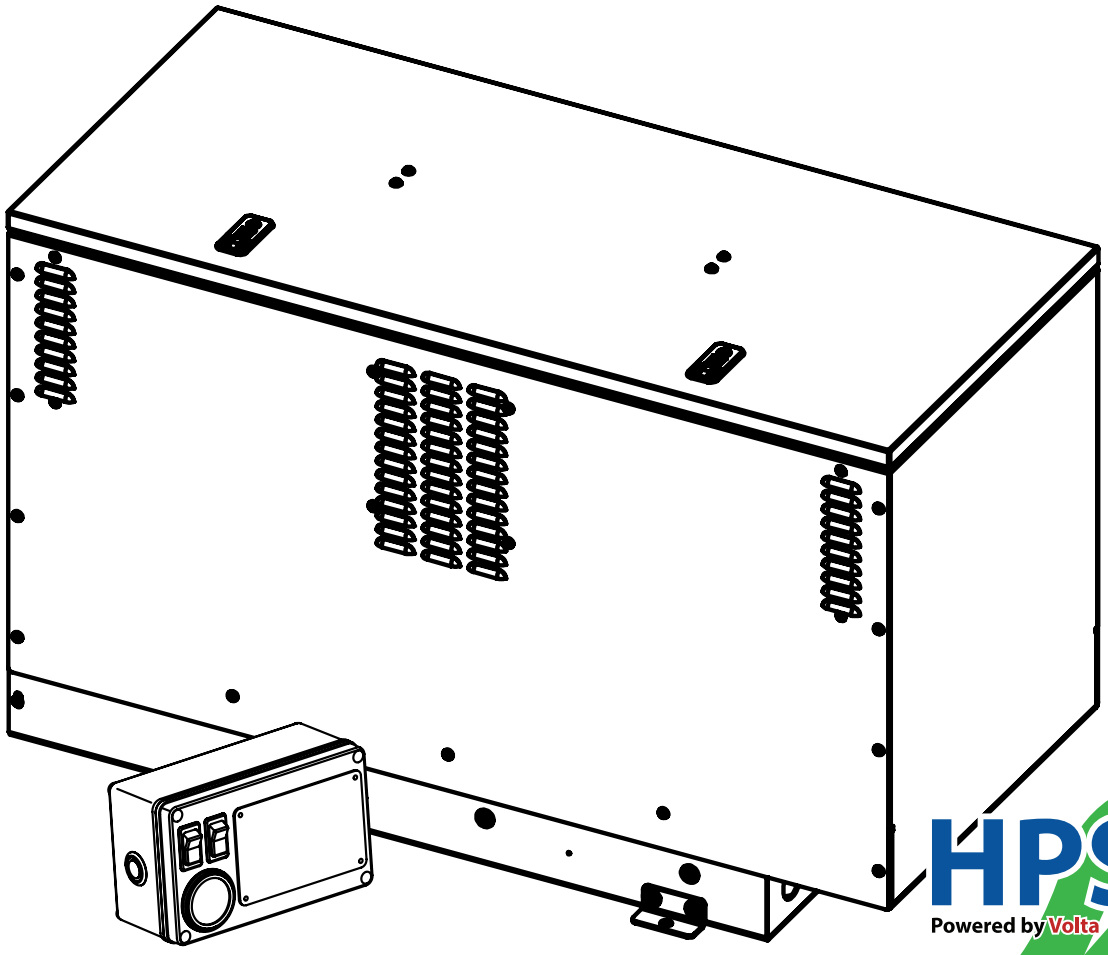
Model HPS
Hybrid Power Source
Owner's Manual

Operation • Maintenance • Assembly & Schematics • Replacement Parts



HPS
Powered by Volta
HYBRID POWER SOURCE

Stellar Industries, Inc
740 North State Street
PO Box 169
Garner, IA 50438
800-392-3015
www.stellarindustries.com

PN 114060

P65 Warning / Serial Tag / Warranty

⚠ WARNING

Operating, maintaining, and servicing a Stellar product may expose you to chemicals including, but not limited to, engine exhaust, carbon monoxide, phthalates, and lead. These chemicals are known to the State of California to cause cancer and birth defects (or other reproductive harm). To keep your exposure to a minimum, be sure to avoid breathing exhaust and service your Stellar product in a well-ventilated area while wearing gloves or washing your hands frequently. For more information, go to www.P65Warnings.ca.gov/passenger-vehicle.

www.p65warnings.ca.gov

NOTICE

Cold Weather Performance

Although clear data on cold weather performance from every steel manufacturer is not available for all types and thicknesses of steel, Stellar Industries is confident that the weldments on our products will operate to 100% of their intended purpose to temperatures down to -40° F / C.

It is recommended it Stellar manufactured equipment needs to be used in temperatures below -40° F / C, the operator should pull the unit into a climate-controlled area and allow the weldments to warm up to and then maintain a temperature above this level.

Record Serial Number

STELLAR®

MODEL

SERIAL NO.

DATE

PATENT / IP INFORMATION:
www.stellarindustries.com/ip

MADE IN THE USA
by the Employee Owners of Stellar Industries PN 112060

For Technical Questions, Information, Parts, or Warranty, Call Toll-Free at

800-321-3741

Hours: Monday - Friday, 8:00 a.m. - 5:00 p.m. CST

Or email at the following addresses:

Technical Questions, and Information:	service@stellarindustries.com
Order Parts:	parts@stellarindustries.com
Warranty Information:	warranty@stellarindustries.com

Table of Contents

Introduction

Stellar Industries® power sources are designed to provide safe and dependable service for a variety of operations. With proper use and maintenance, these power sources will operate at peak performance for many years.

To promote this longevity, carefully study the information contained in this manual before putting the equipment into service. Though it is not intended to be a training manual for beginners, this manual should provide solid guidelines for the safe and proper usage of the power source.

