) | 63" (1600mm) |
| AAB6263 | 550 GAL. | 48" (1219mm) | 77" (1956mm) |
| AAB6266 | 1100 GAL. | 64" (1626mm) | 90" (2286mm) |

AAB6257, AAB6260, AAB6263, AAB6266
OSEC®-BP SYSTEM – NATURAL COLOR PRODUCT TANK
– TYPICAL INSTALLATION

85.070.110.090
ISSUE 1 09-05

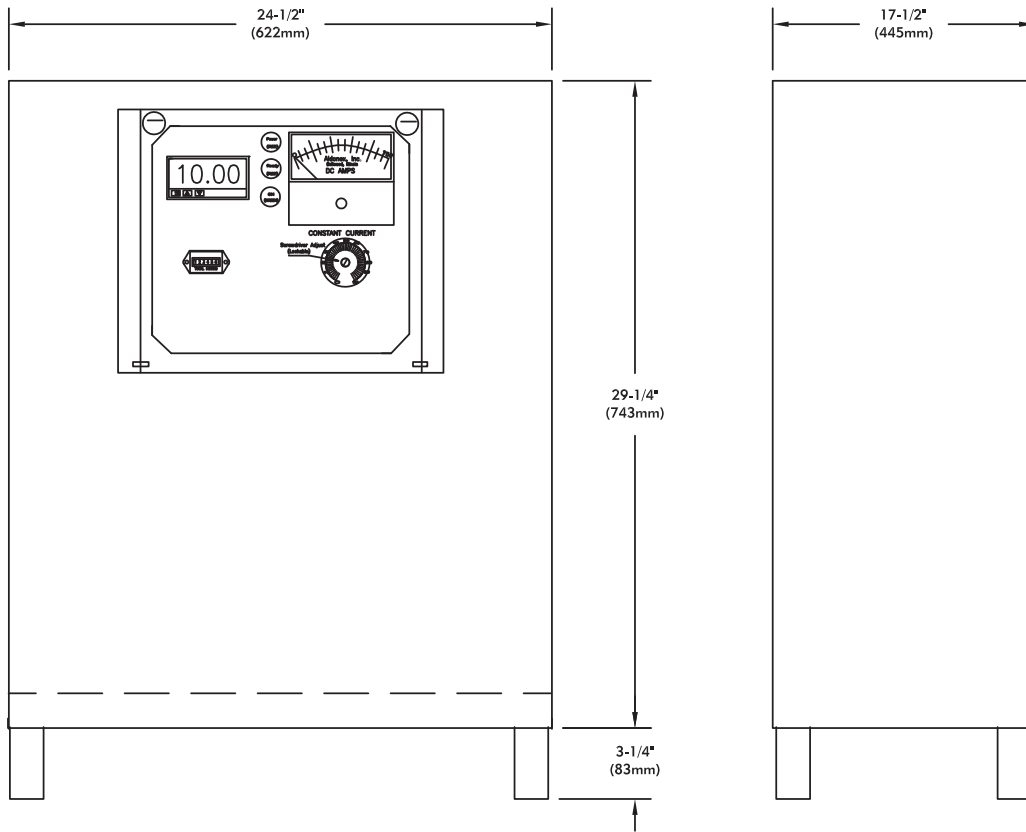


| PART NO. | NOMINAL CAPACITY | DIAMETER | HEIGHT |
|----------|------------------|-----------------|-----------------|
| AAB6608 | 200 GAL. | 33" (838mm) | 69" (1753mm) |
| AAB6611 | 400 GAL. | 45" (1143mm) | 63" (1600mm) |
| AAB6614 | 550 GAL. | 48" (1219mm) | 77" (1956mm) |
| AAB6617 | 1100 GAL. | 64" (1626mm) | 90" (2286mm) |

AAB6608, AAB6611, AAB6614, AAB6617
OSEC®-BP SYSTEM – BLACK COLOR PRODUCT TANK
– TYPICAL INSTALLATION

85.070.111.060

ISSUE 1 9-05



| OSEC-BP C12 35VDC | | OSEC-BP C24 70VDC | | OSEC-BP C36 105VDC | | OSEC-BP C48 140VDC | | ENCLOSURE TYPE | | | |
|----------------------|-----|----------------------|-----|-----------------------|-----|-----------------------|-----|----------------|-------------|-------------|----------|
| PART NO. | ISS | PART NO. | ISS | PART NO. | ISS | PART NO. | ISS | POLY * | STD POLY | STEEL 3R | MET LABS |

| | | | | | | | | | | | | |
|--------------|---------|---|---------|---|---------|---|---------|---|---|---|---|---|
| 1PH / 208VAC | AAC8285 | 1 | AAC8288 | 1 | AAC8291 | 1 | AAC8294 | 1 | X | | | |
| | AAC8309 | 1 | AAC8312 | 1 | AAC8315 | 1 | AAC8318 | 1 | X | | | X |
| | AAC8261 | 1 | AAC8264 | 1 | AAC8267 | 1 | AAC8270 | 1 | | X | | |
| | AAC8333 | 1 | AAC8336 | 1 | AAC8339 | 1 | AAC8342 | 1 | | | X | |
| | AAC8357 | 1 | AAC8360 | 1 | AAC8363 | 1 | AAC8366 | 1 | | | X | X |
| 1PH / 230VAC | AAC8405 | 1 | AAC8408 | 1 | AAC8411 | 1 | AAC8414 | 1 | X | | | |
| | AAC8429 | 1 | AAC8432 | 1 | AAC8435 | 1 | AAC8438 | 1 | X | | | X |
| | AAC8381 | 1 | AAC8384 | 1 | AAC8387 | 1 | AAC8390 | 1 | | X | | |
| | AAC8453 | 1 | AAC8456 | 1 | AAC8459 | 1 | AAC8462 | 1 | | | X | |
| | AAC8477 | 1 | AAC8480 | 1 | AAC8483 | 1 | AAC8486 | 1 | | | X | X |
| 3PH / 230VAC | AAC8297 | 1 | AAC8300 | 1 | AAC8303 | 1 | AAC8306 | 1 | X | | | |
| | AAC8321 | 1 | AAC8324 | 1 | AAC8327 | 1 | AAC8330 | 1 | X | | | X |
| | AAC8273 | 1 | AAC8276 | 1 | AAC8279 | 1 | AAC8282 | 1 | | X | | |
| | AAC8345 | 1 | AAC8348 | 1 | AAC8351 | 1 | AAC8354 | 1 | | | X | |
| | AAC8369 | 1 | AAC8372 | 1 | AAC8375 | 1 | AAC8378 | 1 | | | X | X |
| 3PH / 460VAC | AAC8417 | 1 | AAC8420 | 1 | AAC8423 | 1 | AAC8426 | 1 | X | | | |
| | AAC8441 | 1 | AAC8444 | 1 | AAC8447 | 1 | AAC8450 | 1 | X | | | X |
| | AAC8393 | 1 | AAC8396 | 1 | AAC8399 | 1 | AAC8402 | 1 | | X | | |
| | AAC8465 | 1 | AAC8468 | 1 | AAC8471 | 1 | AAC8474 | 1 | | | X | |
| | AAC8489 | 1 | AAC8492 | 1 | AAC8495 | 1 | AAC8498 | 1 | | | X | X |

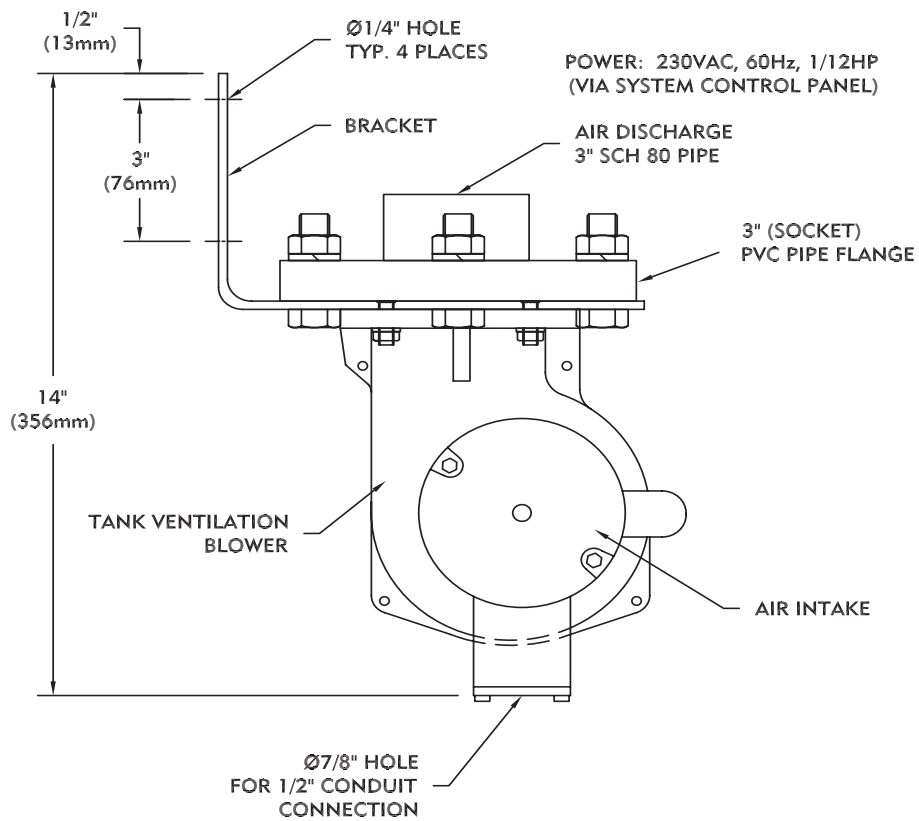
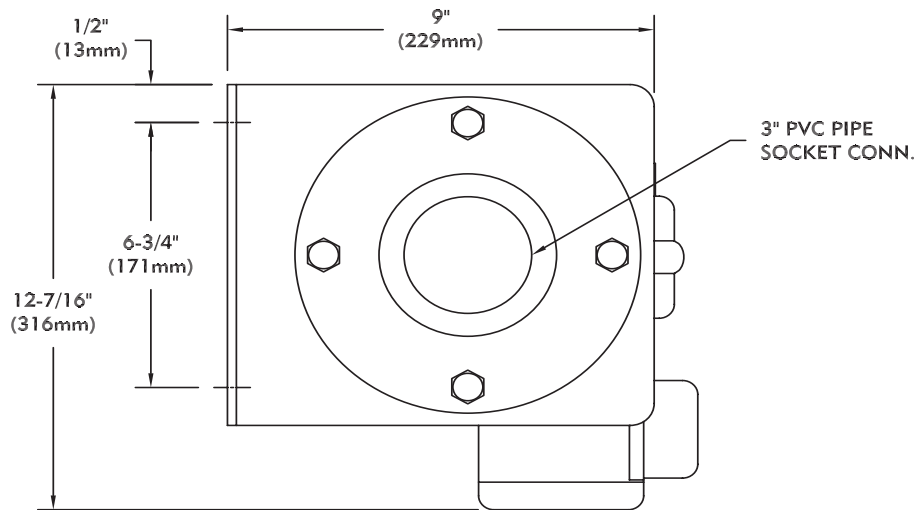
* POLY MATERIAL TO BE UL LISTED (COLOR: WHITE)

NOTE: REFER TO SECTION 1 – TECHNICAL DATA FOR ELECTRICAL RATINGS/REQUIREMENTS.

OSEC®-BP SYSTEM – DC POWER SUPPLY

85.070.111.010

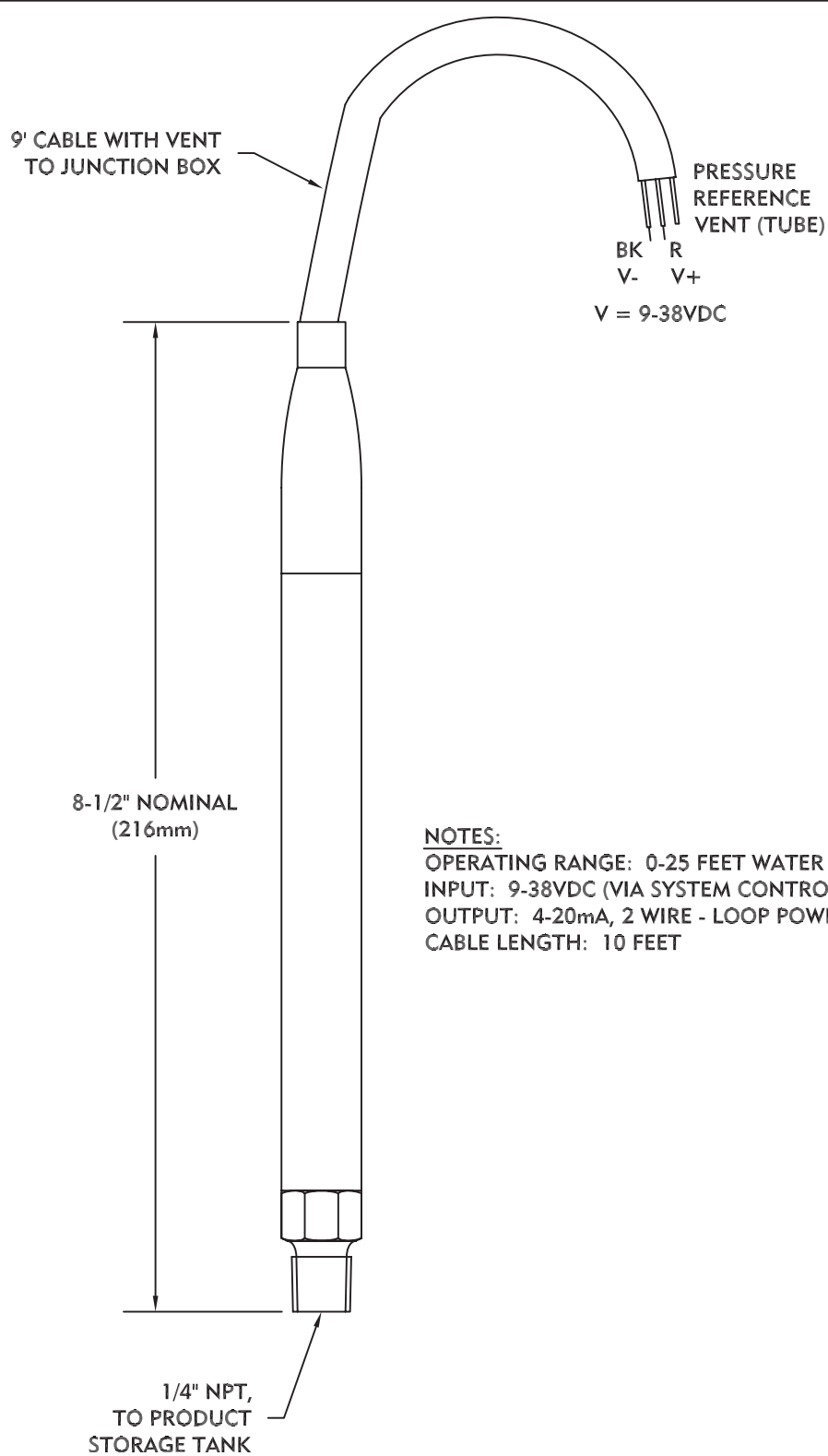
ISSUE 3 7-09



OSEC®-BP SYSTEM – BLOWER ASSEMBLY TYPICAL INSTALLATION

85.070.111.020

ISSUE 2 7-05

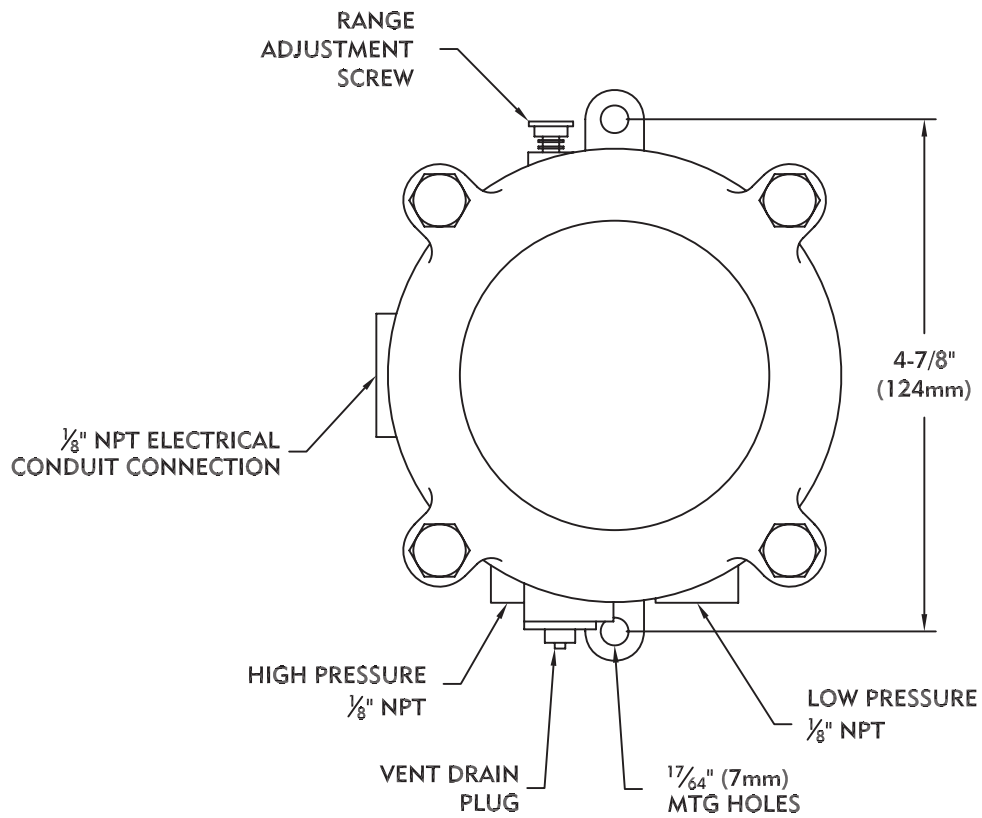


NOTES:
 OPERATING RANGE: 0-25 FEET WATER
 INPUT: 9-38VDC (VIA SYSTEM CONTROL PANEL)
 OUTPUT: 4-20mA, 2 WIRE - LOOP POWERED
 CABLE LENGTH: 10 FEET

OSEC®-BP SYSTEM – LEVEL TRANSDUCER (AAB3225/W2T9535)
 – TYPICAL INSTALLATION

85.070.111.030

ISSUE 3 2-10

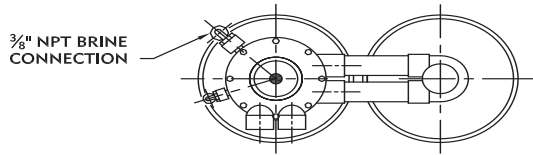


NOTE: DIFFERENTIAL PRESSURE ACTUATION POINT
TO BE SET AS DESCRIBED IN INSTRUCTION MANUAL.