Once you feel comfortable with the material contained in this manual, strive to exercise your knowledge as you safely operate and maintain the power source. This process is vital to the proper use of the unit.

A few notes on this manual:
A copy of this manual is provided with every power source and can be found in the hard plastic manual case that is installed on the chassis. A copy of this manual shall remain with the power source at all times.

Throughout the manual, three signal words will be used to bring attention to important items:

NOTICE A NOTICE signal word indicates a practice not related to physical injury.

⚠WARNING A WARNING signal word indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ DANGER A DANGER signal word indicates a hazardous situation which, if not avoided, will result in death or serious injury.

Information contained within this manual does not cover all maintenance, operating, or repair instructions pertinent to all possible situations. Please be aware that some sections of this manual contain information pertaining to Stellar Industries® manufactured power sources in general and may or may not apply to your specific model.

This manual is not binding. Stellar Industries reserves the right to change, at any time, any or all of the items, components, and parts deemed necessary for product improvement or commercial/production purposes. This right is kept with no requirement or obligation for immediate mandatory updating of this manual.

In closing:
If more information is required or technical assistance is needed, or if you feel that any part of this manual is unclear or incorrect, please contact the Stellar Industries Customer Service Department by phone at 800-341-3741 or email at service@stellarindustries.com.

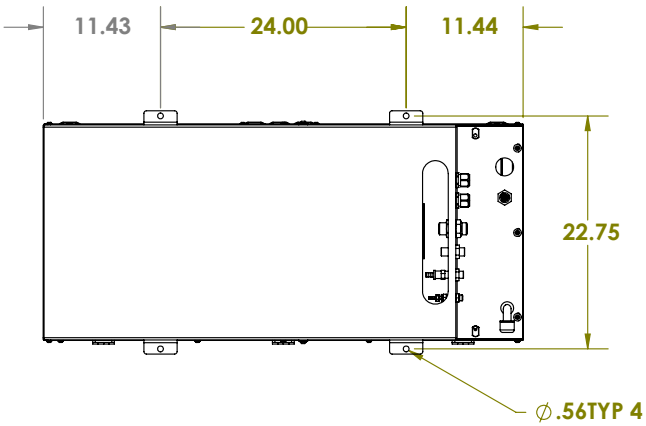
NOTICE

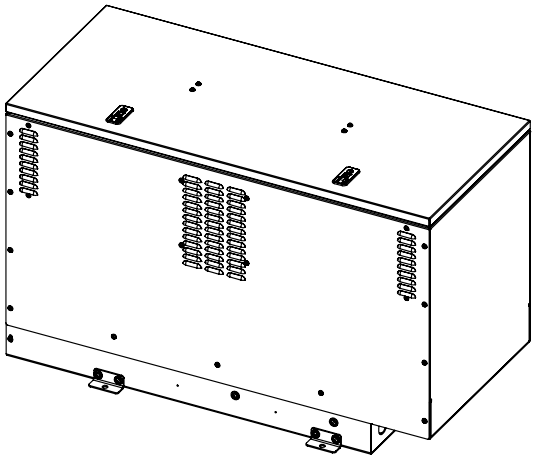
RECYCLING OF USED STORAGE PACKS

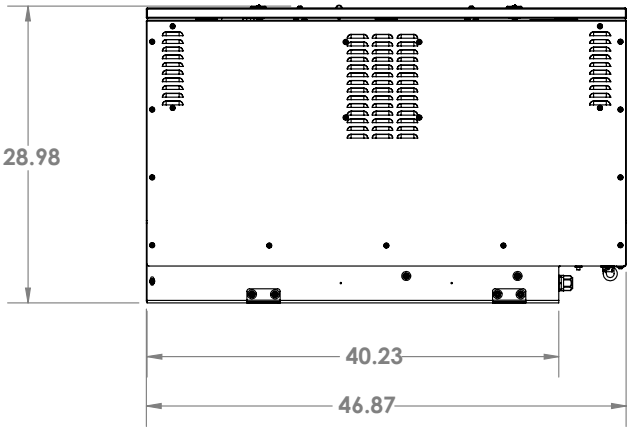
End of Life (EOL) lithium ion battery systems must be properly recycled. Do not landfill. Follow local regulations when recycling EOL and damaged lithium ion battery systems or contact Stellar Industries Customer Service Department.

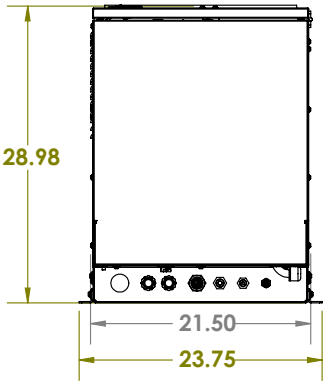
Chapter 1 - Specifications

Main Unit Dimensions









SYSTEM SPECIFICATIONS	
Output Capacity	13.5kWh
Hydraulic Output	12 GPM - Up to 3000 PSI
Hydraulic Reservoir	10 Gallon (integrated)
Dry Weight	790 lbs.
Dimensions (Length)	47.0"
Dimensions (Width)	21.0”
Dimensions (Height)	28.0”
Recharging	110V Shore Power
	48V Chassis Alternator
AC Power Output	120V 3600W (pure sine)
Recharge Time	Shore Power: 9 Hours (100%)
	Chassis: 3 Hours (85%)
Run Time	8 Hours (Based on 1330 Watt Hours of Demand)
Cold Weather	Integrated 200W Heater Pad

Table 01: HPS System Specifications

Miscellaneous Information

Energy Storage Pack Limits

The energy storage pack's lifetime is impacted in certain environmental conditions. It is not recommend to operate the system at, or beyond, limit levels. Table 02 indicates values that are typically associated with HPS systems. Actual values may vary based on application.

Condition	
Maximum Pack Voltage (100% SOC)	58.5V*
Nominal Pack Voltage (50% SOC)	51.5V*
Pack Shutdown Voltage (10% SOC)	48.6V*
High Temp Shutdown	133ºF – 140ºF* (56ºC – 60ºC*)
High Temp Max Storage	113ºF* (45ºC*)
High Temp Max Operating	131ºF* (55ºC*)
Heater OFF Threshold	~68ºF** (~20ºC)
Pack Temp Operating Range (Charge)	41ºF – 113ºF (5ºC -- 45ºC)
Pack Temp Operating Range (Discharge)	-4ºF – 131ºF (-20ºC -- +55ºC)
Heater ON Threshold	59ºF** (15ºC)
Low Temp Shutdown	32ºF* (0ºC*)
Low Temp Min Storage	28ºF* (-2ºC*)

Table 02: Example HPS Energy Storage Pack Specifications

*Limits can vary by system and application. System specific ranges can be obtained by contacting your Stellar Industries representative. All HPS levels assume a 30º C ambient temperature.

Abbreviations and Definitions

AC - Alternating Current (also VAC)
AW - Anti-Wear
BMU - Battery Management Unit located inside an energy storage pack.
BOL - Beginning of Life, meaning when the product is new and unused.
CC - Constant Current
CV - Constant Voltage
DC - Direct Current (also VDC)
EOL - End of Life (meaning the point at which the End User determines the product no longer meets their needs or requirements)
HPS - Hybrid Power Source
IGN - Ignition
OCV - Open-Circuit Voltage is measured across the pack with no load attached.
SOC - State of Charge indicates a percent of total pack charge.
STP - Standard Temperature Pressure
V - Volts (Voltage)
VI - Viscosity Index
W - Watts (Wattage)

Chapter 2 - Operation

Component Information

⚠ WARNING

- HPS power distribution devices, or systems, should not be disassembled or serviced by anyone other than a qualified technician.
- Components and devices inside the HPS unit or other points in the system should not be opened or modified. Only qualified approved technician should perform service work on an HPS system.
- In the event of a cell venting, hot and potentially harmful materials may be expelled from the pack.

Under the Hood

58V Alternator and Specialty Belt - Installation of an HPS System requires the use of a custom high output alternator in addition to the factory alternator(s). This alternator and its specialized engine drive belt are specific to this installation and cannot commonly be found at a parts store. Contact Stellar Industries Customer Support for replacement belts.

In the Cab

HPS System Control - (Figure 01) The control panel for the HPS System gives the operator information about the unit and is the interface for turning the system ON and OFF.

110V Power Outlet (Pure Sine) - (Figure 01) Your HPS System installation may have a 110V outlet mounted in your cab. The outlet is only powered if the System Enable button is depressed on HPS System Control box (Figure 04).

Figure 01: Cab-mounted HPS System Components

Component Information

Inside the HPS Unit Cabinet

Access the internal components of the HPS unit by depressing the buttons on the two latches and raise the lid. Always lower the lid when finished inspecting components inside the cabinet. Do not operate the HPS system with the lid in the OPEN position. The latches are lockable and keys have been included in the cab.

Energy Storage Pack - (Figure 02) The energy storage pack acts much like a large, long lasting battery.

DC/DC Converter - (Figure 02) The 58V supply from the energy storage pack is converted to 12V to run the system electronics of the vehicle.

110V Inverter/Charger - (Figure 02) The inverter also supplies 110V output for use at the various power outlet ports.

Relay Box - (Figure 03) The Relay Box contains various components inside it, but its primary function is monitoring the output of the 58V alternator. See page 27 for more information about the relay box and its LED fault indicator.

Hydraulic Reservoir and Power Units - (Figure 02) The dual power units and hydraulic reservoir act together like a traditional PTO system with out the need to be running an engine.

Power Distribution Panel - (Figure 02) Fuses on the power distribution panel are accessible after you remove the cover. Before you remove the panel to inspect or replace fuses, turn off the HPS system with the control panel in the cab and disable the energy storage pack by turning off and removing the Master Circuit Key.

Air Intake Filter/Fan - (Figure 02) To keep the sensitive components in the unit clean and cool, a fresh air filtered intake fan provides the compartment pressurized with cool air. See figures 11 and 13 about the fan, filter, and its quick connect harness connection.

Master Circuit Key - (Figure 02) The energy storage pack in your HPS unit is equipped with a turn key used to disable the output of the pack. It can be used for lockout purposes during maintenance procedures. Unless removed for the need to disable the energy pack, the key should remain installed in the ON position. For more information about the Master Circuit Key, see Figure 15.