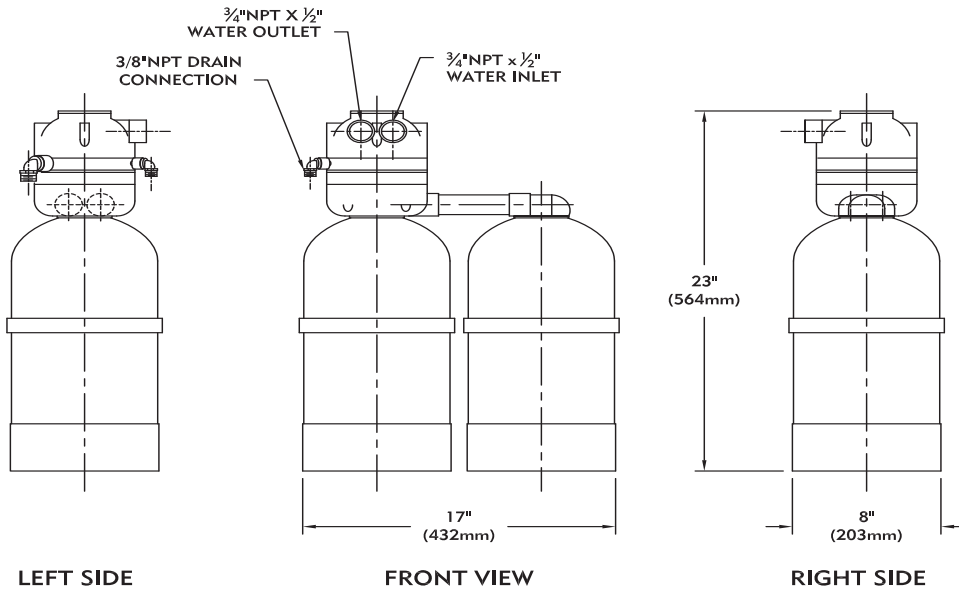
OSEC®-BP SYSTEM – DIFFERENTIAL PRESSURE SWITCH – TYPICAL INSTALLATION

85.070.111.040

ISSUE 1 8-05



TOP VIEW



LEFT SIDE

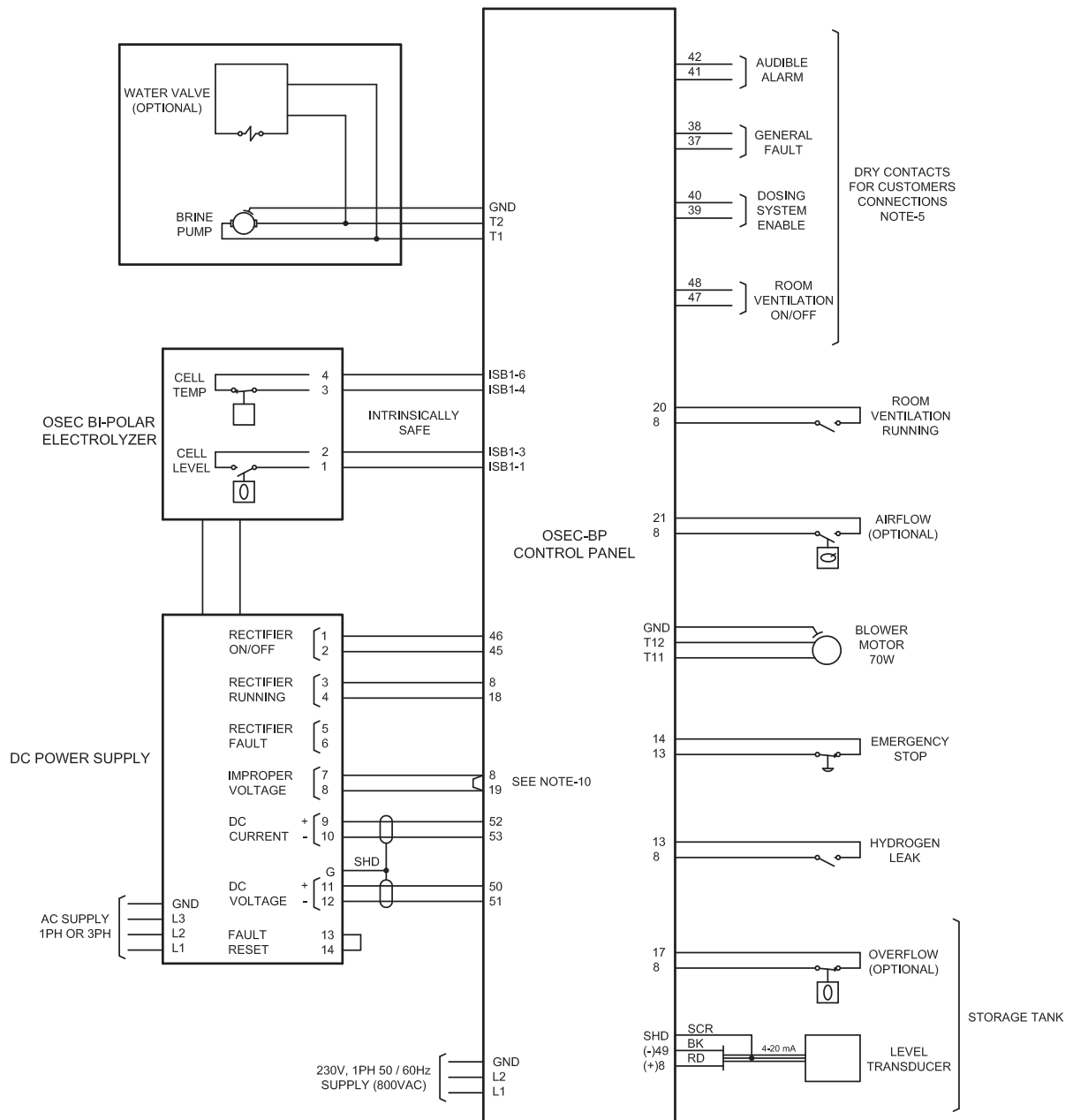
FRONT VIEW

RIGHT SIDE

OSEC® SYSTEM – SOFTENER WITHOUT RECIRCULATION PUMP
– TYPICAL INSTALLATION

85.050.110.075

ISSUE 0 9-05



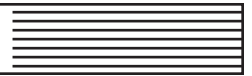
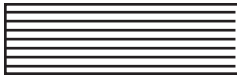
NOTES:

- IF HYDROGEN LEAK CONTACT IS NOT AVAILABLE, LINK TERMINAL 8 TO 13.
- IF EMERGENCY STOP PUSHBUTTON IS NOT FITTED, LINK TERMINAL 14 TO 13.
- IF ROOM VENTILATION RUNNING CONTACT IS NOT FITTED, LINK TERMINAL 8 TO 20.
- IF STORAGE TANK OVERFLOW CONTACT IS NOT AVAILABLE, LINK TERMINAL 8 TO 17.
- THE CABLES ARE SUBJECT TO VOLTAGES APPLIED BY THE EXTERNAL EQUIPMENT AND NOT THE CONTROL PANEL.
- TERMINAL IDENTIFICATION PREFIXED "ISB1" DENOTES A CONNECTION MADE.
- FIELD WARNING TO BE IN ACCORDANCE WITH LOCAL CODES.
- ALL CUSTOMER DRY CONTACTS RATED 5A MAX.
- ALL ALARM RELAYS ARE FAIL SAFE (ENERGIZED WHEN HEALTHY)
- IF IMPROPER ANALOG VOLTAGE SIGNAL IS USED FROM DC POWER SUPPLY, LINK TERMINAL 8 TO 19.

OSEC®-BP SYSTEM
– INSTALLATION WIRING

85.070.130.010

ISSUE 4 07-09



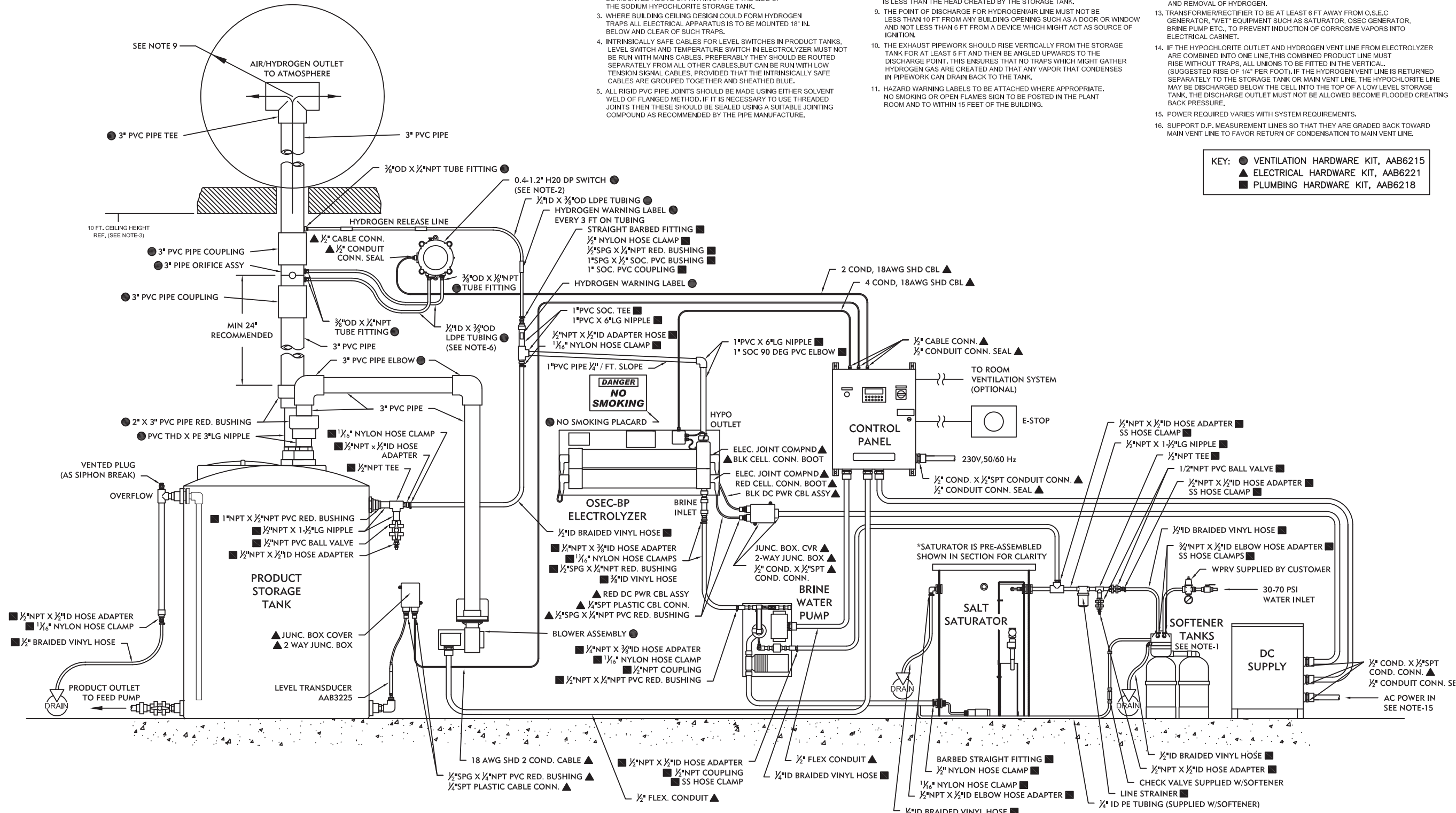
INSTRUCTIONS:

2. THE AIR FLOW DIFFERENTIAL PRESSURE SWITCH MUST NOT BE MOUNTED ABOVE OR WITHIN 5 FT. TO THE SIDE OF THE SODIUM HYPOCHLORITE STORAGE TANK.
3. WHERE BUILDING CEILING DESIGN COULD FORM HYDROGEN TRAPS ALL ELECTRICAL APPARATUS IS TO BE MOUNTED 18" IN. BELOW AND CLEAR OF SUCH TRAPS.
4. INTRINSICALLY SAFE CABLES FOR LEVEL SWITCHES IN PRODUCT TANKS, LEVEL SWITCH AND TEMPERATURE SWITCH IN ELECTROLYZER MUST NOT BE RUN WITH MAINS CABLES. PREFERABLY THEY SHOULD BE ROUTED SEPARATELY FROM ALL OTHER CABLES, BUT CAN BE RUN WITH LOW TENSION SIGNAL CABLES, PROVIDED THAT THE INTRINSICALLY SAFE CABLES ARE GROUPED TOGETHER AND SHEATHED BLUE.
5. ALL RIGID PVC PIPE JOINTS SHOULD BE MADE USING EITHER SOLVENT WELD OF FLANGED METHOD. IF IT IS NECESSARY TO USE THREADED JOINTS THEN THESE SHOULD BE SEALED USING A SUITABLE JOINTING COMPOUND AS RECOMMENDED BY THE PIPE MANUFACTURE.

8. SUCTION DEMAND VALVE TO BE FITTED WHEN THE SUCTION HEAD TO THE DOSING PUMP VARIES BY MORE THAN 10 FEET OR THE P.O.A PRESSURE IS LESS THAN THE HEAD CREATED BY THE STORAGE TANK.
9. THE POINT OF DISCHARGE FOR HYDROGEN/AIR LINE MUST NOT BE LESS THAN 10 FT FROM ANY BUILDING OPENING SUCH AS A DOOR OR WINDOW AND NOT LESS THAN 6 FT FROM A DEVICE WHICH MIGHT ACT AS SOURCE OF IGNITION.
10. THE EXHAUST PIPEWORK SHOULD RISE VERTICALLY FROM THE STORAGE TANK FOR AT LEAST 5 FT AND THEN BE ANGLED UPWARDS TO THE DISCHARGE POINT. THIS ENSURES THAT NO TRAPS WHICH MIGHT GATHER HYDROGEN GAS ARE CREATED AND THAT ANY VAPOR THAT CONDENSES IN PIPEWORK CAN DRAIN BACK TO THE TANK.
11. HAZARD WARNING LABELS TO BE ATTACHED WHERE APPROPRIATE. NO SMOKING OR OPEN FLAMES SIGN TO BE POSTED IN THE PLANT ROOM AND TO WITHIN 15 FEET OF THE BUILDING.

12. TO PREVENT BACK FLOW OF AIR THROUGH THE SYSTEM, VENTS SHOULD BE INSTALLED NEAR FLOOR AND WITHIN 1 FT OF MAX CEILING HEIGHT IN ROOM TO ENSURE EFFECTIVE CIRCULATION, AND REMOVAL OF HYDROGEN.
13. TRANSFORMER/RECTIFIER TO BE AT LEAST 6 FT AWAY FROM O.S.E.C GENERATOR, "WET" EQUIPMENT SUCH AS SATURATOR, OSEC GENERATOR, BRINE PUMP ETC., TO PREVENT INDUCTION OF CORROSIVE VAPORS INTO ELECTRICAL CABINET.
14. IF THE HYPOCHLORITE OUTLET AND HYDROGEN VENT LINE FROM ELECTROLYZER ARE COMBINED INTO ONE LINE, THIS COMBINED PRODUCT LINE MUST RISE WITHOUT TRAPS, ALL UNIONS TO BE FITTED IN THE VERTICAL. (SUGGESTED RISE OF 1/4" PER FOOT). IF THE HYDROGEN VENT LINE IS RETURNED SEPARATELY TO THE STORAGE TANK OR MAIN VENT LINE, THE HYPOCHLORITE LINE MAY BE DISCHARGED BELOW THE CELL INTO THE TOP OF A LOW LEVEL STORAGE TANK. THE DISCHARGE OUTLET MUST NOT BE ALLOWED BECOME FLOODED CREATING BACK PRESSURE.
15. POWER REQUIRED VARIES WITH SYSTEM REQUIREMENTS.
16. SUPPORT D.P. MEASUREMENT LINES SO THAT THEY ARE GRADED BACK TOWARD MAIN VENT LINE TO FAVOR RETURN OF CONDENSATION TO MAIN VENT LINE.

KEY: ● VENTILATION HARDWARE KIT, AAB6215
▲ ELECTRICAL HARDWARE KIT, AAB6221
■ PLUMBING HARDWARE KIT, AAB6218



NOTE: ANY INTERCONNECTING HARDWARE DEPICTED FOR INSTALLATION THAT IS NOT SPECIFICALLY ITEMIZED ON RELATED HARDWARE KIT BOM'S, AAB6215, AAB6221 & AAB6218, IS NOT SUPPLIED BY SIEMENS WATER TECHNOLOGIES.

OSEC®-BP SYSTEM
- TYPICAL INSTALLATION

85.070.111.050
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SECTION 3

SECTION 3 – OPERATION

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3.1 Preparation for Operation

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

3.1.1 Control Panel Configuration and Operation

The control panel is operated via an interactive text screen and keypad—the control panel interface. The text screen is a two-line LCD display. The function of the keys on the keypad vary with the context of the interface. Explanation and instructions on the operation of the interface are given in the Control Panel Supplement of this instruction manual. This information is necessary for the set-up and operation of the system.

A variety of parameters must be supplied to the control panel to enable proper operation of the equipment: storage tank start and stop and alarm levels (varies with tank size), power supply signal range (varies with system size), etc. The Control Panel Supplement details the “configuration” settings required and how to set them, as well as the operation and service of the panel. This must be completed prior to system startup.

3.1.2 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), adjust pressure regulating valve and check for and correct any leaks in the softener and plumbing up to the shut-off valve.
- c. Run water into the saturator under control of the level control valve and fill the product tank with water by temporary hose.



CAUTION: Verify that the discharge piping from the electrolyzer to the product tank is complete and no shutoff valves have been installed. Do not apply pressurized water supply directly 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.

- d. Verify that all electrolyzer and brine panel plumbing connections are tight. Confirm that electrolyzer shields are in place and bolts are tight.



CAUTION: Do not operate system with shield(s) removed.

- e. Run the brine dilution unit to fill the electrolyzer. Verify that electrolyzer cell compartments fill consecutively and that all the electrode plates are fully submerged (approximately 1/2-inch or more above the top of the electrodes). If any electrodes are not covered, verify that the chassis is installed correctly (partition holes at the top) and the end block fittings are correctly oriented. See Dwg. 85.070.000.015A-D, OSec-BP System Electrolyzer – Parts.
- f. 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.
- g. Test product feed equipment (i.e., feed water from storage tank).
- h. Once the system is tested and leaks resolved, drain water from the electrolyzer. The electrolyzers must later be primed with a correct mixture of brine and water before starting operation.

3.1.3 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 (no leaks observed), 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.

3.1.4 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.

3.1.5 Check Safety Interlocks

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

Refer to paragraph 2.13, Description of Operation, for an explanation of system operation—system interlocks in particular.

Perform the following checks with the DC power supply isolated from main power supply (power “off”) and with the control panel powered.

- Cell Level

The cell level switch is mounted on the electrolyzer at the acrylic outlet block and is a normally open float type switch—closing when the fluid level reaches the actuation level. Prior to beginning the operation of the system, test the function and field wiring of this switch 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 pump and solenoid valve. 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 switch is mounted in the clear acrylic outlet block to the left and rear of the float switch assembly. This is a “normally” closed switch—opening when the measured temperature rises above 122° F (50° C). Caution is advised if attempting a functional test of the temperature switch, as the equipment may be damaged by exposure to excessive temperature. Assuming the level switch function has been verified (demonstrating that the wiring is correct), 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. Refer to the Interconnection Wiring Schematic for identification of the temperature switch terminals at the electrolyzer.



CAUTION: Do not test the temperature switch in hot water. The switch assembly is made of materials that may be 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 connected 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 the Interconnection 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 setpoint screw at the top of the switch unit—clockwise to increase the setpoint and counter-clockwise to decrease the setpoint. 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 openings in the ventilation system (including the storage tank) from which air might escape.

With normal airflow, 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.

3.1.6 Setting Brine and Water Feed Rates



WARNING: IF THE SALT CONCENTRATION FALLS BELOW OPERATIONAL LIMITS THE SYSTEM WILL SHUTDOWN AND ALARM FOR IMPROPER VOLTAGE.

Refer to Section 1 – Technical Data for the operating settings chart for proper flow setting corresponding to system capacity/type.

The dilution unit consists of a brine feed pump for metering of saturated brine and a solenoid valve/flow control valve/flow meter combination for metering of dilution water flow.

Adjust dilution water flow by turning the flow adjustment knob on the meter/flow controller until the indicated flow rate is as specified.

Brine feed rate is set by adjusting the metering pump stroke adjustment knob on the pump. The stroke adjustment knob is graduated in percent of maximum stroke and corresponds approximately to feed rate as percent of maximum rated (on pump nameplate). The actual feed rate should be verified using a calibration column in the pump inlet line.

3.2 Start-Up

Having prepared the system for operation, as described in the previous paragraph, an initial start-up may be initiated:

- a. Set the current limit knob on the Electrolytic Power Supply to minimum.
- b. Turn on the AC power to the DC Power Supply.
- c. Set the control mode from Inhibited to Automatic.

On start of operation, the current limit knob is adjusted as described below.

Once the system is placed in Automatic mode, it should immediately begin operation. If it does not, check that the configuration settings of the system have been completed as described in the Control Panel Supplement included with this manual.

Once operation has begun and all appears normal (brine pump is pumping, blower is blowing, no fluid leaks), dial-up the current limit knob to 80 to 90%. Then check the current indicated on the control panel interface and fine-tune the limit knob setting to obtain a value of 35 Amps.

The start of operation is indicated by the sound of the blower running and the production of hydrogen, as fine bubbles that fill the upper quarter of the cell with a pocket of gas. Verify that the electrodes remain submerged and the blower is functioning.

If it is desired to verify the product strength as a part of the initial startup, wait for approximately one hour after the start of operation before taking a sample for evaluation of performance.

Based on the tank size and the system flow rate, estimate the time to fill the storage tank to the stop level (as set during configuration) and arrange to be on-hand at that time to verify that the level transducer is functioning properly and that the system does, in fact, stop as desired.

3.3 Routine Operation

On start-up and during initial operation (first month) it is critical to ensure that set-up parameters are correct and system starts, stops, and performs as expected. Verifying softener function is essential to ensuring trouble-free operation. Once proper system operation is confirmed, some routine maintenance is required to ensure uninterrupted operation.