Component Information

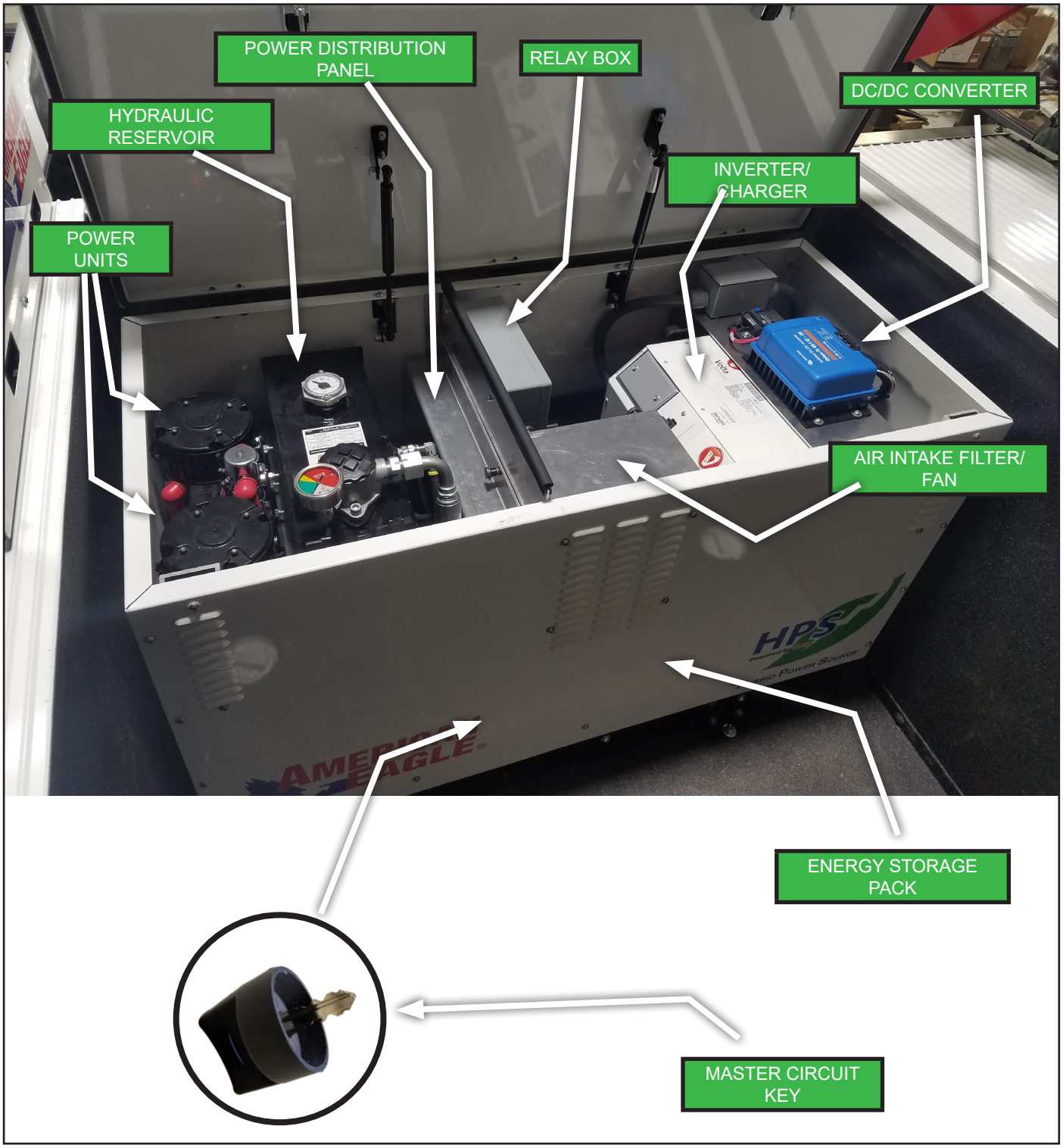


Figure 02: HPS Cabinet Components

Component Information

On the Truck Body

Shore Power Connection - (Figure 03) See pages 10 & 17 for more information about shore power charging.

110V Power Outlet (Pure Sine) - Your HPS System installation may have one or more 110V outlets mounted throughout your vehicle. The outlets are only powered if the System Enable button is depressed on HPS System Control box (Figure 04).

Figure 03: Body-mounted HPS System Components - Shore Power Connection

Energy Pack Safety Recommendations

1. Misusing an HPS energy storage pack may cause it to overheat or ignite and cause serious injury. Make sure to follow the safety rules listed below:

    - Never short-circuit the power terminals of an energy storage pack
    - Do not reverse the polarity, or mix positive and negative connections, of the energy storage pack system or connected devices
    - Do not overcharge, or over-discharge, the energy storage pack system
    - Do not disassemble the energy storage pack system
    - Do not submerge the energy storage pack system
    - Do not incinerate the energy storage pack system
    - Do not use the energy storage pack without its Battery Management Unit (BMU) fully functional
    - Do not subject the energy storage pack to excessive mechanical stresses (vibration, dropping, crushing, etc.)
    - Do use the energy storage pack only in accordance with the guidelines set forth in this manual
    - Do operate the energy storage pack only within the recommended limits for temperature, voltage, current, SOC, and other environmental conditions

2. Do not operate the HPS system if the energy storage pack exhibits soot, scorching, or other evidence of thermal excursion.
3. Do not place the energy storage pack on, in, or near fires, or other high-temperature locations (>140°F [>60°C]). This includes intensive sunlight. Doing so may cause the energy storage pack to overheat and may result in a loss of performance and/or a shortened life expectancy.
4. Do not obstruct the vent port located on the end of the energy storage pack housing during use or periods of storage. The vent is designed to prevent condensation from forming within the pack.

Operating HPS System

Turning On HPS Unit

1. Place truck transmission in PARK.
2. Turn ignition key to OFF position.
3. Disconnect shore power charging cord from truck chassis.
4. Verify the Master Circuit Key is inserted into the Energy Pack and turned clockwise to the ON position. See pages 4 & 25 for more information about the Master Circuit Key.
5. Press and release the round “System Enable” push button on the side of the HPS Control box in the cab. The button will illuminate GREEN and the SOC gauge will light up and the dial will indicate the percentage level of charge. The inverter display will turn on and indicate battery voltage and status. At this point the AC outlets on the truck will be powered by the HPS system.

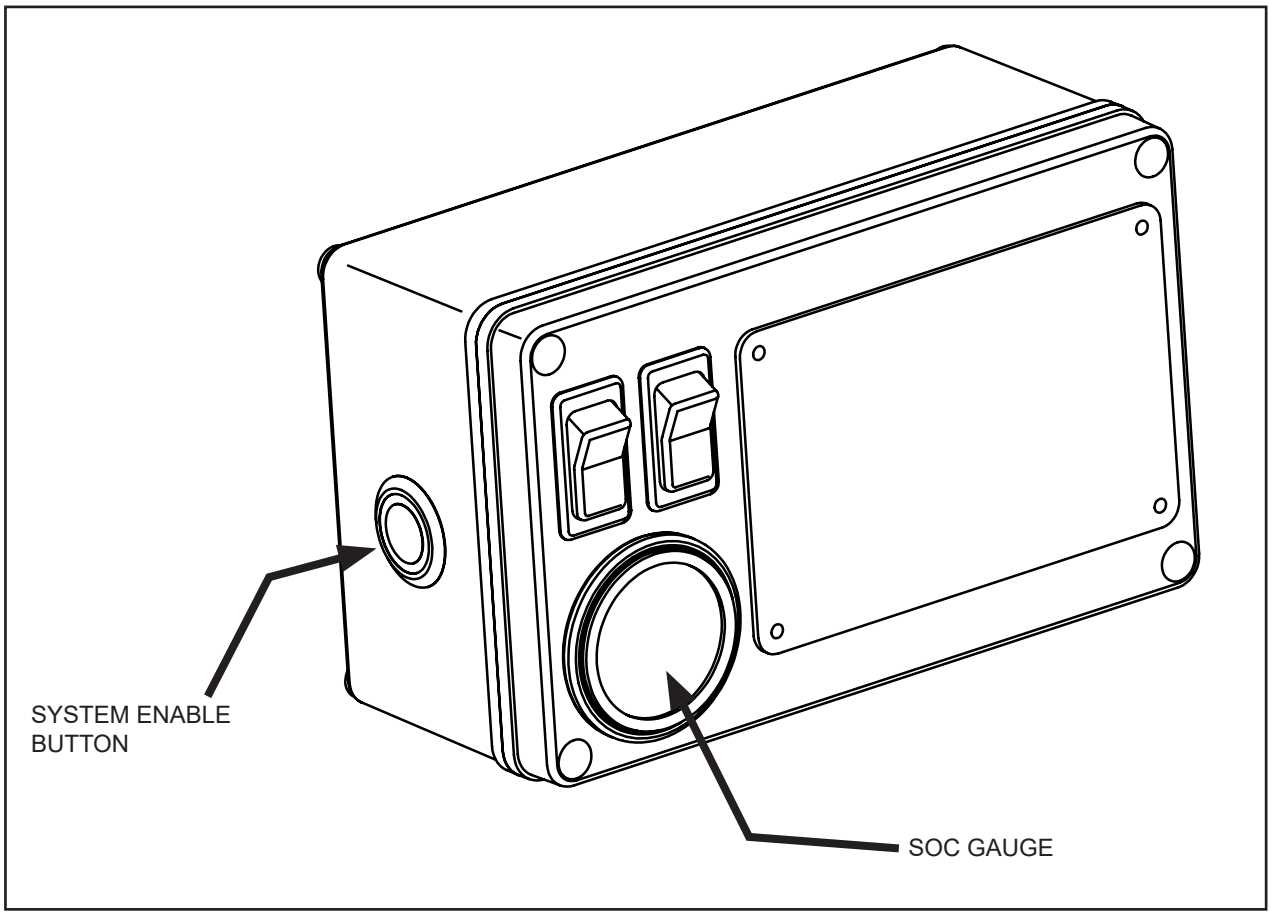


Figure 04: HPS Control Panel - System Enable Button & SOC Gauge

Operating HPS System

Activating HPS-Powered Accessories

1. Ensure the truck is in a key OFF state, and depress the parking brake.
2. Verify the HPS is ON by following the process in “Turning On HPS Unit”.
3. On the front of the HPS Control box, toggle the “Main Power” switch to the ON position. It will illuminate GREEN.
4. Wait 5 seconds for system to initialize.
5. The compressor and lights can be activated by controls on the E-Link™ panel in the cab or the PDM switch panel in the crane compartment. Refer to Remote Control operation instruction in your Crane Operation Manual.

NOTICE

Since the Main Power switch on the HPS Control Panel acts like a “PTO” switch, the PTO switch is no longer selectable on the E-Link™ control panel or PDM switch panel.

6. For hydraulically-powered accessories, the system will start with one Power Unit running. To increase hydraulic flow, press up and hold the Speed Control switch on the crane remote until the second Power Unit activates. Press up and hold the Speed Control switch again to deactivate second Power Unit.
7. To operate the stabilizers, first activate the Stabilizer Power switch in the crane compartment. Operate the stabilizers as normal, then return the Stabilizer Power switch to the OFF position.
8. The crane can be operated as normal with the crane remote.
9. Deactivate each accessory with the E-Link™ control panel or PDM switches. To deactivate the Power Unit(s), toggle the “Main Power” switch to the OFF position.
10. Press and release the round “System Enable” button on the side of the HPS Control box. The system will go through a shutdown process that will take several seconds. The SOC gauge and System Enable button will de-luminate.