- Maintain salt level in the saturator.
- Check for leaks or visible deterioration of hoses, fittings, and seals.
- Check for signs of scaling or fouling of electrodes and electrolyzer float switch. Refer to Section 4 – Service for details.
- Check electrical connections for any overheating. Clean, grease with joint compound, and tighten.
- Monitor for shut-downs due to alarms and correct causes.

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

3.3.1 Control Panel Operation

Refer to the Control Panel Supplement for an explanation of the configuration and operation of the control panel. As explained in paragraph 3.1, Preparation for Operation, the control panel must be “configured” via the interface before the system can operate properly.

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. It will also require time for the brine to reach saturation. Keep the saturator salt near the 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 production and anode life of the electrolyzer. It can also 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. If the hardness exceeds recommended levels, consult the softener manufacturer's instruction manual to determine the cause and solution. The softener is typically preconfigured for a maximum hardness of 42 gpg. If a greater hardness is encountered, a configuration change may be necessary.

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 procedure 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 OSEC 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 total 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:

Total flow (water and brine) GPH x % chlorine / 11.747 lbs/hr

Example (Cl₂): (6.75 + 0.68) gph x 0.8% / 11.747 = 0.5 lbs/hr

3.3.6 Check for Leaks

Watch for and immediately 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

When routine checks are being made or logged, it is recommended to monitor the operating voltage and current indicated at the control panel and rectifier.

The current should remain constant (assuming the current limit knob on the Electrolytic Power Supply is not moved) at the value as specified in Section 1 – Technical Data – Operating Settings (typically 35 A).

The voltage will vary within the ranges as specified in Section 1 – Technical Data (Improper Voltage Alarm points); voltage will increase with declining supply water temperature, brine feed rate, or brine concentration. If the salt concentration falls below operational limits the system will shutdown and alarm for improper voltage. Electrode scaling or anode coating loss can also result in higher than normal voltage. If the voltage appears to be drifting and is approaching either of the alarm points, it should be investigated prior to unplanned failure due to alarm.

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. This will require that the salt be replenished and time allowed for saturation. The system must then be 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. Hard water and an increased requirement for softener regeneration can raise this figure. The system should be producing the 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 typically involve 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

Regularly observe the system while in 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.

The system may be manually started by initiating the Top-Up command through the control panel interface—it will run until it reaches the set stop level, permitting observation while running. Refer to the Control Panel Supplement for details of use of the interface.

3.3.9 Responding to Alarms

If the system has shut down with an alarm, it will be indicated on the control panel display. The system may optionally be fitted with an audible alarm or alarm indicating lamp or beacon.

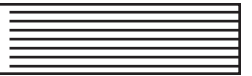
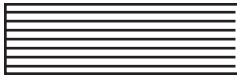
An output is available for remote indication of an alarm—for permissive to a remote alarming device or for connection to an alarm telemetry system.

The cause and time of the alarm is logged in the alarm history screen and the audible alarm (if fitted) is silenced upon accessing the history screen.

Failure messages must be acknowledged before the system can be returned to operation-Auto mode.

Refer to the Control Panel Supplement for details on using the interface and viewing and acknowledging alarms.

Refer to paragraph 4.2, Troubleshooting Alarms, for a discussion of probable causes of alarms.



SECTION 4



SECTION 4 – SERVICE

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| Casing Installation | 4.3.4 |

4.1 Acid Cleaning Procedure



WARNING: THE ACID CLEANING PROCEDURE REQUIRES THE HANDLING OF HAZARDOUS CHEMICAL (STRONG ACID). PERSONNEL HANDLING HAZARDOUS CHEMICALS SHOULD BE AWARE OF HAZARDS PRESENTED BY THEM (REACTIVITY, EXPOSURE, FLAMMABILITY, ETC.) AS DESCRIBED IN MATERIAL SAFETY DATA SHEET (MSDS) AND ACT ACCORDINGLY.



WARNING: THE PRODUCT OF THIS PROCESS, AS CONTAINED IN THE ELECTROLYZER AND PIPING THEREAFTER AND PRODUCT STORAGE TANK AND PIPING THEREAFTER TO POINT OF CHEMICAL (PRODUCT) APPLICATION, IS A HYPOCHLORITE (BLEACH-LIKE, CHLORINE SOLUTION*) THAT WILL RELEASE CHLORINE GAS IF ACIDIFIED—AS BY MIXING WITH ACID. USE CARE NOT TO ALLOW ACID TO MIX WITH PRODUCT—DISCONNECT ELECTROLYZER PIPING SYSTEM FROM STORAGE TANK AND DRAIN/FLUSH PRODUCT FROM SYSTEM BEFORE INTRODUCING ACID SOLUTION (AS DESCRIBED IN CLEANING PROCEDURE) AND THEN DRAIN/FLUSH ACID SOLUTION FROM SYSTEM BEFORE RETURNING TO OPERATION.

***NOTE:** Nominal concentration is 8 g/L, so 15 gallons of solution (product) would contain 1 lb of chlorine—which could be released as gas if acidified.



WARNING: THE ELECTROLYZER WILL CONTAIN SOME VOLUME OF TRAPPED HYDROGEN GAS WHEN IN OPERATION AND SOME WILL BE RETAINED EVEN WHEN SHUT-DOWN. HYDROGEN (IN PRESENCE OF AIR) MAY IGNITE EXPLOSIVELY, SO IT IS CRITICAL TO AVOID SOURCES OF IGNITION (SPARK, FLAME, ETC.) WHERE HYDROGEN IS CONTAINED. FOR THIS REASON, ELECTRICAL CONNECTIONS TO THE ELECTROLYZER SHOULD BE REMOVED (DISCONNECTED AT ELECTROLYZER TERMINALS) PRIOR TO DRAINING THE ELECTROLYZER FOR SERVICE. CONTACT WITH TERMINALS SHOULD BE AVOIDED WHEN DRAINED, BECAUSE WHEN EXPOSED THE METAL CONDUCTORS INSIDE THE ELECTROLYZER COULD SPARK IF VOLTAGE IS APPLIED (SUCH AS BY INADVERTENT ACTUATION OF CONNECTED DEVICE OR CONTACT WITH UNEXPECTED SOURCE OF SPARK, SUCH AS INSTRUMENT OR STATIC DISCHARGE, SUCH AS BY CONTACT WITH MOST ANY UNGROUNDED OBJECT).

Acid cleaning is done to remove scale and deposits formed inside the electrolyzer(s). When present in sufficient quantity to require cleaning, scale is evident as a coating on the electrodes—generally color might vary from dark gray to light tan. Acid solution will dissolve and loosen scale from surfaces permitting removal by flushing with clean water.

Acid cleaning should only be necessary in the event that the water used for electrolyte is not soft enough (failure of softener) or the salt used to make brine contains impurities (improper salt used). The cause of scaling should be resolved as it causes unnecessary interruption of operation, reduces efficiency, and requires acid cleaning.

- a. Disconnect power to the DC power supply
- b. Slide the insulation boot off both DC power terminals on the ends of the casings.
- c. Unclamp both of the main DC power connectors and remove the cables; retain bolts.
- d. Drain the cell by disconnecting piping at the bottom of the unit.
- e. Reconnect piping to inlet. Turn on only the control panel, and with control mode set to inhibit, actuate the brine dilution unit.
- f. Flush (prime) the cell for the predetermined duration.
- g. Once the cell has been flushed the pump will stop. Drain the electrolyzer again.
- h. Disconnect the brine suction line from the brine pump and attach separate tubing to this point for feed of acid solution. Insert the tubing into a container of hydrochloric acid.
- i. Disconnect product line (discharge from electrolyzer) pipe work and install acid return line to a separate container of hydrochloric acid.



CAUTION: To avoid spill and exposure hazard, ensure that any tubing cannot become detached once acid cleaning has started.

- j. Restart the brine dilution unit from the control panel. This will feed both hydrochloric acid and water into the electrolyzer assembly to produce a 10 to 1 diluted acid solution.
- k. Once the solution has started to return to the separate waste container, stop the brine feed unit.
- l. Once the bubbling action in the cells has ceased, drain the cell into a suitable container and dispose of it in the correct manner.

NOTE: If the electrolyzers are not free of scale after a single treatment, the above process may be repeated. Flush and drain system twice, then flush and leave filled.

- m. Disconnect the acid clean return line from the outlet of the electrolyzer. Reinstall the product line to the storage tank
- n. Reconnect the dc power cables and insulation boots.



CAUTION: Particular care must be taken when reconnecting the DC power cables connections to ensure the contacting surfaces are clean, coated with electrical joint compound, and fully tightened together. Excessive voltage drop in the contacting areas can result in overheating of the joint and possible damage to the equipment.

- o. Turn on power at the control panel. Change control mode to inhibit by the operator interface.
- p. With control mode set to manual, actuate the brine dilution unit. Enable brine feed at pump and let electrolyzers fill.
- q. Verify level switch operation. Refer to paragraph 3.1.5, Check Safety Interlocks.
- r. Verify Brine and dilution water flow. Refer to paragraph 3.1.6, Setting Brine and Water Feed Rate.
- s. Restart system and verify proper operation. Refer to paragraph 3.2, Startup.

4.2 Troubleshooting Alarms

In the event of alarm, the remote signaling relay is de-energized (contact opens) and the audible signaling relay (to optional, external audible device) is energized (contact closes).

The nature of the alarm is indicated by a message on the operator interface terminal on the control panel.

Alarms are of two types: Warning and Failure. In the event of a warning alarm, the system can continue to function. In the event of a failure alarm, the system is shut down (either immediately or with shut-down sequence) and is reset to Inhibit mode. To restore operation in the event of failure, the alarm must first be acknowledged, fault corrected, then the control mode set to Auto.

In the following troubleshooting table, the possibility of improper interconnecting wiring and defective device are generally not suggested as the former is normally resolved during start-up and the latter is usually last resort, though always a possibility. During start-up, improper wiring (or failure to apply power) is the most common source of alarm, after start-up this is unlikely though a connection may come loose or become bad by corrosion.

With the likely cause indicated and with understanding of the system, investigative steps should be apparent—refer to paragraph 2.13, Description of Operation, to understand the purpose and function of the system components. Refer to the Control Panel Supplement to understand the operating sequence and logic. Refer to the interconnection wiring diagram to trace wiring connection to verify or make correct connections.

Table 4.1 - Troubleshooting

| Alarm Message | Trigger | Likely Cause(s) |
|-------------------------------|---|--|
| Low Storage Level | Storage tank level transmitter signal below alarm setpoint. | Level low. Improper setpoint. Signal zeroed improperly. |
| High Storage Level | Storage tank level transmitter signal above alarm setpoint. | Level high. Improper setpoint. |
| Storage Tank Overflow | Level switch mounted on storage tank (optional device/connection) open. | Level high at switch level. Input not connected. |
| Low Electrolyzer Level | Level switch installed in electrolyzer outlet pipework open. | Level low. Triggered by gas pocket. |
| High Cell Temperature | Temperature switch installed in electrolyzer outlet pipework open. | Loss of water flow. High inlet temperature. |
| Improper Voltage | D.C. power supply signal (may be configured to use analog or discrete signal) out of range or fails to close. | Low brine feed. Low current setting. Low inlet water temperature. Setpoints incorrect or alarm configured incorrectly. Power supply failure. |
| Rectifier Failed | D.C. power supply "running" discrete signal fails to close. | Power to power supply lost/tripped breaker. Fuse/breaker in rectifier tripped. |
| Room Ventilation Fault | External discrete input fails to close. | External device fails to respond or malfunctions. Not connected/not configured properly. |

Table 4.1 - Troubleshooting (Cont'd)

| Alarm Message | Trigger | Likely Cause(s) |
|--------------------------------|--|--|
| Air Flow Fault | Differential pressure switch fails to close. | Airflow blocked or break in air duct (lid off tank). Blower faulty/fuse blown (in panel). Condensation in signal tubing between duct and switch. Switch needs adjustment. |
| Air Flow Switch Failure | Differential pressure switch fails to open. | Condensation in signal tubing between duct and switch. Switch stuck or defective. |
| Hydrogen Leak | External discrete input open. | Hydrogen leak detected by external monitor. External device not connected and input not jumpered. |
| Emergency Stop | External discrete input open. | External E-Stop device actuated (button pressed). External device not connected and input not jumpered. |
| Tank Signal Lost | Level transmitter analog signal out of range. | Transmitter or receiver defective. |
| Voltage Signal Lost | D.C. power supply analog signal out of functional range. | Transmitter or receiver defective. |
| Current Signal Lost | D.C. power supply analog signal out of functional range. | Transmitter or receiver defective. |

4.3 Chassis Replacement Procedure

The electrolyzer panels consist of chassis and casing assemblies of one to four in number. Chassis replacement requires the removal of the casing with end blocks from the panel. The removal of an upper or lower casing may be performed without disturbing the other casings. The replacement of a middle chassis requires the removal of the casing assembly directly above or below it. If all the chassis are being replaced, disassembly should begin with the upper most casing.



WARNING: THIS PROCEDURE SHOULD ONLY BE PERFORMED BY TRAINED QUALIFIED PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE ENTIRE CONTENTS OF THIS INSTRUCTION BOOK.

4.3.1 Casing Removal

Prior to any work on the electrolyzer panel or associated piping, ensure that the area is well ventilated for dissipation of any chemical vapors or gases that may be present.

- a. Change control mode to inhibit by the operator interface.
- b. Turn off the DC Power Supply disconnect and lock out/tag out switch and/or breaker.
- c. Change to manual mode and turn on the Product Tank Blower.
- d. With control mode set to manual, actuate the brine dilution unit. Disable brine feed at pump and let dilution water run for at least 10 minutes.
- e. Turn off blower and dilution water.
- f. Drain electrolyzers by removing inlet piping connection.
- g. Reconnect inlet piping and refill and drain electrolyzers.
- h. Turn off control panel power at disconnect switch.
- i. Disconnect DC power cables to electrolyzers.
- j. Disconnect outlet piping from acrylic end block at union connection.
- k. Disconnect level switch and temperature switch at terminal box. Note terminal positions and wire colors. Switches may be removed or left in place.

- l. Loosen the four front bolts from the top electrolyzer end blocks.

C12 or Single casing: Require support when removing bolts.

C24, C36 & C48: Casing is connected to and supported by unit below. Remove bolts and shield.

- m. Lift casing until inlet nipple is cleared. If difficulty is encountered, a screwdriver may be used to separate the end block connection. Slightly lift the side opposite the connector. This should allow a slight gap between the end blocks at the connector side. Insert a screwdriver into this gap and lower the lifted casing end. Repeat as necessary to separate end blocks.
- n. Some solution will be contained in the electrolyzer and will not drain. This solution may contain a low concentration of hypochlorite. To minimize spilling of this solution the electrolyzer casings should be lifted straight up until the inlet nipple is cleared. It then may be rotated (front side down) to retain the solution within the unit. Once removed the casing may be completely drained by placing it in a vertical position, preferably in a sink.
- o. The lower casing assemblies may be removed by repeating steps l through n.

4.3.2 Casing Disassembly

Once removed and drained, each casing may be disassembled. To simplify reassembly it is recommended to disassemble and reassemble each unit individually.

- a. Position the casing horizontally with the end blocks flat and mounting holes vertical.
- b. Clean grease from end studs and remove seal nuts from end connectors.
- c. End blocks are mounted with O-rings and must be pulled or gently tapped off acrylic tube. If removal is difficult, a block of wood and mallet may be used. Alternate tapping on opposite sides of end block.
- d. The chassis should be pushed out of the casing in the same direction it was installed (partition seals bent away from installation and typically positive end leading).
- e. Once disassembled, the casing, end blocks, and seals should be cleaned and examined for any deterioration. O-ring and seal materials are specifically selected for this service and no substitutions should be made.
- f. The level and temperature switches should be examined for any signs of deterioration or scale deposits. They should be removed and cleaned if necessary.

4.3.3 Chassis Replacement and Casing Assembly

- a. Layout acrylic casing, end blocks, and chassis for a single electrolyzer cell.
- b. If an upper cell is being assembled, the clear acrylic end block containing the float switch, temperature switch, and outlet connection is always at the top right most position.
- c. Each PVC end block is marked as to position (L or R), position number (1-4), and polarity (+ or -). Verify matched end block pairs are selected.
- d. Install and lubricate O-rings on each end of the clear acrylic tube with silicone or halocarbon grease.
- e. Install positive marked end block on acrylic tube.
- f. Lightly lubricate partition gaskets with silicone grease.
- g. Position the replacement chassis with positive end leading (marked on end stud) and partition orifice (holes) and electrodes as shown in figure 4.1

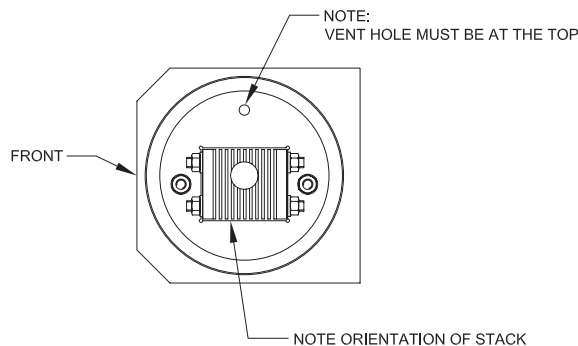


Figure 4.1



WARNING: WHEN INSTALLED ON THE PANEL, PARTITION HOLES MUST BE POSITIONED AT THE TOP OF THE CASING.

- h. Install chassis into casing until firmly seated against the positive end block.
- i. Verify that partition holes and end block are oriented properly. Reposition chassis or end block if necessary.
- j. Install negative end block on a flat surface to maintain alignment with positive end block.
- k. Install and tighten end connection seals and nuts.
- l. Position shield over end blocks to check alignment and loosely insert the four mounting bolts.

- m. Repeat this procedure for the remaining units.

4.3.4 Casing Installation

Prior to reinstalling the casing assemblies on the electrolyzer panel they should be laid out on a flat surface to check placement, orientation, and fitting positions. Refer to Dwg. 85.070.000.015A-D, Electrolyzer Panel – C12, C24, C36 & C48. Verify that each end block, interconnecting fittings, and plugs are correctly positioned and installed. Each casing inlet is positioned at the bottom of each positive end block with the top plugged. Each outlet must be at the top of each negative end block with the bottom plugged. The inlet and outlet connections between casing end blocks utilize a PVC nipple sealed by O-rings.

The number of casings used depends upon system capacity. The casing end blocks are numbered from (1) to (4) and (L) or (R). These numbers designate its position on the Electrolyzer panel with 1 being the lowest position and 4 being the highest.

- a. The lowest casing (#1) should be installed first and in the bottom position on the panel. With the shield in position and the bolts inserted into the holes in the end blocks, position casing and tighten bolts into the panel inserts.
- b. Verify that the assembly is properly oriented with the partition holes at the top and the inlet fitting at the bottom of the positive end.
- c. The next casing is to be installed above the previous and requires an interconnect nipple between its inlet and the outlet of the lower casing. The interconnect nipple has four O-rings installed on it that should be lubricated with silicone or halocarbon grease. Unless it was removed during disassembly it should be already inserted into one of the end blocks.
- d. Noting orientation, place the casing assembly level above the previously installed unit and against the panel. Align the interconnect nipple and lower the casing evenly until it mates with the lower assembly.
- e. Place the shield in position and fasten the four bolts that hold the end blocks to the panel.
- f. Verify that the assembly is properly oriented with the partition holes at the top and the only open outlet fitting is at the top of the negative end.
- g. Repeat steps c through f for all casing assemblies.
- h. The top casing assembly has a clear acrylic end block at its outlet. This contains the level switch and temperature switch. If these were removed they should be reinstalled.

- i. Reconnect the level and temperature switch wiring. Refer to Dwg. 85.070.000.015E, Electrolyzer Panel – C12, C24, C36 & C48.
- j. Reconnect outlet piping from acrylic end block at union connection.
- k. Reconnect inlet piping from brine dilution panel.
- l. Clean end studs with fine emery cloth or abrasive pad. Coat surfaces with electrical joint compound.
- m. Reconnect and tighten DC power cables to electrolyzers. Refer to the appropriate Dwg. 85.070.000.015A-D, Electrolyzer Panel – C12, C24, C36 & C48, for polarity and position.
- n. Completely cover all the electrolyzer end connections with protective boots.
- o. Verify that all electrolyzer and brine panel plumbing connections are tight. Confirm that all electrolyzer shields are in place and bolts are tight.



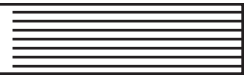
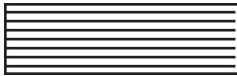
WARNING: DO NOT OPERATE SYSTEM WITH SHIELD(S) REMOVED.

- p. Turn on power at the control panel. Change control mode to inhibit by the operator interface.
- q. With control mode set to manual, actuate the brine dilution unit. Enable brine feed at pump and let electrolyzers fill.
- r. Verify that electrolyzer cell compartments fill consecutively [inlet (+) end to outlet (-) end] and that all the electrode plates are fully submerged (approximately 1/2-inch or more above top of electrodes). If any electrodes are not covered, verify that the chassis is installed correctly (partition holes at top) and the end block fittings (interconnect nipples and plugs) are correctly oriented. See Dwg. 85.070.000.015A-D, OSEC-BP System Electrolyzer – Parts.



WARNING: VERIFY THAT ELECTROLYTE LEVEL IN EACH COMPARTMENT IS APPROXIMATELY 3/4 FULL AND THAT ALL THE ELECTRODES REMAIN SUBMERGED. DO NOT APPLY DC POWER TO ELECTROLYZERS UNLESS THIS IS CONFIRMED.

- s. Verify level switch operation. Refer to paragraph 3.1.5, Check Safety Interlocks.
- t. Verify Brine and dilution water flow. Refer to paragraph 3.1.6, Setting Brine and Water Feed Rate.
- u. Restart system and verify proper operation. Refer to paragraph 3.2, Startup.



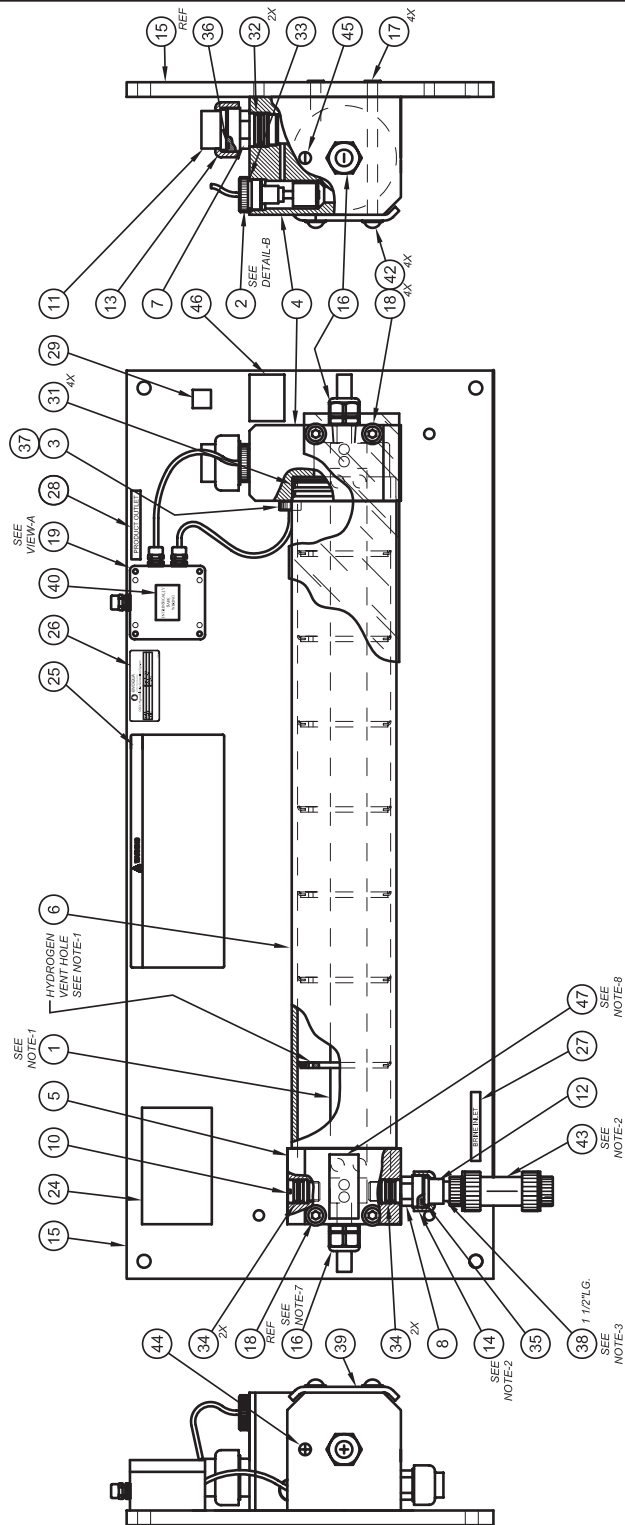
SECTION 5



SECTION 5 – ILLUSTRATIONS

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| | DWG. NO. |
|--|-------------------|
| Parts | |
| Electrolyzer Panel – C12, C24, C36 & C48 | 85.070.000.015A&F |
| Ventilation Hardware Kit | 85.070.000.110 |
| Electrical Hardware Kit | 85.070.000.115 |
| Plumbing Hardware Kit | 85.070.000.120 |
| Brine Pump (AAC2858, AAC4098 & AAC4100) | 85.070.000.035A&B |
| Salt Saturator..... | 85.070.000.040A&B |
| Control Panel..... | 85.070.170.150A-D |
| Control Panel Schematic..... | 85.070.155.110 |
| Control Panel Schematic..... | 85.070.155.120 |

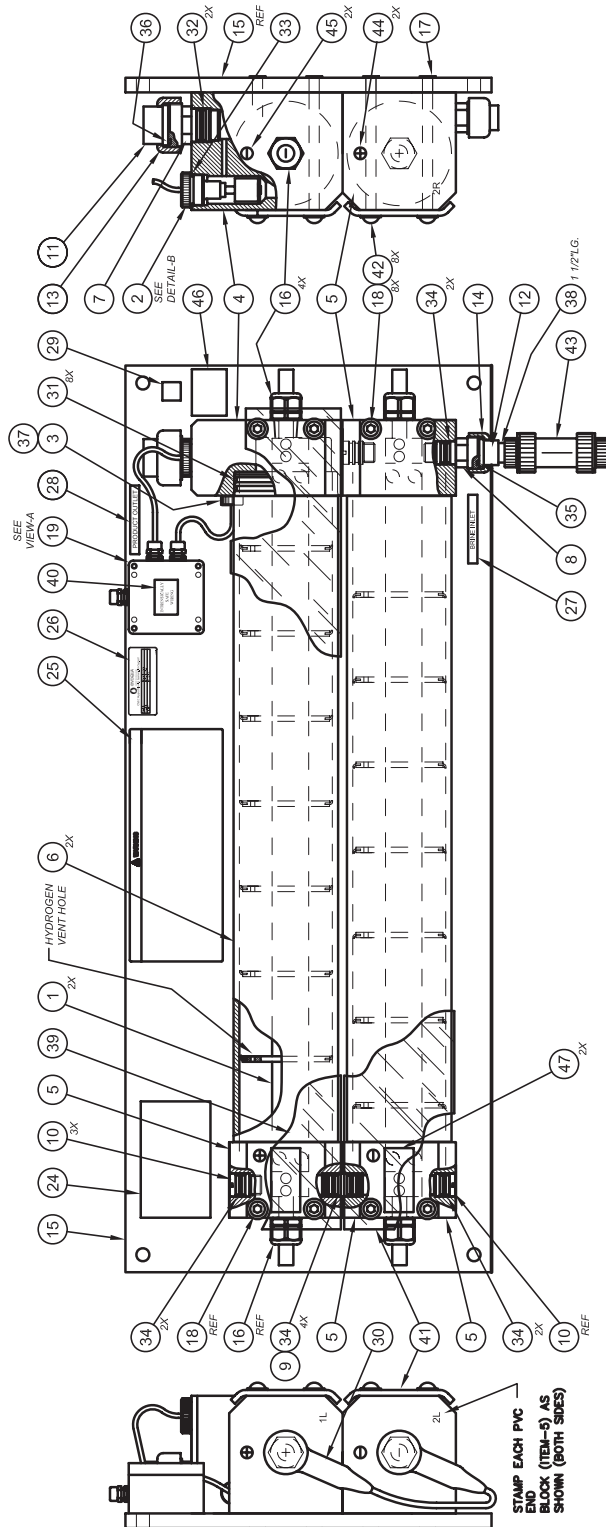


NOTE: FOR DETAILED VIEW, SEE DWG. 85.070.000.015E.
 FOR PARTS LIST, SEE DWG. 85.070.000.015F.

OSEC®-BP SYSTEM – ELECTROLYZER – PARTS -C12 (AAC8216)

85.070.000.015A

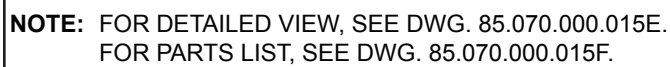
ISSUE 3 10-14



NOTE: FOR DETAILED VIEW, SEE DWG. 85.070.000.015E.
 FOR PARTS LIST, SEE DWG. 85.070.000.015F.

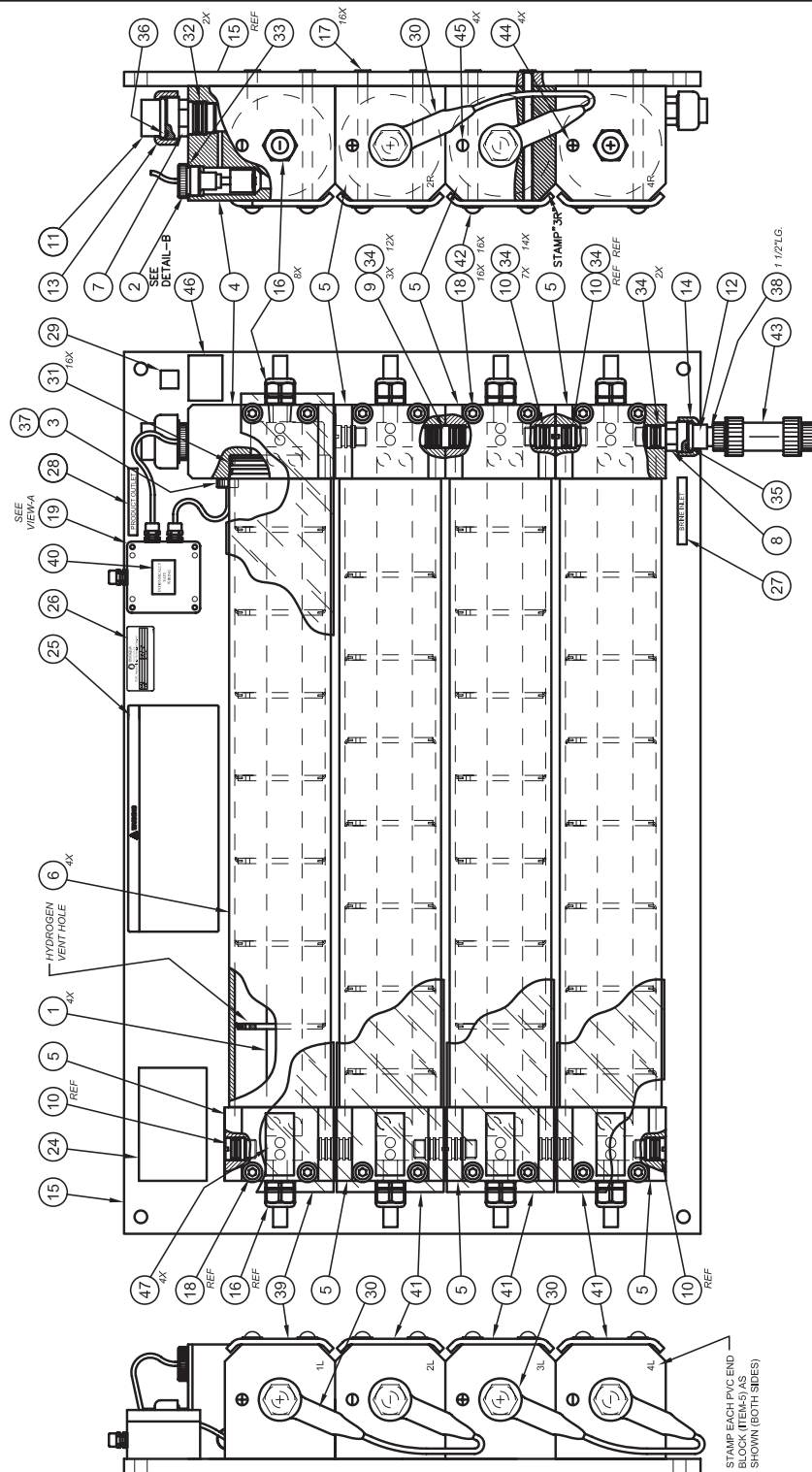
OSEC®-BP SYSTEM – ELECTROLYZER – PARTS -C24 (AAC8219)

85.070.000.015B



85.070.000.015C

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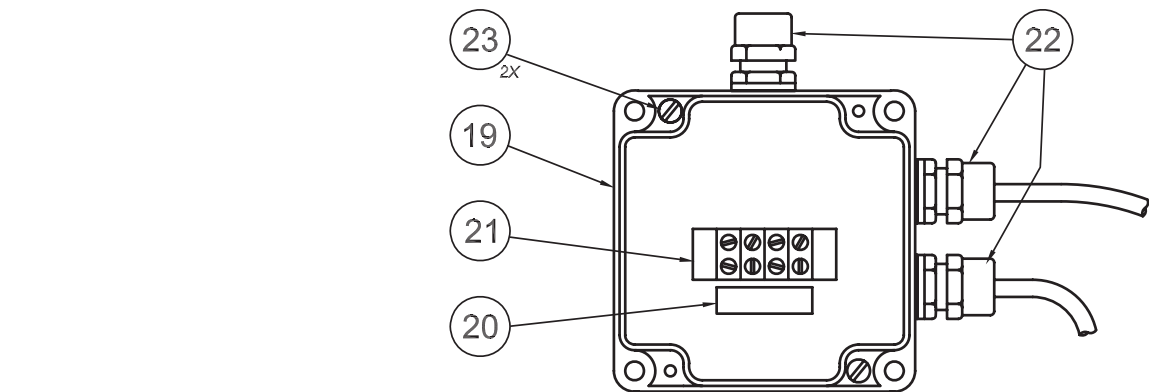


NOTE: FOR DETAILED VIEW, SEE DWG. 85.070.000.015E.
 FOR PARTS LIST, SEE DWG. 85.070.000.015F.

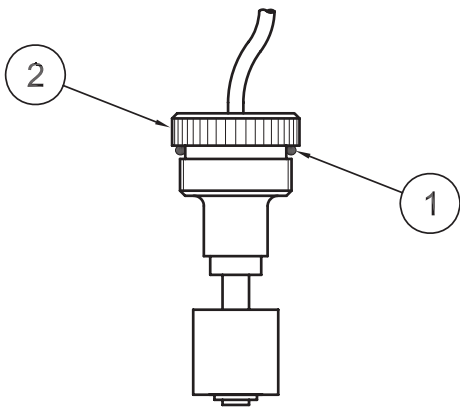
OSEC®-BP SYSTEM – ELECTROLYZER – PARTS -C48 (AAC8225)

85.070.000.015D

ISSUE 3 10-14



VIEW - A
TERMINAL BOX W/O COVER



DETAIL - B

TERMINAL BOX

| | | | | |
|-------|-------|--|-------|-------|
| 1 | 2 | | 3 | 4 |
| WHITE | WHITE | | BLACK | BLACK |
| [] | | | [] | |

LOW
CELL
LEVEL

TEMP
SWITCH

CONNECTION DIAGRAM

NOTE: FOR PARTS LIST, SEE DWG. 85.070.000.015F.

OSEC®-BP SYSTEM – ELECTROLYZER – PARTS
-C12 (AAC8216), C24 (AAC8219), C36 (AAC8222), C48 (AAC8225)

85.070.000.015E
ISSUE 0 7-05

| KEY NO. | PART NO. | QUANTITY | | | | DESCRIPTION |
|---------|-----------|----------|---------|---------|---------|---|
| | | AAC8216 | AAC8219 | AAC8222 | AAC8225 | |
| 1 | AAC8213 | 1 | 2 | 3 | 4 | CHASSIS, ELECTROLYZER |
| 2 | AAD3329 | 1 | 1 | 1 | 1 | LEVEL SWITCH ASSY |
| 3 | AAC8201 | 1 | 1 | 1 | 1 | TEMPERATURE SWITCH ASSY |
| 4 | AAC8033 | 1 | 1 | 1 | 1 | END BLOCK, OUTLET |
| 5 | AAC8030 | 1 | 3 | 5 | 7 | END BLOCK |
| 6 | AAC8036 | 1 | 2 | 3 | 4 | TUBE |
| 7 | AAC8042 | 1 | 1 | 1 | 1 | ADAPTER, UNION, OUTLET |
| 8 | AAC8039 | 1 | 1 | 1 | 1 | ADAPTER, UNION, INLET |
| 9 | AAC8045 | N/A | 1 | 2 | 3 | NIPPLE, INTERCONNECT |
| 10 | AAC8048 | 1 | 3 | 5 | 7 | PLUG |
| 11 | AAA2529 | 1 | 1 | 1 | 1 | END, UNION, 1" |
| 12 | AAA2523 | 1 | 1 | 1 | 1 | END, UNION, ½" |
| 13 | AAA2508 | 1 | 1 | 1 | 1 | NUT, UNION, 1" |
| 14 | AAA2502 | 1 | 1 | 1 | 1 | NUT, UNION, ½" |
| 15 | AAC8063 | 1 | 1 | N/A | N/A | BACK PANEL, C12 & C24 |
| | OR | | | | | |
| | AAC8066 | N/A | N/A | 1 | 1 | BACK PANEL, C36 & C48 |
| 16 | AAB3072 | 2 | 4 | 6 | 8 | CORD GRIP, ¾" |
| 17 | AAC8129 | 4 | 8 | 12 | 16 | NUT, PROPELLER, 3/8-16 |
| 18 | AAC8027 | 4 | 8 | 12 | 16 | SCR., BUTTON, SOC.HD.CAP, 3/8-16 X 6" LG. |
| 19 | AAC8189 | 1 | 1 | 1 | 1 | TERMINAL BOX |
| 20 | AAB3150 | 1 | 1 | 1 | 1 | TERMINAL MARKER |
| 21 | AAA3838 | 1 | 1 | 1 | 1 | TERMINAL 4 WAY |
| 22 | AAA3292 | 3 | 3 | 3 | 3 | CORD GRIP |
| 23 | P59432 | 2 | 2 | 2 | 2 | SCR, SELF TAP, #6 X ½" LG. |
| 24 | AAB1547 | 1 | 1 | 1 | 1 | LABEL, OSEC |
| 25 | AAC8513 | 1 | 1 | 1 | 1 | LABEL, WARNING, OSEC BP |
| 26 | W2T421095 | 1 | 1 | 1 | 1 | LABEL, SER. NO. |
| 27 | AAB1908 | 1 | 1 | 1 | 1 | BRINE INLET LABEL |
| 28 | AAB1905 | 1 | 1 | 1 | 1 | PRODUCT OUTLET LABEL |
| 29 | L80176 | 1 | 1 | 1 | 1 | LABEL, EXPLOSION HAZARD |
| 30 | AAB9146 | N/A | 1 | 2 | 3 | CABLE ASSY, INTERCONN. |
| 31 | AAC8054 | 4 | 8 | 12 | 16 | O-RING, 4 ½" ID X 1/8" SEC, VITON |
| 32 | AAC8024 | 2 | 2 | 2 | 2 | O-RING, 1 ¼" ID X 3/32" SEC, VITON |
| 33 | AAC8198 | 1 | 1 | 1 | 1 | O-RING, 1 3/16" ID X 1/8" SEC, VITON |
| 34 | AAC8195 | 4 | 12 | 20 | 28 | O-RING, 13/16" ID X 3/32" SEC, VITON |
| 35 | AAC8057 | 1 | 1 | 1 | 1 | O-RING, 13/16" ID X 1/8" SEC, VITON |
| 36 | AAC8192 | 1 | 1 | 1 | 1 | O-RING, 1 5/16" ID X 1/8" SEC, VITON |
| 37 | AAC8258 | 1 | 1 | 1 | 1 | O-RING, 9/16" ID X 3/32" SEC, VITON |
| 38 | CAA1001 | .25 FT. | .25 FT. | .25 FT. | .25 FT. | PIPE, ½" SCH. 40 PVC |
| 39 | AAC8255 | 1 | 1 | 1 | 1 | BRACE, ELECTROLYZER, UPPER |
| 40 | AAB6893 | 1 | 1 | 1 | 1 | LABEL, IS WARNING |
| 41 | AAC8252 | N/A | 1 | 2 | 3 | BRACE, ELECTROLYZER |
| 42 | P40507 | 4 | 8 | 12 | 16 | WASHER, FLAT, 3/8", SS |
| 43 | AAB3621 | 1 | 1 | 1 | 1 | VALVE, CHECK, ½" SOC. |
| 44 | AAB3501 | 1 | 2 | 3 | 4 | LABEL, POSITIVE |
| 45 | AAB3504 | 1 | 2 | 3 | 4 | LABEL, NEGATIVE |
| 46 | AAC8510 | 1 | 1 | 1 | 1 | LABEL, WARNING, HIGH VOLTAGE |
| 47 | AAC8516 | 1 | 2 | 3 | 4 | LABEL, WARNING, DO NOT OPERATE |