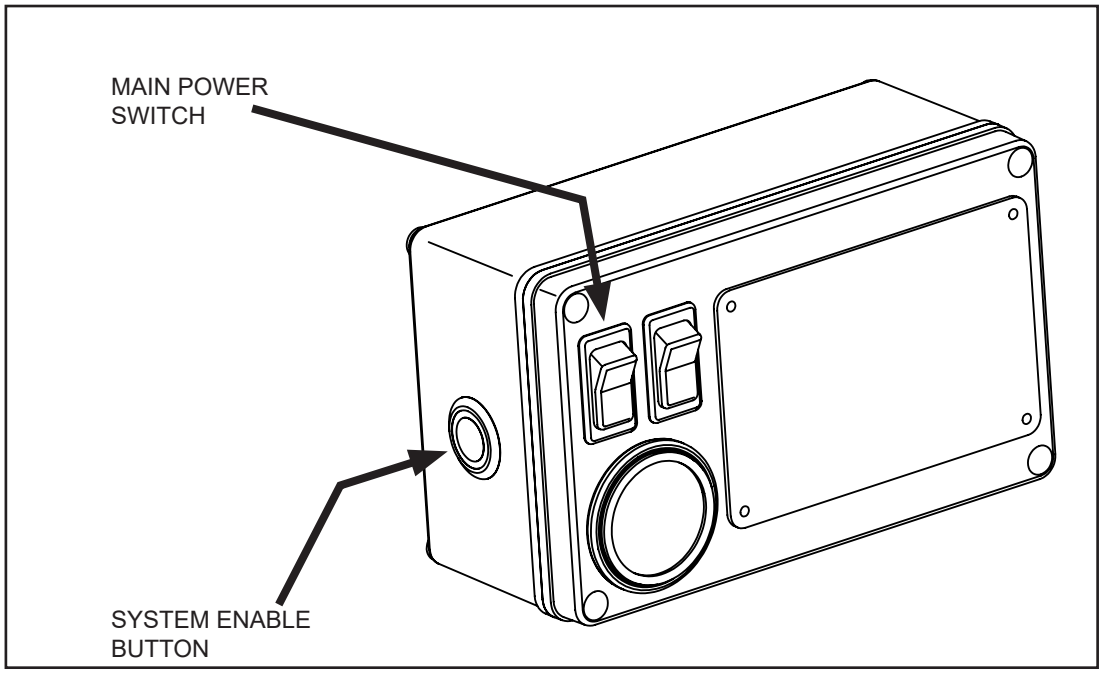


Figure 05: HPS Control Panel - System Enable Button & Main Power Switch

Charging Energy Pack

Shore Power Charging

1. Place the HPS into an OFF state by making sure the System Enable button is not depressed or illuminated.
2. Plug a properly rated AC line cord into the Shore Power charging port on the truck body located on the driver's side behind the cab. Plug the other end of the cord into an outlet rated for 15 Amps circuit branch current. No other appliance should be plugged into this AC branch or it may overload the circuit and blow circuit breaker or panel fuse, or cause the system to charge slower.
3. The System Enable button will illuminate and the SOC gauge will come on (illuminate and needle will show Percentage of charge)
4. If the Inverter Display is not illuminated, press the INFO button. The bottom line of the display will show battery voltage and charging current.
5. Once the HPS has fully charged, approximately 8 hrs from empty, remove the AC line cord from the AC outlet and then remove from the Shore power charging port on the truck body. SOC needle should be close to 100 and display current 0A.
6. The HPS system will go into shut down mode and turn off after a few seconds if System Enable button is not depressed, If System Enable button is depressed the HPS system will stay active.

NOTICE

Also see Page 17 for additional information about charging options.

Figure 06: Shore Power Connection

Charging Energy Pack

Chassis Charging

1. Enable the HPS by following the steps in “Turning On HPS Unit” section in this manual.
2. Make sure the truck is in Park and parking brake is engaged. Turn on ignition, starting the truck.
3. Select either HI or LO on the Charge Rate toggle switch on the HPS Control Box to open the charging circuit and control engine idle speed.
   Hi - High engine idle (increased charging rate)
   OFF - No Charging (zero charging rate)
   LO - Low engine idle (regular charging rate)
4. The engine idle speed will change based on the selection of the switch, and the HPS unit will start accepting charge from the chassis alternator.
5. When the SOC Gauge needle is indicating 100, the HPS battery is fully charged.
6. Return the Charge Rate switch back to the OFF position.
7. Turn off the ignition to the truck.

NOTICE

The energy storage pack will automatically charge while the truck is driving down the road. During roadway charging, you do not have to activate the Charge Rate Switch. See also Page 17 for additional information about charging options.