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

OSEC®-BP SYSTEM – ELECTROLYZER – PARTS LIST

C12 (AAC8216), C24 (AAC8219), C36 (AAC8222), C48 (AAC8225)

85.070.000.015F

ISSUE 2 5-10

| PART NO. | QTY. | DESCRIPTION |
|----------|--------|---|
| AAB6986 | 1 | BLOWER ASSEMBLY |
| AAB5519 | 1 | DP SWITCH 0.4-1.2" H2O |
| AAB6998 | 1 | ORIFICE ASSY, 3" PIPE |
| RP684818 | 20 FT. | TUBING, LDPE, 1/4 ID X 3/8 OD |
| AAB5525 | 4 | FITTING, TUBE, 3/8 OD X 1/4 NPT |
| AAB5522 | 2 | FITTING, TUBE, 3/8 OD X 1/8 NPT |
| 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" |
| P43788 | 2 | NIPPLE, PVC THD X P.E., 3" LG |
| P56006 | 2 | ELBOW, PVC PIPE, 3" |
| AAB7073 | 3 | PLACARD, NO SMOKING |
| XAA1029 | 1 | PROC., TYPICAL INSTALLATION, OSEC BP (TO BE PACKAGED W/KIT PARTS) |

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 9-05

| PART NO. | QTY. | DESCRIPTION |
|----------|-------|---|
| AAB1319 | 2 | COVER, JUNC BOX |
| AAB2039 | 4 | CABLE, CONN, ¼" SPT, PLASTIC |
| AAB5504 | 40 FT | CABLE, 2 COND, 18 AWG, SHIELDED |
| AAB6947 | 2 | JUNC BOX, 2 WAY |
| AAB6944 | 20 FT | CABLE, 4 COND, 18 AWG, SHIELDED |
| AAB9149 | 1 | DC POWER CABLE ASSY, RED |
| AAB9152 | 1 | DC POWER CABLE ASSY, BLACK |
| AAB5777 | 4 | RED BUSH, ½ SPG X ¼ NPT, PVC |
| RB934104 | 50 FT | FLEX, CONDUIT, ½" |
| U16116 | 10 | CONDUIT CONN.S, ½" COND. X ½" SPT |
| U19808 | 4 | CABLE, CONN., 1/8 – ¼ X ½ SPT |
| U22760 | 13 | CONDUIT, CONN. SEAL, ½" |
| U85553 | 1 | ELECTRICAL JOINT COMPOUND |
| AAA8346 | 1 | BOOT, RED, CELL CONN. |
| AAA8349 | 1 | BOOT, BLACK, CELL CONN. |
| XAA1029 | 1 | PROC., TYPICAL INSTALLATION, OSEC BP (TO BE PACKAGED W/KIT PARTS) |

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 9-05

| PART NO. | QTY. | DESCRIPTION |
|----------|--------|---|
| AAB6056 | 3 | FITTING, STRAIGHT, BARBED |
| AAB6212 | 4 | HOSE CLAMPS, NYLON, ½" |
| AAB4169 | 8 | ADAPTER, HOSE, ½" NPT X ½" ID HOSE |
| AAB6926 | 2 | ADAPTER, HOSE, ¼" NPT X 3/8 ID HOSE |
| AAB6923 | 1 | ADAPTER, HOSE, ELBOW, ½" NPT X ½" ID |
| AAC8504 | 2 | ADAPTER, HOSE, ELBOW, ¾" NPT X ½" ID |
| AAB6920 | 6 | HOSE CLAMPS, NYLON, 11/16" |
| P42694 | 6 | NIPPLE, ½" NPT X 1-1/2" LONG |
| P42700 | 2 | TEE, ½" NPT |
| P44138 | 1 | TEE, 1", PVC, SOCKET |
| AAB3953 | 1 | RED. BUSH, 1" SPG X ½" NPT |
| AAB5777 | 2 | RED. BUSH, ½" SPG X ¼" NPT |
| P34759 | 2 | COUPLING, ½" NPT |
| RP234206 | 1.0 FT | NIPPLE, 1" PVC, P.E., 6" LONG (QTY. 2)* |
| RP524484 | 20 FT | HOSE, 3/8 ID, VINYL |
| RP234534 | 30 FT | HOSE, ½ ID, BRAIDED VINYL |
| RP534473 | 20 FT | HOSE, ¼ ID, BRAIDED VINYL |
| U10119 | 6 | HOSE CLAMPS, SS |
| UXA21673 | 3 | VALVE, BALL, PVC, ½ NPT |
| P35108 | 2 | BUSHING, RED., ½' NPT X ¼" NPT, PVC |
| P38254 | 1 | BUSHING, RED., 1" NPT X ½" NPT, PVC |
| AAB2027 | 1 | STRAINER, LINE |
| AAB3836 | 1 | BUSH., 1" SPG X ½" SOCK, PVC |
| AAB8072 | 1 | COUPLING, 1" SOCK, PVC |
| P44137 | 1 | PIPE, 1" SOC, 90 DEG., PVC |
| XAA1029 | 1 | PROC., TYPICAL INSTALLATION, OSEC BP (TO BE PACKAGED W/KIT PARTS) |

*FABRICATE AS REQUIRED PER KIT

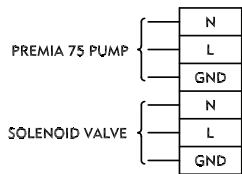
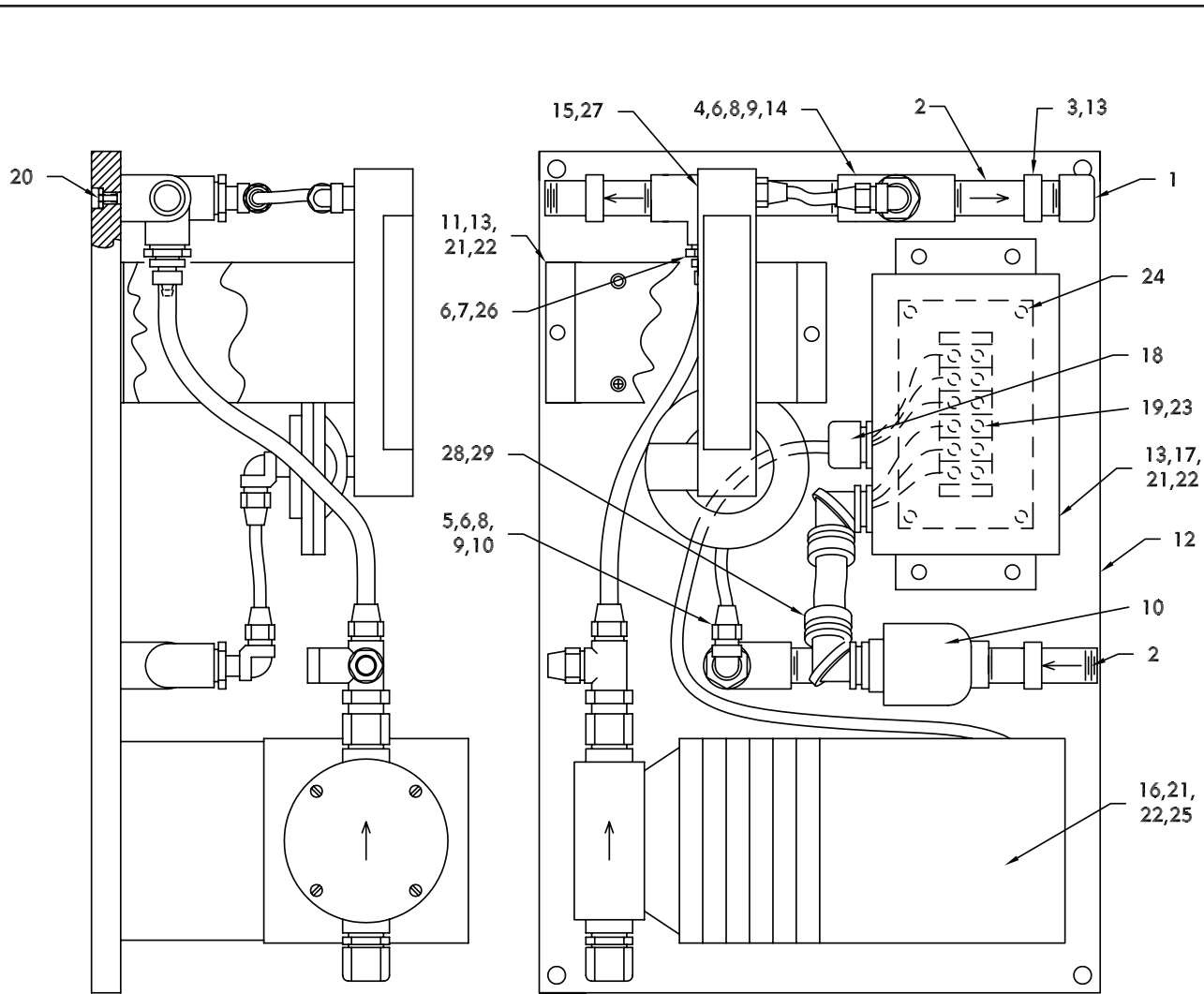
NOTE: THIS KIT APPLIES TO SEVERAL OSEC SYSTEMS. SOME ITEMS MAY NOT BE REQUIRED.

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 9-05



WIRING DIAGRAM

NOTE: FOR PARTS LIST, SEE DWG. 85.070.000.035B.

AAC2858, AAC4097, AAC4100
OSEC®-BP SYSTEM – BRINE PUMP – PARTS

85.070.000.035A

ISSUE 0 12-03

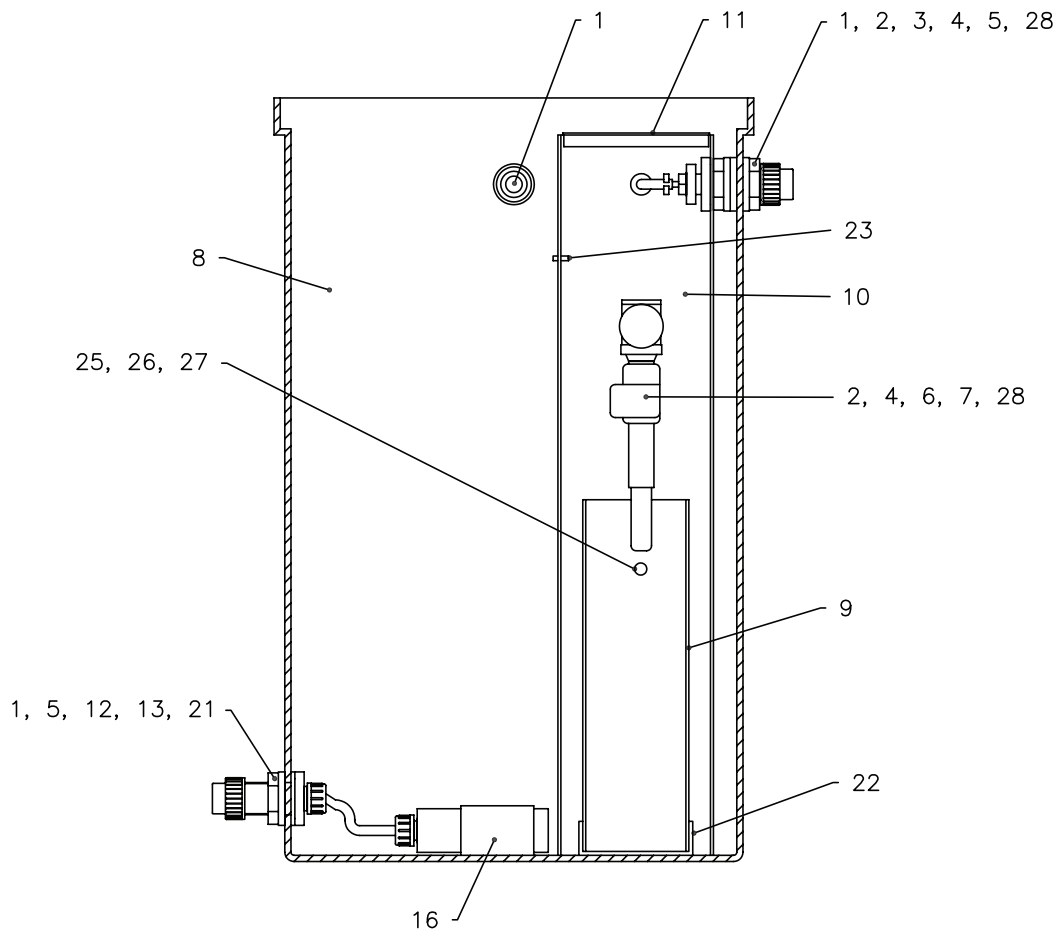
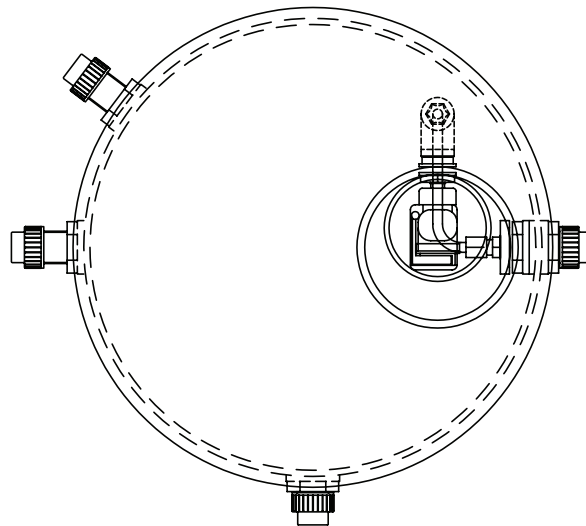
| KEY NO. | PART NO. | QTY. | DESCRIPTION |
|---------|----------------|-------|---------------------------------------|
| 1 | P58745 | 1 | PIPE CAP, ½" NPT SCH 80 PVC |
| 2 | P42585 | 5 | NIPPLE, ½" NPT X 3" LG. SCH 80 PVC |
| 3 | AAA3081 | 4 | CLAMP, ½" PIPE |
| 4 | P42700 | 2 | TEE, ½" NPT PVC |
| 5 | P42699 | 1 | ELBOW, ½" NPT PVC |
| 6 | P35108 | 3 | ADAPTER, ½" NPT X ¼" NPT PVC |
| 7 | AAB6926 | 1 | ADAPTER, ¼" OD TUBE X ¼" NPT |
| 8 | P39235 | 4 | ADAPTER, 3/8" OD TUBE X ¼" NPT |
| 9 | PXB39234 | 4 | ADAPTER CAP, TUBE |
| 10 | AAC2870 | 1 | VALVE, ½" SOL. |
| 11 | AAB1550 | 1 | BRACKET, METER |
| 12 | AAC2861 | 1 | PANEL |
| 13 | P41344 | 10 | SCR, 10-32 X ¾" LG |
| | P42418 | 10 | SCR, 10-32 X ¾" LG (C24 ONLY) |
| 14 | RP524464 | 1½ FT | TUBING, ¼" ID X 3/8" OD |
| 15 | AAC4088 | 1 | PURGEMETER, C12 |
| | AAC4091 | 1 | PURGEMETER, C24 |
| | AAC4094 | 1 | PURGEMETER, C36 & C48 |
| 16 | P75MEM7DEVHTAA | 1 | PUMP, PREMIA 75 (C12 & C24) |
| | P75ME15DEVHT3A | 1 | PUMP, PREMIA 75 (C36 & C48) |
| 17 | AAC2864 | 1 | JUNCTION BOX |
| 18 | U27409 | 1 | FITTING, ½" (C12 & C24) |
| | | 2 | FITTING, ½" (C36 & C48) |
| 19 | U25271 | 1 | TERMINAL STRIP, 6 POLE |
| 20 | AAC2867 | 14 | INSERT, THREADED 8-32 |
| 21 | P38740 | 10 | WASHER, #10, SS |
| 22 | P13619 | 10 | LOCKWASHER, #10, SS |
| 23 | P30128 | 4 | SCREW, 6-32 X 5/8" LG, SS |
| 24 | P18277 | 4 | SCREW, 10-32 X 3/8" LG, SS |
| | | 1 | SCREW, 10-32 X 3/8" LG, SS (C24 ONLY) |
| 25 | P42109 | 4 | SCREW, 10-32 X 7/8" LG, SS |
| 26 | AAB6212 | 1 | HOSE CLAMP |
| | | 4 | HOSE CLAMP (C24 ONLY) |
| 27 | AA1338 | 2 | SCREW, M5 X 20 |
| 28 | AAB2924 | 6 IN | CONDUIT |
| 29 | U28019 | 2 | ADAPTER |

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

AAC2858, AAC4097, AAC4100
OSEC®-BP SYSTEM – BRINE PUMP – PARTS LIST

85.070.000.035B

ISSUE 0 12-03



NOTE: FOR PARTS LIST, SEE DWG. 85.070.000.040B.

OSEC®-BP SYSTEM – SALT SATURATOR – PARTS
(AAB6239, AAB6242, AAB6245 & AAB6248)

85.070.000.040A

ISSUE 3 6-04

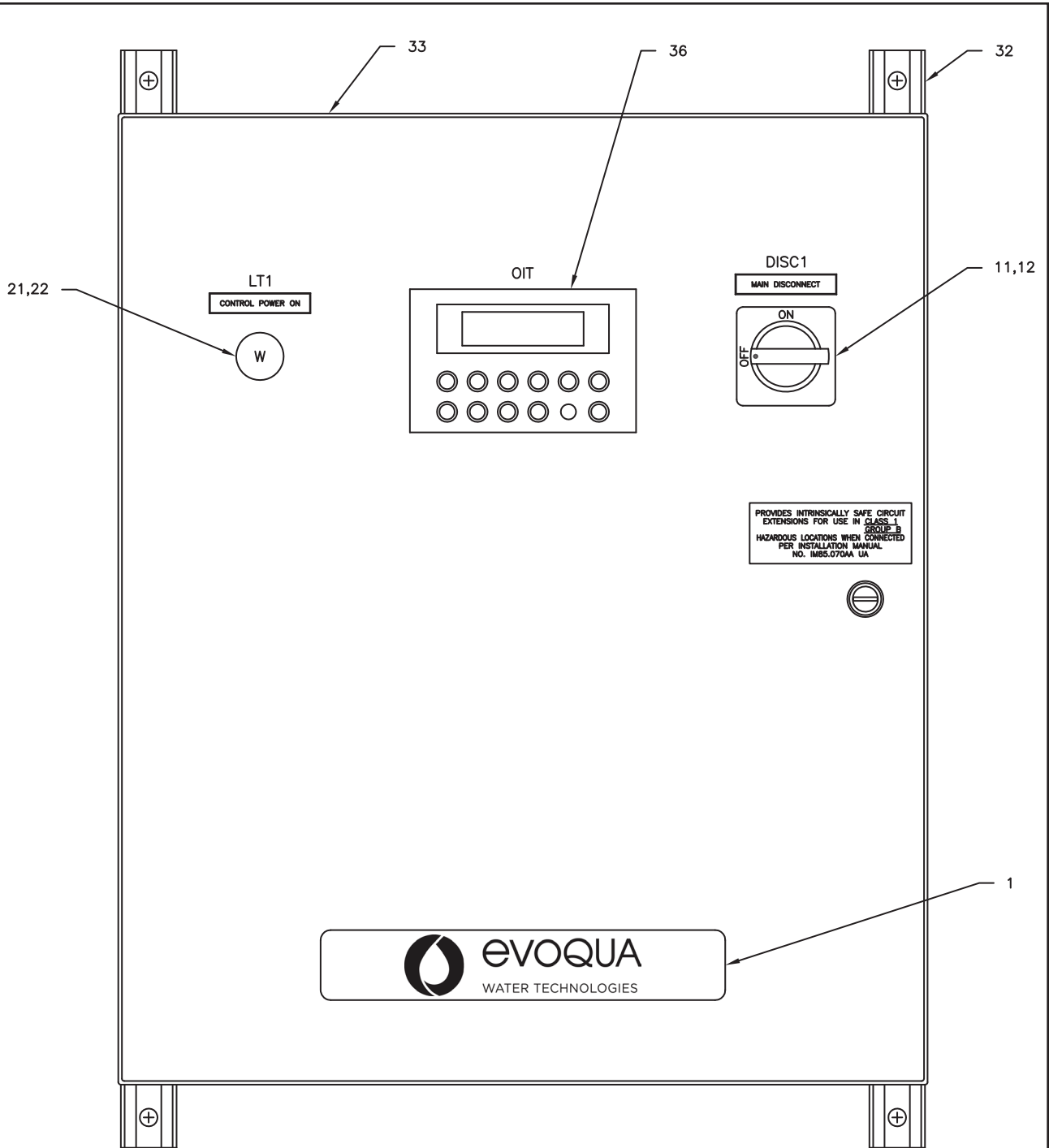
| KEY NO. | PART NO. | QTY. | DESCRIPTION |
|---------|-----------|-------|--|
| 1 | AAB7001 | 4 | TANK CONN., 1/2 NPT x 1/2 SOCK, PVC |
| 2 | AAB5777 | 2 | BUSHING, 1/2 SPG x 1/4 NPT, PVC |
| 3 | P88537 | 1 | NUT, BACKNUT (SPACER) |
| 4 | AAB9155 | 2 | HOSE CONNECTOR, 1/4 NPT x ID HOSE, BRASS |
| 5 | RP534473 | 3 FT. | HOSE, 1/4 ID, BRAIDED |
| 6 | AAB1299 | 1 | FLOAT VALVE |
| 7 | P42699 | 1 | ELBOW, 1/2 SOC x 1/2 NPT, PVC |
| 8 | AAB6878 | 1 | TANK, SALT SATURATOR, 55 GAL. NAT. (400 LB CAPACITY) |
| | OR | | |
| | AAB6881 | 1 | TANK, SALT SATURATOR, 100 GAL. NAT. (800 LB CAPACITY) |
| | OR | | |
| | AAB6884 | 1 | TANK, SALT SATURATOR, 200 GAL. NAT. (1500 LB CAPACITY) |
| | OR | | |
| | AAB6887 | 1 | TANK, SALT SATURATOR, 360 GAL. NAT. (2800 LB CAPACITY) |
| 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 | P89036 | 2 | COLLET |
| 13 | P100738 | 2 | NUT |
| 16 | AAB9143 | 2 | STRAINER, SUB-ASSEMBLY |
| 17 | P55108 | 1 | REDUCING BUSHING, 1/2" x 1/4" NPT |
| 21 | JP83536 | 1 | 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®-BP SYSTEM – SALT SATURATOR – PARTS LIST
-AAB6239, AAB6242, AAB6245 & AAB6248

85.070.000.040B

ISSUE 2 9-05

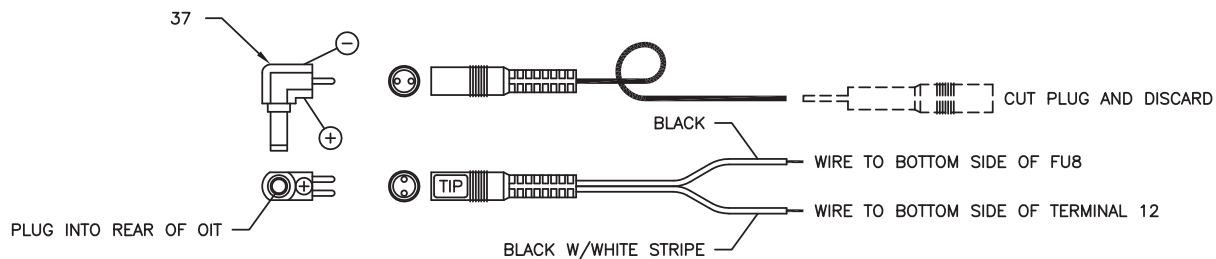


NOTE: FOR PARTS LIST, SEE DWG. 85.070.170.150D.

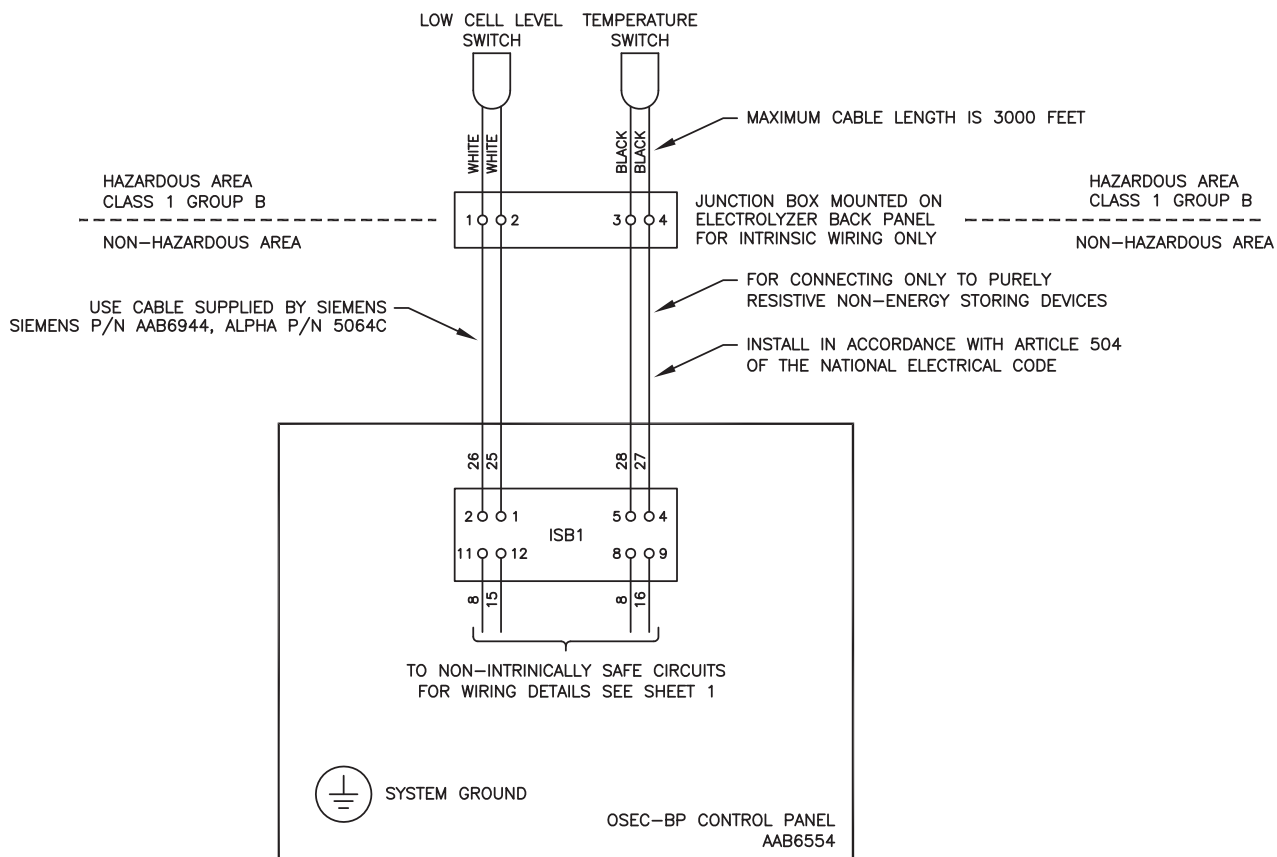
OSEC®-BP SYSTEM – CONTROL PANEL – PARTS
- AAB6554 - Front Panel Detail

85.070.170.150A

ISSUE 3 10-14



DETAIL OF POWER CABLE CONNECTION FOR OIT



NOTE: FOR PARTS LIST, SEE DWG. 85.070.170.150D.

OSEC®-BP SYSTEM – CONTROL PANEL – PARTS
-AAB6554
Inside View

85.070.170.150C

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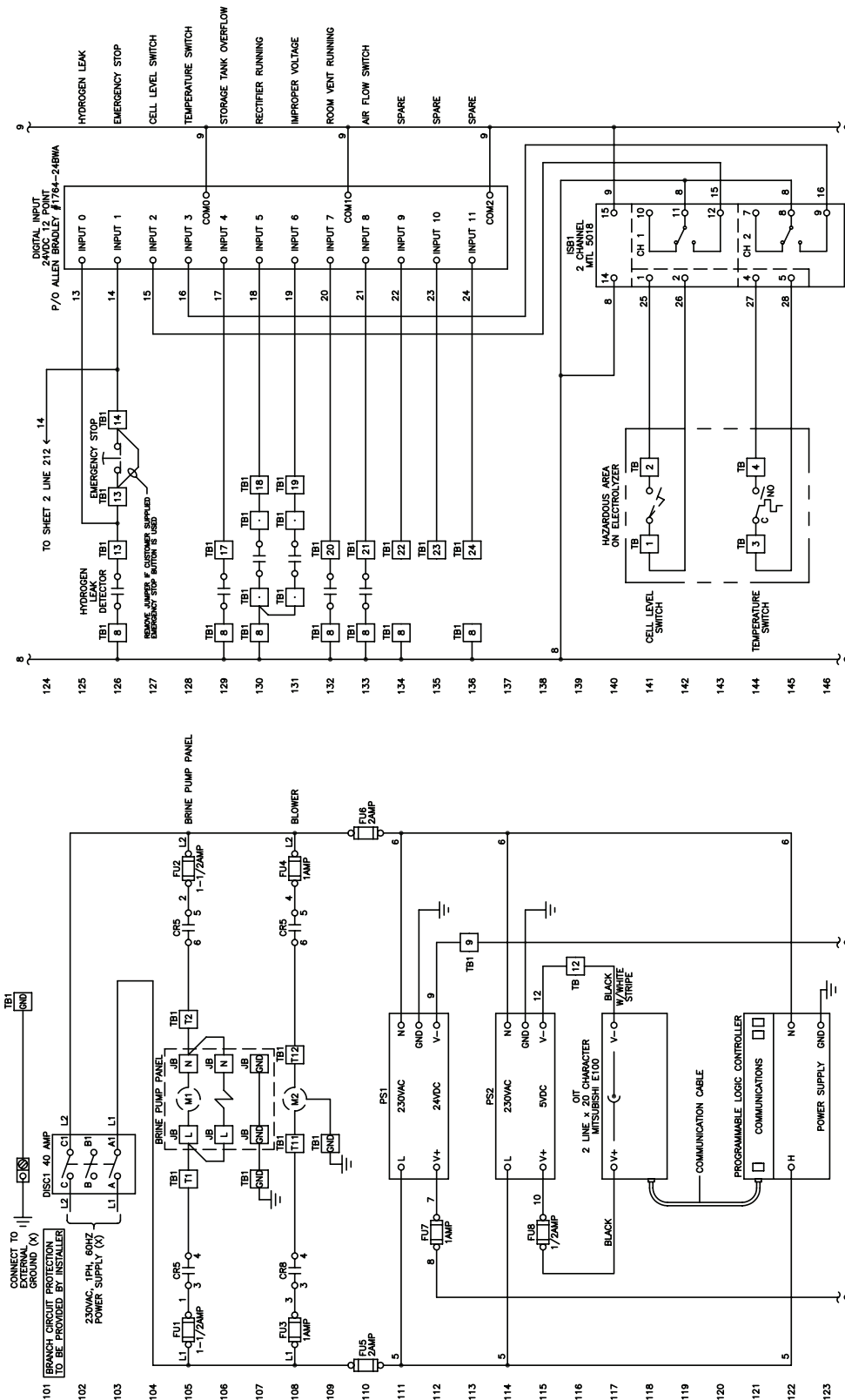
| KEY NO. | PART NO. | VENDOR | QTY. | DESCRIPTION | REFERENCE DESIG. |
|---------|-------------|----------------|------|---|---|
| 1 | AA7449 | Evoqua | 1 | NAMEPLATE, Evoqua WATER TECHNOLOGIES | CR1,2,3,4,6,7 CR5,8 CR1,2,3,4,6,7 CR5,8 DISC1 DISC1 DISC1 FU1,2 FU3,4 FU5,6 FU7 FU8 FU1-6 FU7,8 FU8 LT1 LT1 |
| 2 | P58164 | Evoqua | 1 | NAMEPLATE, SERIAL NUMBER IDENTIFICATION | |
| 3 | L2016 | Evoqua | 1 | LABEL, WARNING | |
| 4 | L2022 | Evoqua | 1 | LABEL, WARNING | |
| 5 | AAB7118 | Evoqua | 1 | LIST, PARTS USED IN AAB6554 | |
| 6 | 700-HK36Z24 | ALLEN BRADLEY | 6 | RELAY, SPDT 24 VDC COIL | |
| 7 | 700-HK32Z24 | ALLEN BRADLEY | 2 | RELAY, DPDT 24 VDC COIL | |
| 8 | 700-HN121 | ALLEN BRADLEY | 6 | SOCKET, SPDT RELAY | |
| 9 | 700-HN122 | ALLEN BRADLEY | 2 | SOCKET, DPDT RELAY | |
| 10 | LBSR40 | FERRAZ SHAWMUT | 1 | DISCONNECT SWITCH 3 POLE 40A, 600V | |
| 11 | HMSR | FERRAZ SHAWMUT | 1 | DISCONNECT SWITCH, HANDLE NEMA 4X | |
| 12 | SM300-5L | FERRAZ SHAWMUT | 1 | DISCONNECT SWITCH, SHAFT | |
| 13 | ATDR1-1/2 | FERRAZ SHAWMUT | 2 | FUSE, 1 1-2 AMP, 600 VOLT | |
| 14 | ATDR1 | FERRAZ SHAWMUT | 2 | FUSE, 1 AMP, 600 VOLT | |
| 15 | ATQR2 | FERRAZ SHAWMUT | 2 | FUSE, 2 AMP, 600 VOLT | |
| 16 | CDL1 | FERRAZ SHAWMUT | 1 | FUSE, 1 AMP, 250 VOLT | |
| 17 | GDL1/2 | FERRAZ SHAWMUT | 1 | FUSE, 1/2 AMP, 250 VOLT | |
| 18 | 1492-FB2C30 | ALLEN BRADLEY | 3 | FUSEBLOCK, 2 POLE DIN MOUNT | |
| 19 | 1492-H6 | ALLEN BRADLEY | 2 | FUSEBLOCK, DIN MOUNT | |
| 20 | 1492-N37 | ALLEN BRADLEY | 1 | FUSEBLOCK, END BARRIER | |
| 21 | 800EP-PL1 | ALLEN BRADLEY | 1 | PILOT BARRIER OPERATOR WHITE | |
| 22 | 800E-2DL3 | ALLEN BRADLEY | 1 | PILOT LIGHT POWER MODULE & LATCH | |
| 23 | 1764-24BWA | ALLEN BRADLEY | 1 | PLC, BASE UNIT 12IN/12 OUT 24 VDC CONTROL | |
| 24 | 1764-LSP | ALLEN BRADLEY | 1 | PLC, PROCESSOR | |
| 25 | 1769-IF4 | ALLEN BRADLEY | 1 | PLC, 4 CHANNEL ANALOG INPUT MODULE | |
| 26 | 1769-ECR | ALLEN BRADLEY | 1 | PLC, END CAP | |
| 27 | 1492-W4 | ALLEN BRADLEY | 51 | TERMINAL BLOCK, 30A, 600V, CREY | TB1 |
| 28 | 1492-EB3 | ALLEN BRADLEY | 2 | TERMINAL BLOCK END BARRIER | TB1 |
| 29 | 1492-EA35 | ALLEN BRADLEY | 10 | TERMINAL BLOCK END ANCHOR | TB1 |
| 30 | C-SD24208SS | HOFFMAN | 1 | ENCLOSURE, 24" X 20" X 8 NEMA 4X 304 S.S | GND CONN ISB1 |
| 31 | C-P2420 | HOFFMAN | 1 | PLATE, STEEL REALY MOUNTING | |
| 32 | C-MFKSS | HOFFMAN | 1 | MOUNTING FOOT KIT STAINLESS STEEL | |
| 33 | A-S050SS | HOFFMAN | 1 | HOLE SEAL, 1/2" STAINLESS STEEL | |
| 34 | 31003 | THOMAS & BETTS | 2 | CONNECTOR, GROUND | |
| 35 | 5018 | MTL | 1 | INTRINSIC 2-CHANNEL SWITCH OPERATED RELAY | OIT |
| 36 | E100 | MITSUBISHI | 1 | OPERATOR INTERFACE TERMINAL 2-LINE X 20-CHARACTER | |
| 37 | 273-1716 | RADIO SHACK | 1 | ADAPTAPLUG "M" 5.5 O.D. X 2.1MM I.D | PS2 TO OIT |
| 38 | 273-1740 | RADIO SHACK | 1 | ADAPTAPLUG 6-FT POWER CORD SOCKET-TO-SOCKET | PS2 TO OIT |
| 39 | MIT-CAB-2 | MITSUBISHI | 1 | PLC, COMMUNICATION CABLE | PLC TO OIT |
| 40 | S82K-03024 | OMRON | 1 | POWER SUPPLY 24 VDC 1.3 AMP | PS1 |
| 41 | S82K-00305 | OMRON | 1 | POWER SUPPLY 5 VDC 0.6 AMP | PS2 |
| 42 | 1492-CJ6-2 | ALLEN BRADLEY | 1 | TERMINAL BLOCK, CENTER JUMPER 2 POLE | TB1-13 |
| 43 | 1492-CJ6-10 | ALLEN BRADLEY | 1 | TERMINAL BLOCK, CENTER JUMPER 10 POLE | TB1-GND, 8 |
| 44 | 1492-SM6X12 | ALLEN BRADLEY | 1 | TERMINAL BLOCK MARKING STRIP | TB1 |
| 45 | 199-DR1 | ALLEN BRADLEY | 44" | RAIL, DIN MOUNTING | CR, TB |
| 46 | E1X3LG6 | PANDUIT | 6' | WIREWAY 1" X 3" | |
| 47 | C1LG6 | PANDUIT | 6' | COVER, WIREWAY 1" | |

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

(AAB6554) OSEC®-BP SYSTEM – CONTROL PANEL – PARTS LIST

85.070.170.150D

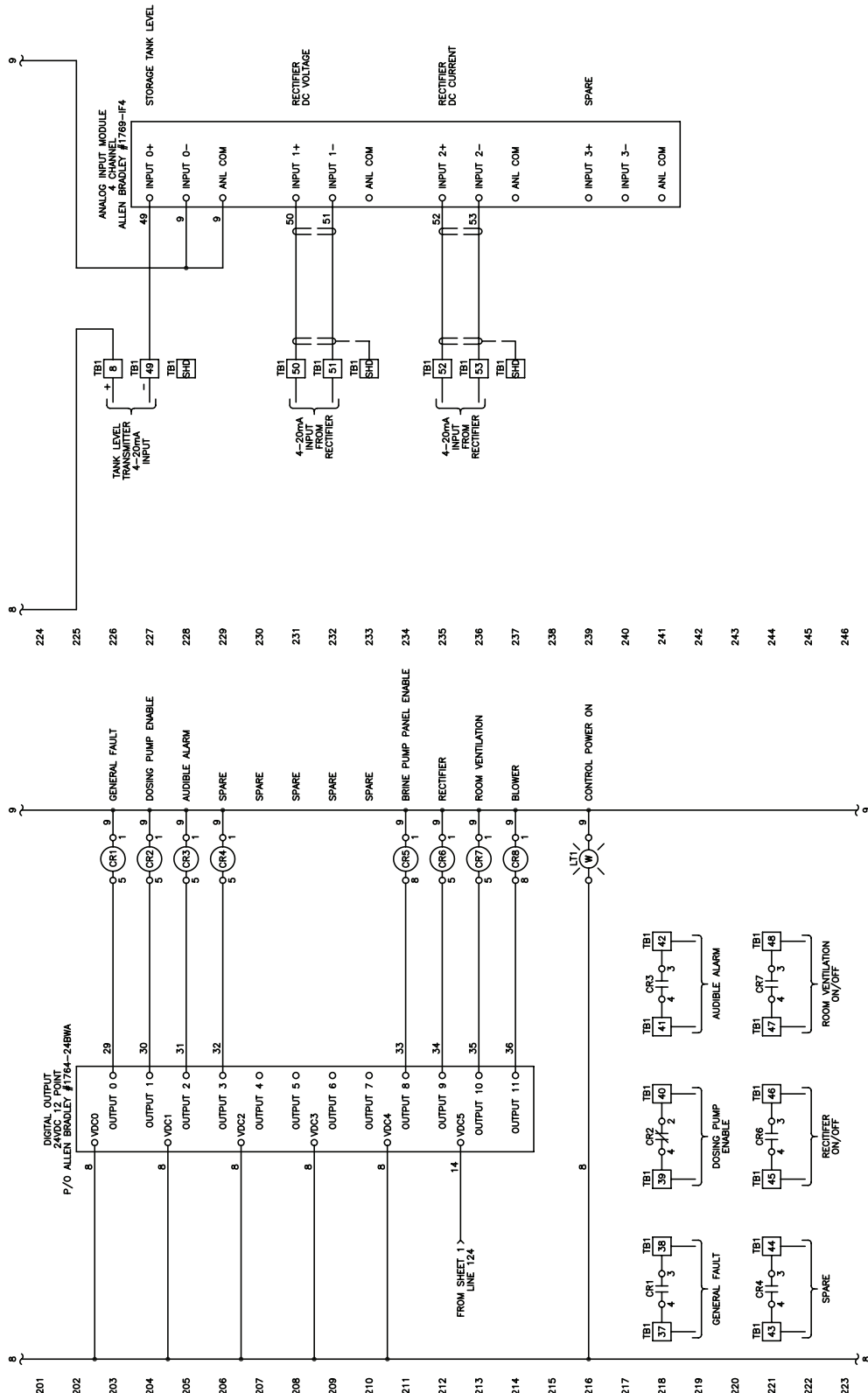
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OSEC-BP SYSTEM – CONTROL PANEL SCHEMATIC