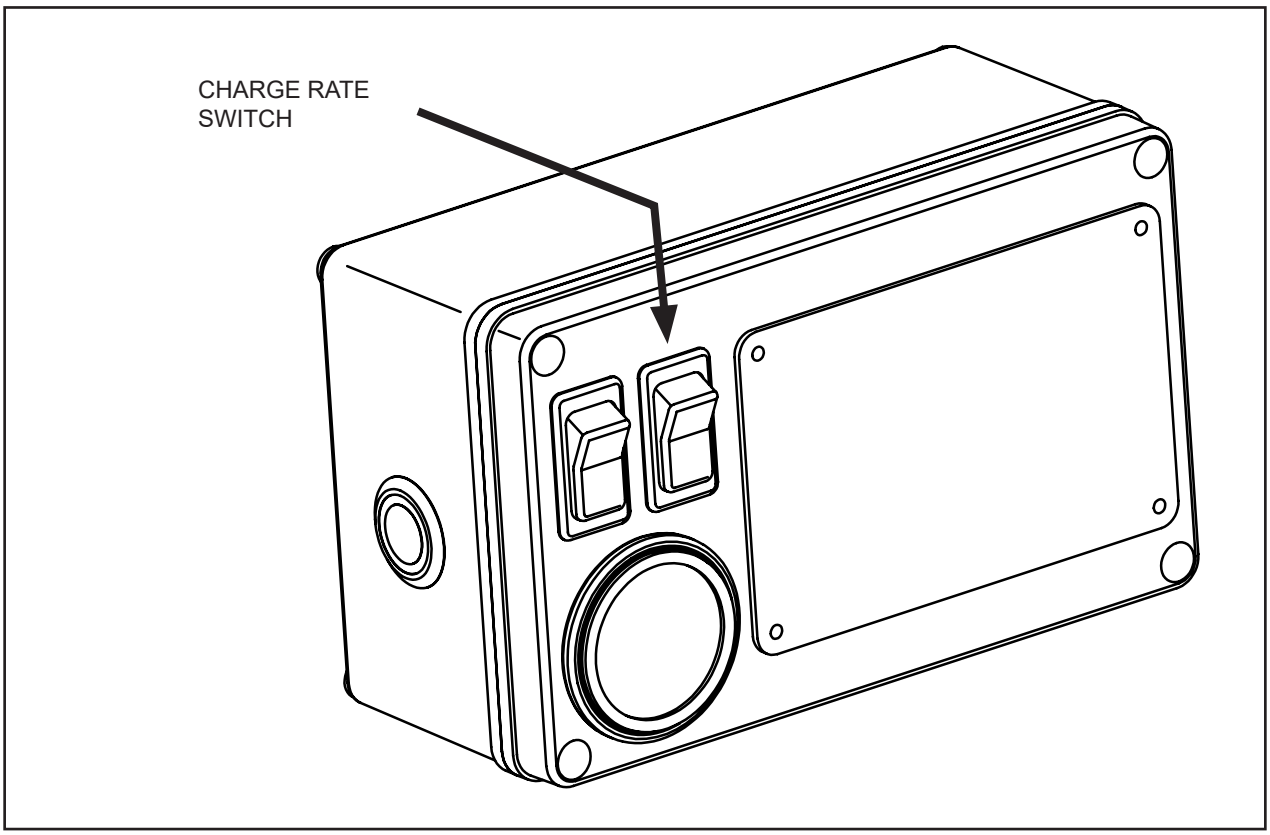


Figure 07: HPS Control Panel - Charge Rate Switch

Status of Charge Gauge

SOC GAUGE

The SOC gauge (Figure 08) is used to display the State of Charge (SOC) for the pack. The following color and blink codes can be used as general ranges displayed by the gauge (Table 03).

Figure 08: SOC gauge when in OFF state

HPS system State	Backlight color	SOC
Waiting for Data	Slow BLUE Blink	10-95%
Normal Operation	Solid GREEN	21-95%
Low SOC	Solid YELLOW	10-20%
Very Low SOC	Solid RED	<10%
Pack EMPTY	6x Fast RED Blink	10-95%
FAULT	Slow RED Blink	10-95%
Too HOT to Charge	YELLOW 5 Seconds	10-95%
Too COLD to Charge	BLUE 5 Seconds	10-95%

Table 03: SOC gauge color and blink codes*

HPS Control Display

Display Overview

A remote display that interfaces with the inverter/charger via an RJ45 connector is mounted on the control panel located in the truck cab. The display has a small LCD screen for displaying messages, settings, and faults along with 3 buttons to interface with the system (Figure 09). For help with troubleshooting error messages see pages 30 & 31.

Figure 09: HPS Control Panel - Energy Pack Display

⚠ WARNING

Do not remove display cover. There are no user-serviceable parts inside the display.

Display Specifications

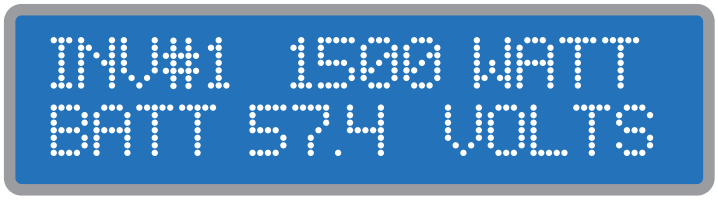
Display	141541
Input Voltage (VDC)	40V -- 60V
Operating Temperature	-20ºC -- +65ºC (0ºF -- 149ºF)

Table 04: Voltage and temperature specifications for the display

*Exact display may appear different in your system depending on which revision of features and firmware is equipped.

Display Message for Inverting

TURNING THE INVERTER “ON” OR “OFF” (NO AC APPLIED)



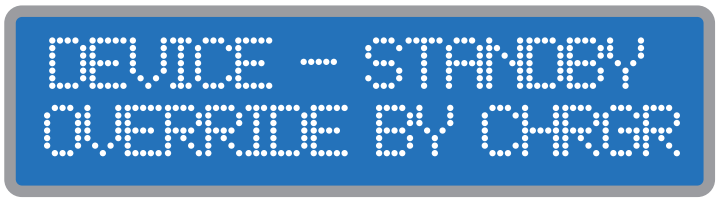
Simply press the [ON/OFF] button and the inverter will turn on. Press the [ON/OFF] button again to turn the inverter off. This message shows that the inverter is on, the load is consuming 1500 watts of power, and that the battery voltage is currently at 57.4 V.

HPS Control Display

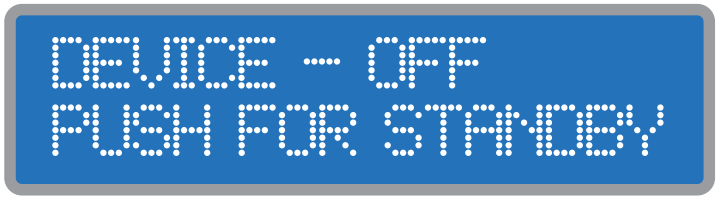
Display Overview, cont.

INVERTER “STANDBY”

The inverter standby feature allows the inverter to automatically come on anytime that it senses a loss of shore power. It returns to standby when shore power is restored. It takes 30 seconds for the inverter/charger to qualify the AC power once the AC power has been applied to the inverter/charger AC input. When shore power is applied, pressing the [ON/OFF] button will toggle the inverter between Standby mode and Off mode.

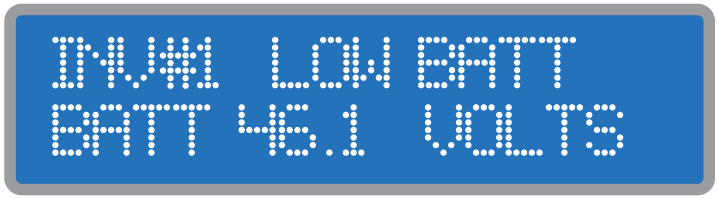


This message is stating that the inverter is in standby and the charger is running. If AC power is removed, the inverter will automatically turn on. This message will show for 15 seconds before reverting to the charger status.