85.070.155.110

ISSUE 2 5-04



OSEC®-BP SYSTEM – CONTROL PANEL SCHEMATIC

85.070.155.120

ISSUE 2 5-04

SECTION 6

SECTION 6 – SPARE PARTS LIST

| <u>QTY.</u> | <u>DESCRIPTION</u> | <u>PART NO.</u> |
|--------------------|---|------------------------|
| 1 | Blower | AAB6992 |
| 1 | Brine Pump, C12 & C24 | P75MEM7DEVHTAA |
| 1 | Brine Pump, C36 & C48 | P75ME15DEVHT3A |
| 1 | Electrolyzer Chassis | AAC8213 |
| 1 | Float Valve (Saturator) | AAB1299 |
| 1 | D.P. Switch (Air Flow) | AAB5519 |
| 1 | Float Switch | AAD3329 |
| 1 | Temperature Switch | AAC8201 |
| 1 | Level Transducer (Product Tank) | AAB3225 |
| 1 | Boot, Red | AAA8346 |
| 1 | Boot, Black | AAA8349 |
| 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 |
| 4 | O-Ring, 4-1/2"ID X 1/8"Sec., Viton | AAC8054 |
| 2 | O-Ring, 1-1/4"ID X 3/32"Sec., Viton | AAC8024 |
| 1 | O-Ring, 1-3/16"ID X 1/8"Sec., Viton | AAC8198 |
| 4 | O-Ring, 13/16"ID X 3/32"Sec., Viton | AAC8195 |
| 1 | O-Ring, 13/16"ID X 1/8"Sec., Viton | AAC8057 |
| 1 | O-Ring, 1-5/16"ID X 1/8"Sec., Viton | AAC8192 |
| 1 | O-Ring, 9/16"ID X 3/32"Sec., Viton | AAC8258 |
| 1 | Grease, Halocarbon | U25546 |
| 1 | Electrical Joint Compound | U26978 |
| 1 | Chemical Analysis Kit | U85655 |
| 1 | Iodide Tablets (included in U85655) | U82272 |
| 1 | Sodium Thiosulphate Sol. (included in U85655) | E80203 |
| 1 | Citric Acid, 500g (included in U85655) | E80202 |
| 1 | Hardness Test Kit (included in U85655) | U84911 |
| 1 | Brineometer (included in U85655) | U84912 |

Control Panel Fuses

| <u>QTY.</u> | <u>DESCRIPTION</u> | <u>PART NO.</u> |
|--------------------|--------------------------------|------------------------|
| 1 | Fuse, 1/2A, 250V GDL-1/2 | P49146 |
| 1 | Fuse, 1A, 250V GDL-1 | P56645 |
| 1 | Fuse, 1A. 600V, ATDR-1 | AAC6455 |
| 1 | Fuse, 1-1/2A, 600V, ATDR-1-1/2 | AAC6452 |
| 1 | Fuse, 2A, 600V, ATQR-2 | AAC6449 |

SECTION 7

OSEC®-BP CONTROL PANEL

INTRODUCTION

This supplement describes the OSEC®-BP control panel, including its operation and troubleshooting, should an alarm condition occur. Refer to the Wiring diagram in Section 2 - Installation of system manual for system wiring in summary.

TABLE OF CONTENTS

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| Technical Data | Section 1 |
| Installation | Section 2 |
| Operation | Section 3 |
| Service | Section 4 |
| Alarm System..... | Section 5 |



OSEC[®]-BP CONTROL PANEL

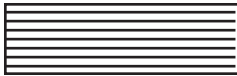


SECTION 1 - TECHNICAL DATA

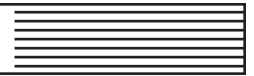
The OSEC-BP Control Panel monitors and controls the OSEC-BP process described in the earlier sections of the manual. Housed in a NEMA 4X, 304 stainless steel, wall-mounting cabinet, the OSEC-BP control panel utilizes a Programmable Logic Controller (PLC) to manage the system. An Operator Interface Terminal (OIT) fitted to the front of the panel enables the system to be configured and allows the operator to monitor and control the system status. This OIT has a two-row by 20-character display and keys to enable navigation of the menu structure.

Using the signal from the storage tank level transmitter the control panel maintains a working volume of sodium hypochlorite in the storage tank. This is achieved by batch (on/off) operation of the system between the user set start and stop levels.

At all times the status of the electrolyzer, DC 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 OIT and safe corrective action is taken.



OSEC[®]-BP CONTROL PANEL



SECTION 2



OSEC[®]-BP CONTROL PANEL



SECTION 2 - INSTALLATION

List of Contents

| | PARA. NO. |
|--------------------------|-----------|
| General | 2.1 |
| Connection Details | 2.2 |
| Configuration..... | 2.3 |

2.1 General

The control panel is designed to be wall mounted using the wall mounting brackets supplied. It should be mounted adjacent to the electrolyzer assembly in a readily accessible position but care should be taken to avoid locations subject to any water or chemical splashes. The ambient temperature should not be lower than 5°C or greater than 40°C.

2.2 Connection Details

The control panel requires a 230V, 50/60Hz single phase power supply. This should be fused at 10A.



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

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

- OSEC Electrolyzer
- DC power supply
- Brine Dilution Panel
- Storage tank level transmitter
- Storage tank blower
- Storage tank air flow switch

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.

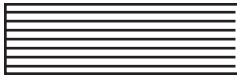
Areas within the installation may be classified as “hazardous;” any cable, conduit, or trunking within these areas should be installed accordingly.

2.3 Configuration

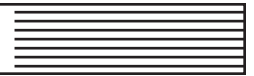
Prior to operation, the control system has to be configured to suit the installation it is being used in. The following information has to be entered or selected:

- Electrolyzer size (sets default value of other parameters)
- Electrolyzer prime time (optional - default based on electrolyzer size)
- Storage tank diameter (optional - use for stored volume calculation)
- Storage tank level transducer range (optional - default matches standard transducer default)
- Storage tank level transducer zero (optional - default is zero @ 4mA)
- Storage tank overflow switch fitted (optional - default is none)
- Storage tank low level alarm point
- Storage tank high level alarm point
- Fill start level
- Fill stop level
- DC voltage display range (optional - default based on electrolyzer size)
- DC current display range (optional - default based on electrolyzer size)
- Improper Voltage Alarm Signal (Analog or discrete; default is discrete)

The system is configured via the configuration menu. The configuration parameter ranges and default values are shown in Appendix B.



OSEC[®]-BP CONTROL PANEL



SECTION 3



SECTION 3 - OPERATION

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|---|-----------|
| Overview Display and Operational Mode | 3.1 |
| Inhibit Mode | 3.2 |
| Auto Mode..... | 3.3 |
| Tank Top-Up..... | 3.4 |
| Dosing Pump Enable | 3.5 |

3.1 Overview Display and Operational Mode

The control/status screen provides a summary overview of the current status of the system, such as whether the flow (brine dilution unit), DC power supply or storage tank blower are running, and the current status text. This status text shows the operational mode—either ‘INHIBIT’ or ‘AUTO’ if the unit is not running—or the current state if it is.

A tank status screen displays the storage tank level and available product volume.

The DC status screen shows the voltage and current being applied to the electrolyzer. This information is obtained from two analog signals from the DC power supply.

3.2 Inhibit Mode

In the INHIBIT mode, the system will not operate; however, the emergency stop, hydrogen leak, and storage alarms are active. Should an alarm occur, the appropriate alarm message is displayed and the general alarm relay is de-energized. In the INHIBIT mode, the brine feed and blower can each be activated manually.

3.3 Auto Mode

When in the AUTO mode, the electrolyzer is started and stopped as required by the level in the storage tank. Starting when the level is below the start fill point and stopping when the level reaches the stop fill point.

When the start signal is received a pre-start systems check is executed. This checks that the air flow switch (unless the blower is still running) and DC power supply running contacts are open. If either of these checks fail, the appropriate alarm message is displayed. Once the pre-start check has been passed the room ventilation request is turned on and the status text changes to ‘START-ING’. When the room ventilation running signal (optionally enabled interlock) is received the storage tank blower is started. Once the air flow switch indicates that an air flow has been established the brine feed is turned on, and providing the cell is full (level switch closed) the DC power supply is turned on, the status text changes to ‘GENERATING’.

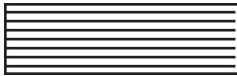
The system continues to run until the stop level is reached or an alarm forces a shutdown. Upon shut-down, the DC power supply is turned off and the brine feed is kept running for a period determined by the prime setting (as set in the configuration menu) in order to prime the cell with fresh electrolyte. The status text changes to ‘PRIMING’. The room ventilation system and storage tank blower remain running for a minimum of 15 minutes from the time the rectifier is stopped or until the prime is complete. After the prime has been completed the status text changes to ‘PURGING’ while the blower is still on. Once the blower has stopped the status text reverts back to ‘AUTO’.

3.4 Tank Top-Up

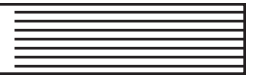
A function key is defined to enable the operator to start a tank TOP-UP, without waiting for the storage tank to drop to the start level. The fill is terminated when the stop level is reached, the RESET key is pressed or the mode changed to INHIBIT.

3.5 Dosing Pump Enable

The dosing pump enable relay is held energized all the time the level in the storage tank is above the low storage level set by the operator.



OSEC[®]-BP CONTROL PANEL



SECTION 4

SECTION 4 - OPERATION

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| Tank Input Zero | 4.7.4.2.2 |
| Tank Diameter..... | 4.7.4.2.3 |
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| Analog Alarm | 4.7.4.3.3 |
| Volt Alarm, LOW | 4.7.4.3.4 |
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| Help..... | 4.7.5 |

NOTE: The system is operated and monitored through the OIT. This has a menu structure consisting of a series of menus, sub-menus, and display screens as seen in Appendix A.

4.1 Operator Interface Terminal (OIT)

The OIT comprises a two-row by 20-character backlit LCD display and a keypad. Most of the keys have two or more functions, the 'num' key being used to make the keys produce numbers. The arrow keys are used to scroll the displays (where applicable) and the 'enter' key used to select or confirm actions.

Where there are more than two lines of text, as in most menus, the remaining lines can be viewed by pressing the down arrow key.

The first key, marked '-', '' and '0', produces a '-' on the first press that can be changed to a '.' if quickly pressed a second time.

4.2 Power-Up

The power for the control panel is connected via a door interlocked isolator. When this is placed in the on position the 'power on' indicator will illuminate and the OIT displays its firmware 'boot-up' data.

This is followed by the first of two splash screens:

Evoqua
Water Technologies

This is followed by the second splash screen that gives the software number and version numbers for both parts of the software (PLC and OIT):

OSEC-BP (EAC1033)
PLC v1.00 OIT v1.00

After a few seconds the second splash screen is replaced by the main menu.

4.3 Main Menu

The Main Menu is a list of sub-menus that may be selected, it appears as follows:

MAIN MENU (↓↑ and ←)
> Status Displays
> Alarms
> Set Time & Date
> Configuration
> Help

The 'up' and 'down' cursor keys are used to move a block cursor between the menu options and to move the list into the display window. With the cursor on the '>' adjacent to the option required the 'Enter' key can be pressed to move to that option.

4.4 Status Displays

The Status Display sub-menu enables the selection of one of four status displays, it appears as:

STATUS (↓↑ and ←)
> Control
> Tank Level
> DC Power
> Process Times
> Main menu

The normal navigation of the menu options applies. The main menu option enables the operator to return to the main menu. This can also be achieved by pressing the 'F4' function key (this applies to virtually all screens).

4.4.1 Control/Overview

The Control/Overview screen shows the current status of most of the system, excluding the storage tank level, DC output level and process times. Its layout is:

Flow OFF, Blower OFF
DC OFF, - status -
MODE TOP-UP STOP BACK

The word 'OFF' may be replaced by the word 'ON' and reflects the current status of that item of equipment. The '- status -' entry is continuously updated to show the current system state. This may show 'INHIBIT', 'AUTO', 'STARTING', 'GENERATING', 'TOP-UP', 'PRIMING' or 'PURGING'.

The four function keys have the following uses:

- F1 – (MODE) Select control mode (AUTO, INHIBIT, or MANUAL).
- F2 – (TOP-UP) Initiate batch; available only when in AUTO mode.
- F3 – (STOP) Terminate batch; system remains in AUTO mode and will restart should storage level fall below start level.
- F4 – Return to the 'Status' sub-menu.

The function key labels can be viewed by scrolling down the screen (pressing the down arrow twice; it is pressed twice because although the cursor is turned off, it is still located on the first line—the first press moves it down one line while the second scrolls the third line into the display window).

If the F1 (MODE) or F2 (TOP-UP) keys are selected, respective screens are displayed requiring additional input as described in the following paragraphs. F1 is pressed to access a screen to permit a change of system mode. F2 is pressed to initiate a batch cycle (as if storage at start level) while in AUTO mode.

If the F3 (STOP) key is pressed while the system is running, the batch cycle will terminate (with normal shut-down sequence). The system remains in AUTO mode and will restart when storage level falls to start level (set-point).

The F4 key returns to higher level menu: Status menu.

4.4.2 Mode Selection

If the MODE key is pressed at the CONTROL screen, the MODE SELECTION screen is displayed.

The following function keys are available for input:

- F1 - (AUTO) selects AUTO mode.
- F2 - (INHIB) selects INHIBIT mode.
- F3 - (MANL) selects MANUAL mode: INHIBITED mode but enabling manual operation of the brine feed and blower for testing.
- F4 - (BACK) return to prior menu.

When the AUTO key is pressed, one of two responses can be expected. If the system is in INHIBIT the following screen will appear:

Enter AUTO mode ?
YES NO

Pressing F2 'YES' will change the control mode to AUTO, pressing F3 'NO' will revert back to the 'Control' screen.

If the INHIBIT key is pressed, the mode is changed to Inhibit without confirmation.

If the MANL key is pressed, the MANUAL CONTROL screen is displayed permitting manual control of the brine feed and blower. The inputs on the MANUAL CONTROL screen are active only if the system is in Inhibit mode. There are no interlocks on manual operation of the devices—will continue to operate until stopped by user input. If the system mode is changed to Auto, manual operation of the brine feed and blower is immediately terminated.

4.4.3 Top-Up Control

If 'TOP-UP' is selected from the control screen, there are two possible responses. If the system is in INHIBIT an error message stating that top-up is only available while in AUTO is generated. If the system is in AUTO then the following screen is displayed:

— TOP-UP mode —
START BACK

The function keys then control the following actions:

- F2 – Starts the TOP-UP mode.
- F3 – 'not used'
- F4 – Return to the 'Control' screen.

4.4.4 Tank Level (Status)

The 'Tank level' display shows the current status of the storage tank level in both feet and U.S. gallons, it appears as:

TANK - xx.x ft
LEVEL - xxx gal

The value in feet is the height of the liquid level above the level transducer. The value in gallons is an approximation of the volume of liquid between the current level and the low alarm level; this is calculated based on level and on the tank diameter value entered in the configuration menu.

F4 returns the operator back to the 'Status' sub-menu.

4.4.5 DC Power (Status)

This screen shows the current and voltage being applied to the electrolyzer. This information is taken from two analog signals provided by the DC power supply. The screen appears as:

Current = xx.x A
Voltage = xxx.x V

F4 returns the operator back to the 'Status' sub-menu.

4.4.6 Process Times (Status)

This process times screen shows the time remaining for the prime and purge cycles, when running. The screen appears as:

End Prime : xxx sec
End Purge : xxxx sec

F4 returns the operator back to the 'Status' sub-menu.

4.5 Alarms

The alarm screen can be selected for display from the main menu, but will also be displayed automatically if an alarm condition is detected. The screen appears as:

Alarm message.....
ACK RESET HIST BACK

The top line shows the last (until reset) alarm message. If no alarm is present the text 'Alarms clear' is displayed.

The function keys have the following affect:

- F1 – Acknowledge (silence) the audible alarm, when fitted.
- F2 – Reset all alarms, enabling the system to return to operation.
- F3 – Display the 'alarm history' screen, showing the last 20 alarms.
- F4 – Return to the 'Main menu'.

4.5.1 Alarm History

The alarm history screen shows the last 20 alarms that have occurred, along with the time and date of the occurrence. The format of the screen is:

Alarm description 1
at HH:MM on MM/DD/YY

Alarm description 2
at HH:MM on MM/DD/YY

Alarm description 3
at HH:MM on MM/DD/YY

Alarm description 4
at HH:MM on MM/DD/YY

Alarm description 5
at HH:MM on MM/DD/YY

Alarm description 6
at HH:MM on MM/DD/YY



Alarm description 20
at HH:MM on MM/DD/YY

The alarms are displayed with the most recent alarm at the top of the list.

The functions keys are defined as:

F1 – Scroll the screen down to the previous alarm (2 lines).

F2 – Scroll the screen up to the next alarm (2 lines).

F3 – ‘not used’

F4 – Return to the ‘Alarm’ screen.

The up/down cursor keys will still prove a single line scroll.

4.6 Set Time & Date

This screen enables the ‘real’ time and date to be set or changed. This information is used in the alarm history. The screen appears as:

Time : HH:MM:SS
Date : MM/DD/YY

To change either the time or the date, over write the current value using the numeric, cursor and enter keys. The ‘NUM’ key in the bottom left position acts as a shift key to make the keys produce numbers.

F4 returns the operator back to the ‘Main menu’.

4.7 Configuration

The configuration sub-menu enables the control system to be set up with the electrolyzer size, storage tank size, required fill levels, etc. Its appearance is:

CONFIGURE (↓↑ and ←)
 > Generator
 > Storage Tank
 > DC Analogs
 > Main menu

The normal navigation of the menu options applies. The main menu option enables the operator to return to the main menu. This can also be achieved by pressing the 'F4' function key.

4.7.1 Generator (Configuration)

The 'Generator' selection leads to a further sub-menu of options:

GENERATOR (↓↑ and ←)
 > Unit Size
 > Prime Time
 > Configure Menu
 > Main Menu

The 'Configure Menu' returns to that menu, while the 'Main Menu' returns to the main menu. The F4 key also returns the user back one level to the configuration menu.

4.7.2 Unit Size (Generator – Configuration)

When entering the 'Unit Size' option the following screen is displayed:

Unit Size = xx lb/d
 (← for list) BACK

The currently selected unit size is displayed. Pressing the 'enter' key changes the screen to show a selection list from which the required size can be selected, this screen looks is as follows:

>xx
 SELEC EXIT

The up and down cursor keys are used to scroll through the available selections (12, 24, 36 or 50). The SELEC key (F1) is pressed once the required selection is displayed. The EXIT key (F4) can be pressed at any time to exit the selection process without making a change.

Selection of system type presets several other configuration parameters: Prime Time, analog Current signal range, analog Voltage signal range, and Improper Voltage alarm analog set-points.

Once back to the 'Unit Size' screen, the F4 key can be pressed to return to the 'Generator' sub-menu.

4.7.3 Prime Time (Generator – Configuration)

This screen enables the prime time to be set. The screen layout is:

| |
|---------------------|
| Prime Time = xx min |
| INC DEC BACK |

NOTE: A default prime time is set when the system type is selected (refer to paragraph 4.7.2) and should not need adjustment under usual circumstances.

The current prime time is displayed and the user has the option to change it. Using the 'INC' and 'DEC' keys (F1 and F2) increments or decrements the value by one minute. A new value can also be keyed in. Values less than 3 or greater than 30 will be rejected.

F4 returns the operator back to the 'Generator' sub-menu.

4.7.4 Storage Tank (Configuration)

The 'Storage Tank' selection leads to a further sub-menu of options:

| |
|-----------------------|
| STORE TANK (↓↑ and ←) |
| > Set Levels |
| > Tank Parameters |
| > Configure Menu |
| > Main Menu |

The 'Configure Menu' option take the user back to that menu, while the 'Main Menu' option take the user right back to the main menu. The F4 key also returns the user back one level to the configuration menu.

4.7.4.1 Set Levels (Storage Tank – Configuration)

This sub-menu enables the various storage tank level set points to be set. The menu comprises:

SET LEVELS (↓↑ and ←)
> Low Alarm
> Start Fill
> Stop Fill
> High Alarm
> Storage Tank Menu
> Configure Menu
> Main Menu

The last three options take the user directly to those menus. The F4 key returns the user to the storage tank menu.

4.7.4.1.1 Low Alarm (Set Levels – Storage Tank – Configuration)

When this option is selected the following screen appears:

Low Alarm = x.x ft
INC DEC BACK

The current low alarm level is displayed and the user has the option to change it. Using the 'INC' and 'DEC' keys (F1 and F2) increments or decrements the value by one tenth of a foot. A new value can also be keyed in. Values less than 0.0 or greater than 2.0 will be rejected.

F4 returns the operator back to the 'Set Levels' sub-menu.

4.7.4.1.2 Start Fill (Set Levels – Storage Tank – Configuration)

When this option is selected the following screen appears:

Start fill = x.x ft
INC DEC BACK

The current start fill level is displayed and the user has the option to change it. Using the 'INC' and 'DEC' keys (F1 and F2) increments or decrements the value by one tenth of a foot. A new value can also be keyed in. Values less than 0.0 or greater than 10.0 will be rejected.

F4 returns the operator back to the 'Set Levels' sub-menu.

4.7.4.1.3 Stop Fill (Set Levels – Storage Tank – Configuration)

When this option is selected the following screen appears:

Stop fill = xx.x ft
INC DEC BACK

The current stop fill level is displayed and the user has the option to change it. Using the 'INC' and 'DEC' keys (F1 and F2) increments or decrements the value by one tenth of a foot. A new value can also be keyed in. Values less than 0.0 or greater than 20.0 will be rejected.

F4 returns the operator back to the 'Set Levels' sub-menu.

4.7.4.1.4 High Alarm (Set Levels – Storage Tank – Configuration)

When this option is selected the following screen appears:

High Alarm = xx.x ft
INC DEC BACK

The current high alarm level is displayed and the user has the option to change it. Using the 'INC' and 'DEC' keys (F1 and F2) increments or decrements the value by one tenth of a foot. A new value can also be keyed in. Values less than 0.0 or greater than 20.0 will be rejected.

F4 returns the operator back to the 'Set Levels' sub-menu.

4.7.4.2 Tank Parameters (Storage Tank – Configuration)

This sub-menu enables the various storage tank and level transducer parameters to be set. The menu comprises:

TANK PARA. (↓↑ and ←)
> Transducer Range
> Tank Input Zero
> Tank Diameter
> Overflow Switch
> Storage Tank Menu
> Configure Menu
> Main Menu

The last three options take the user directly to those menus. The F4 key returns the user to the storage tank menu.

4.7.4.2.1 Transducer Range (Tank Parameters – Storage Tank – Configuration)

The transducer range is the height of liquid that will product a 20mA output from the transducer. The screen layout is:

Transducer = xx ft
range BACK

The set range is shown. This may be changed by keying in a new value (the value should match the range of the transducer supplied). Values less than 2 or greater than 30 will be rejected

F4 returns the user to the tank parameters menu.

4.7.4.2.2 Tank Input Zero (Tank Parameters – Storage Tank – Configuration)

This enables the zero point of the level transducer input signal to be set or reset (to uncalibrated level). The screen appears as:

Storage tank zero.
SET RESET BACK

F1 – (SET) Press to set the current signal as the zero level signal.

F2 – (RESET) Press to reset the level signal zero point to default (4 mA).

F4 – (BACK) Press to return to the tank parameter menu.

4.7.4.2.3 Tank Diameter (Tank Parameters – Storage Tank – Configuration)

When this option is selected the following screen is displayed:

Tank = x.x ft
diameter BACK

The currently set tank diameter is shown. This may be change by keying in a new value. Values less than 0.0 or greater than 7.5 will be rejected

The tank diameter value is used to calculate the stored volume (based on level signal) for information only.

F4 returns the user to the tank parameters menu.

4.7.4.3 DC Analogs (Configuration)

The 'DC Analogs' selection leads to a further sub-menu of options:

```

DC ANALOG (↓↑ and ←)
> Current
> Voltage
> Analog Alarm
> Volt Alarm, LOW
> Volt Alarm, HIGH
> Configure Menu
> Main Menu
    
```

The 'Configure Menu' option takes the user back to that menu, while the 'Main Menu' option takes the user right back to the main menu. The F4 key also returns the user back one level to the configuration menu.

The current and voltage analog ranges are set to default values when the system type is selected. The following described screens allow user adjustment of ranges (generally not required or advised).

4.7.4.3.1 Current (DC Analog – Configuration)

This screen enables the analog signal that is proportional to the current being applied to the electrolyzer by the power supply to be ranged. This is the actual current at 20mA output. The screen layout is:

```

Amps at 20mA = xx A
INC  DEC  BACK
    
```

The current and voltage analog ranges are set to default values when the system type is selected (refer to paragraph 4.7.2).

This shows the current range of the analog input and enables it to be changed. Using the 'INC' and 'DEC' keys (F1 and F2) increments or decrements the value by one amp. A new value can also be keyed in. Values less than 10 or greater than 99 will be rejected.

F4 returns the user to the tank DC analog menu.

4.7.4.3.2 Voltage (DC Analog – Configuration)

This screen enables the analog signal that is proportional to the voltage being applied to the electrolyzer by the power supply to be ranged. This is the actual voltage at 20mA output. The screen layout is:

Volts at 20mA = xxxV

INC DEC BACK

The current and voltage analog ranges are set to default values when the system type is selected (refer to paragraph 4.7.2).

This shows the current range of the analog input and enables it to be changed. Using the 'INC' and 'DEC' keys (F1 and F2) increments or decrements the value by one volt. A new value can also be keyed in. Values less than 10 or greater than 200 will be rejected.

F4 returns the user to the tank DC analog menu.

4.7.4.3.3 Analog Alarm

The Improper Voltage alarm may be triggered based on either the analog (voltage indicating) input signal or a discrete alarm signal from an alarm module (in power supply). This menu allows the operator to enable or disable ("F1" to toggle) the analog-based alarm. If the discrete input is not used, it must be jumpered. If the analog input is used, the analog alarm must be enabled. The analog alarm points are preset when the system type is selected (refer to paragraph 4.7.2).

4.7.4.3.4 Volt Alarm, LOW

This screen permits adjustment of the low voltage alarm set-point.

The analog alarm points are preset when the system type is selected (refer to paragraph 4.7.2); adjustment is not normally required or advised.

4.7.4.3.5 Volt Alarm, HIGH

This screen permits adjustment of the high voltage alarm set-point.

The analog alarm points are preset when the system type is selected (refer to paragraph 4.7.2); adjustment is not normally required or advised.

4.7.5 Help

The 'help' selection leads to a further sub-menu of options:

HELP (↓↑ and ←)

> Alarms

> Display

> Status, Control

> Status, Level

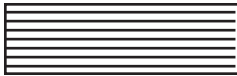
> Status, DC

> Config, Generator

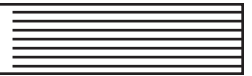
> Config, Tank

Selecting any of the options displays a help screen on the selected subject.

F4 returns the user to the tank main menu.



OSEC[®]-BP CONTROL PANEL



SECTION 5

SECTION 5 - ALARM SYSTEM

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5.1 Alarm Conditions

The following alarm conditions are monitored and displayed:

| ALARM | DERIVED FROM |
|-----------------------------|---------------------------------------|
| Low storage level | Storage tank level transmitter signal |
| High storage level | Storage tank level transmitter signal |
| Storage tank overflow | External switch (optional) |
| Low electrolyzer cell level | Level switch (electrolyzer) |
| High cell temperature | Temperature switch |
| Improper voltage | DC power supply |
| Rectifier failed | DC Power supply |
| Room ventilation fault | External running contact |
| Air flow fault | Air flow switch |
| Air flow switch failure | Air flow switch |
| Hydrogen leak | External contact |
| Emergency stop | External contact |
| Tank signal lost | Storage tank analog input |
| Voltage signal lost | DC power supply analog input |
| Current signal lost | DC power supply analog input |

When an alarm condition is detected an alarm message is displayed, the alarm is written to the alarm list (last 20 alarms) and the audible alarm output is turned on. Alarms can only be reset while the alarm message screen is displayed.

5.2 Low Storage Level

The low storage level is derived from an adjustable set point with respect to the storage tank level transmitter analog signal. The dosing pump enable relay is held energized while the level is above the set level.

If the level drops below the set level, then:

- The 'Low storage' alarm message is generated.
- The general alarm relay is de-energized.
- The dosing pump enable relay is de-energized.

5.3 High Storage Level

The high storage level alarm is derived from an adjustable set point with respect to the storage tank level transmitter analog signal.

If the level rises above the set level, then:

- The 'High storage' alarm message is generated.

- The general alarm relay is de-energized.
- The DC power supply is turned off.
- The brine feed is stopped.
- The room ventilation and storage tank blower remain on for a minimum of 15 minutes.

5.4 Overflow

The overflow alarm is optional and has to be turned on in the configuration menu if an overflow switch is fitted. This switch is fitted to the discharge point of the storage tank overflow pipework. The contact should be closed in the healthy state.

If an overflow is detected (contact opens), then:

- The 'Storage overflow' alarm message is generated.
- The general alarm relay is de-energized.
- The DC power supply is turned off.
- The brine feed is stopped.
- The room ventilation and storage tank blower remain on for a minimum of 15 minutes.

5.5 Low Electrolyte Level

A level switch on the electrolyzer cell is used to detect when the electrolyte level in the cell is correct, this opens at low level. When the system begins a batch cycle in AUTO mode, it has 30 seconds to close the switch. Once the level switch has closed there is also a 10-second transient time if the switch opens before any action is taken. If the cell fails to fill or the transient time is exceeded, then:

- The 'Low cell level' alarm message is generated.
- The general alarm relay is de-energized.
- The DC power supply is turned off.
- The brine feed is stopped.
- The room ventilation and storage tank blower remain on for a minimum of 15 minutes.

5.6 High Cell Temperature

This alarm is derived from the electrolyzer mounted temperature switch, which opens under the high temperature condition. There is a 10 second transient time to take care of any fluctuations in the flow.

If this alarm condition is detected, then:

- The 'High cell temp' alarm message is generated.
- The general alarm relay is de-energized.
- The DC power supply is turned off.
- The brine feed is stopped.
- The room ventilation and storage tank blower remain on for a minimum of 15 minutes.

5.7 Improper Voltage

This alarm may be derived from either a contact or the analog voltage indicating signal from within the DC power supply. The alarm is inhibited when the rectifier is off, and for 120 seconds after the rectifier is turned on.

If this alarm condition is detected, then:

- The 'Improper voltage' alarm message is generated.
- The general alarm relay is de-energized.
- The DC power supply is turned off.
- The brine feed remains running for the set prime period.
- The room ventilation and storage tank blower remain on for a minimum of 15 minutes.

5.8 Rectifier Failed

If the DC power supply running contact does not close within 10 seconds of the rectifier being asked to run or opens while the system is running, then:

- The 'DC Supply Fault' alarm message is generated.
- The general alarm relay is de-energized.
- The DC power supply is turned off.

- The brine feed remains running for the set prime period.
- The room ventilation and storage tank blower remain on for a minimum of 15 minutes.

5.9 Room Ventilation Fault

The room ventilation running contact is monitored for correct operation; this can be either a running contact off of the room ventilation fan or an air flow switch. In either case when the room ventilation run signal is issued this contact must close within 60 seconds. There is also a 10 second transient time to take care of any fluctuations in the flow.

If this alarm condition is detected, then:

- The 'Room vent fault' alarm message is generated.
- The general alarm relay is de-energized.
- The DC power supply is turned off.
- The brine feed remains running for the set prime period.
- The room ventilation and storage tank blower remain on for a minimum of 15 minutes.

5.10 Air Flow Fault

An air-flow switch mounted in the storage tank blower ductwork is used to monitor whether there is airflow or not, this switch is open under the no-flow condition. The alarm is inhibited when the blower is off, and for 60 seconds after the blower is started. There is also a 10 second transient time to take care of any fluctuations in the flow.

If this alarm condition is detected, then:

- The 'Air flow fault' alarm message is generated.
- The general alarm relay is de-energized.
- The DC power supply is turned off.
- The brine feed remains running for the set prime period.
- The room ventilation and storage tank blower remain on for a minimum of 15 minutes.

When the blower is stopped the air-flow switch is checked to see that it returns to the open, no-flow condition. If the switch is not open after 120 seconds, then:

- The 'Air switch fault' alarm message is generated.
- The general alarm relay is de-energized.

5.11 Hydrogen Leak

If an external contact for a hydrogen leak is used, this should be closed when healthy. This contact forms part of a hard-wired shutdown circuit to stop the room ventilation, DC power supply, brine feed and storage tank blower.

If this contact opens, then:

- The 'Hydrogen leak' alarm message is generated.
- The general alarm relay is de-energized.

If the system is running, then everything is stopped.

5.12 Emergency Stop

An external contact from an emergency stop push button is monitored; this should be closed when healthy. This contact forms part of a hard-wired shutdown circuit to stop the room ventilation, DC power supply, brine feed, and storage tank blower.

If this contact opens, then:

- The 'Emergency stop' alarm message is generated.
- The general alarm relay is de-energized.

If the system is running, then:

Everything is stopped.

5.13 Storage Tank Level Signal Lost

If the input from the storage tank level transmitter analog signal should fall below 2mA, then:

- The 'Tank Signal Lost' alarm message is generated.
- The general alarm relay is de-energized.

If the electrolyzer is running, then:

- The DC power supply is turned off.
- The brine feed remains running for the set prime period.
- The room ventilation and storage tank blower remain on for a minimum of 15 minutes.

5.14 Voltage Signal Lost

If the input from the DC power supply analog signal for voltage should fall below 2mA, then:

- The 'Volts Signal Lost' alarm message is generated.
- The general alarm relay is de-energized.

5.15 Current Signal Lost

If the input from the DC power supply analog signal for current should fall below 2mA, then:

- The 'Amps Signal Lost' alarm message is generated.
- The general alarm relay is de-energized.

5.16 Pre-Start System Checks

When the level in the storage tank reaches the start level and providing the control switch is in the auto position, a systems check is performed before the electrolyzer is allowed to start. This checks that certain input conditions are in the expected state. If they are not, an appropriate error message is generated and the electrolyzer is prevented from starting.

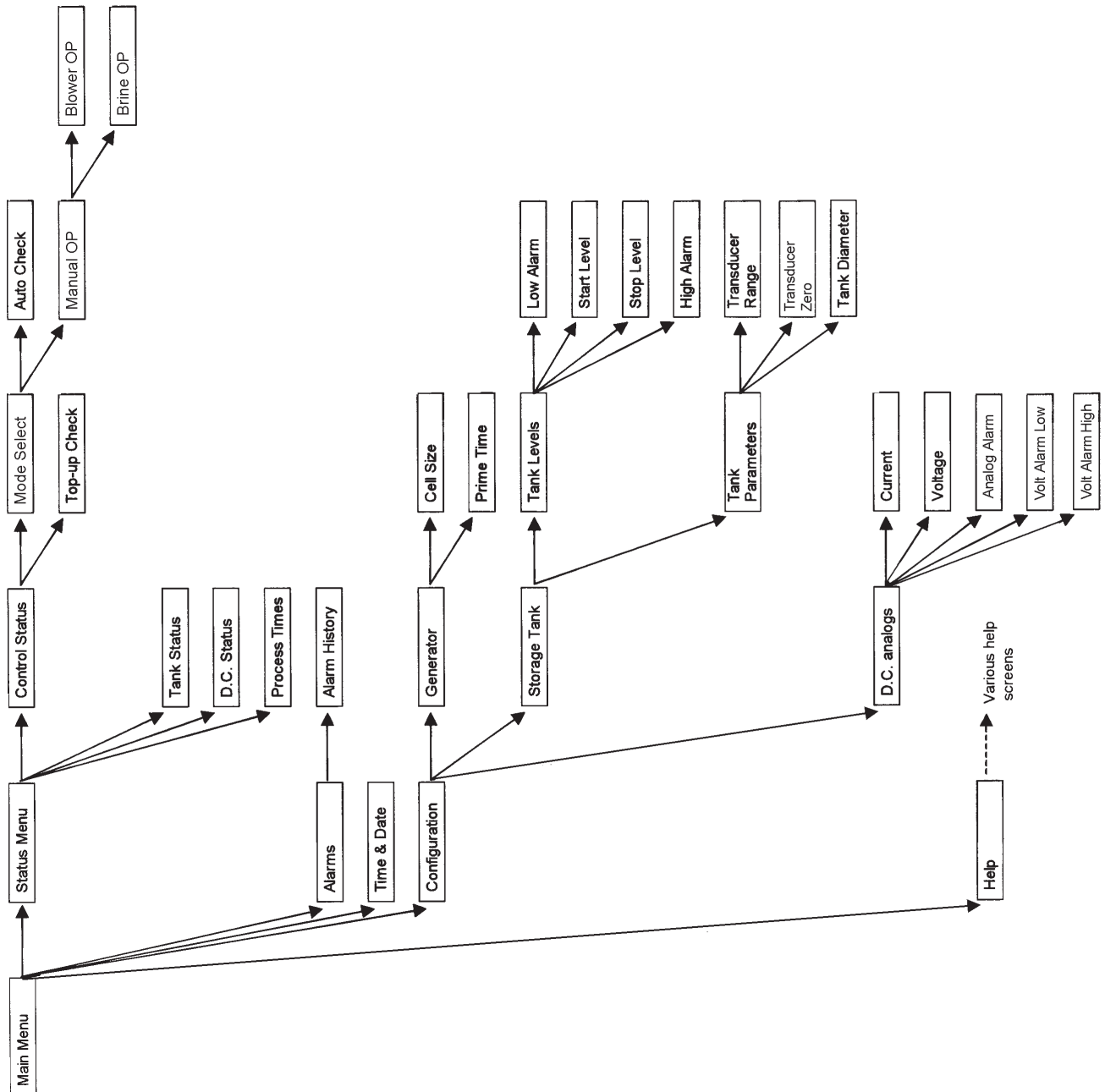
The following checks are made:

- Air flow switch open (unless the blower is still running).
- Rectifier running contact open.

5.17 Audible Alarm Output

A dry contact is available to drive an external audible alarm. This is turned on when an alarm is detected. It can be turned off by pressing the 'ACK' (acknowledge) key on the alarm screen. It will turn off automatically after 10 minutes if not acknowledged.

Appendix A – OIT Menu Structure



Appendix B – Parameter Ranges & Defaults

| <u>Parameter</u> | <u>Minimum Value</u> | <u>Maximum Value</u> | <u>Units</u> | <u>Default</u> |
|----------------------|----------------------|----------------------|--------------|----------------|
| Electrolyzer size | 12, 24, 36, or 50 | | lb/day | 12* |
| Prime Time | 3 | 30 | minutes | 3* |
| Low Alarm Level | 0.1 | 2.0 | feet | 0.5 |
| Start Fill Level | 0.1 | 10.0 | feet | 1.0 |
| Stop Fill Level | 0.1 | 20.0 | feet | 2.0 |
| High Alarm Level | 0.1 | 20.0 | feet | 3.0 |
| Transducer Range | 2 | 30 | feet | 25 |
| Tank Diameter | 1.0 | 7.5 | feet | 4.0 |
| Current Analog Range | 10 | 99 | amps | 40* |
| Voltage Analog Range | 10 | 200 | volts | 50* |
| Analog Alarm | Enabled/Disabled | | | Disabled |

Values may be entered at the resolution shown.

*Default values are set when electrolyzer size is selected and may be modified thereafter.