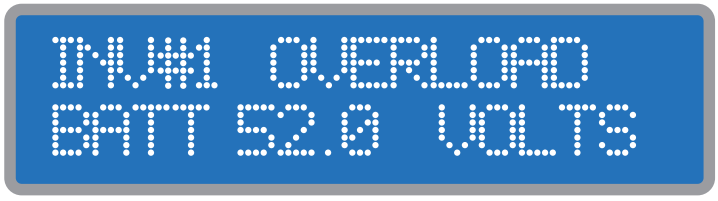


This message is stating that inverter mode will not be enabled if AC power is removed. To change this, press the [ON/OFF] button.

OTHER INVERTER MESSAGES



Low battery condition due to start surge or undersized battery cable gauge. If this condition remains for more than 5 seconds the inverter will shut down.



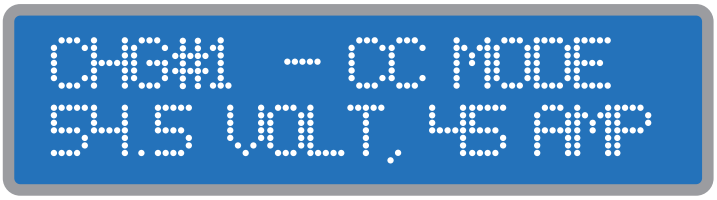
Overload condition due to excessive loads or short circuit. If this condition remains for more than 5 seconds the inverter will shut down.

HPS Control Display

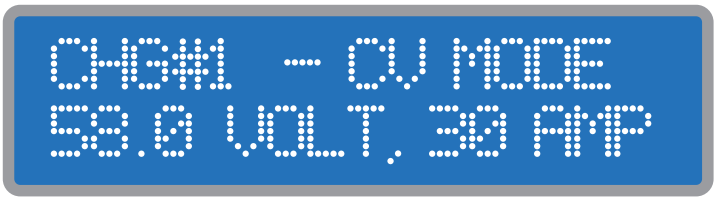
Display Messages for Charging

The display panel will state which mode the charger is in when shore power is applied. The mode along with the charge voltage and current will be displayed. The battery charger will engage automatically and independently of the inverter ON/OFF status. The 2-step charging process modes are: Constant Current (CC) and Constant Voltage (CV).

Constant Current (CC)

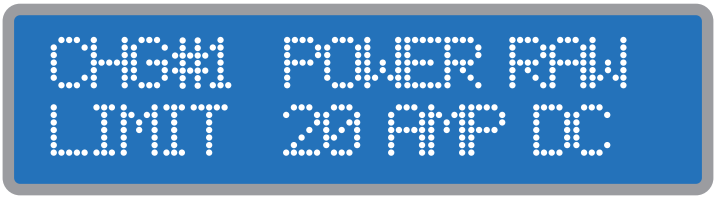


Constant Voltage (CV)



CHARGER CURRENT LIMIT

If the total AC input current into the charger exceeds the branch circuit rating of the inverter (as set by the LCD or other method), the charger will reduce the battery charging current. When in this mode, the following message will be displayed.



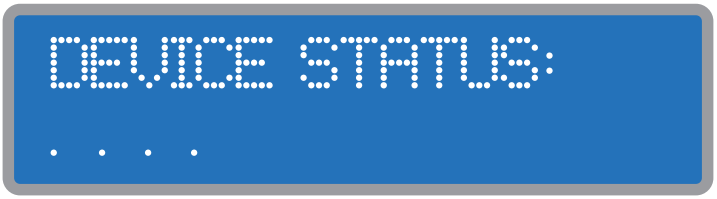
Display Messages for Charging, cont.

CHARGE ENABLE CABLE

If the charge enable cable is not connected to the “Temp Sense” connector on the inverter; the battery charger will not function, and the display will show (if the display is off, press the [DISPLAY] button):

INFO BUTTON – RUN MODE

Pressing the “Info” button while in run, idle, or fault mode will cycle through the current system configuration and settings. The information displayed will depend on the state of the inverter/charger. If the ‘Info” button is pushed when DC power is initially applied, no information will be displayed. The inverter must first be turned on to wake up the processor to enable communication between the devices. The display will momentarily display 3 or 4 dots while it is querying the requested data from the inverter or converter. If screen freezes with the dots showing, unplug the display and then plug it back in. See the display manual for specific cycle order.



System Operation and Recharging

Charging Options and Safe Charging

HPS energy storage packs are designed to safely charge when using approved power distribution devices. Charging devices include alternators, inverter/chargers, shore power, and generators. No additional charging devices should be connected to the HPS system. Doing so could cause a potentially unsafe condition and/or could damage your system.

RECHARGING AND OPERATION WHILE DRIVING

The vehicle is equipped with a high power alternator from Stellar Industries. While the vehicle is being driven, the alternator will charge the HPS system automatically. No changes to the HPS system, or vehicle, settings are required. The installed alternator is custom and specifically designed to work with the HPS energy storage pack.

NOTICE

The alternator may not always be ON while the vehicle is running. If the battery pack is above a set State of Charge (SOC) the alternator will be OFF until the pack controller determines it is appropriate to turn on the alternator.

RECHARGING AND OPERATION FROM SHORE POWER

When plugged into shore power the inverter/charger is designed to automatically recognize and sample incoming power. After initial plug in, the system will sample incoming power for a few seconds to ensure uniformity requirements are met. If incoming power meets the requirements, the system will automatically feed power to the vehicle and begin charging the energy storage pack.

If the system does not transfer power and begin charging, the cause can be due to poor quality incoming power. This feature protects the vehicle from brown outs due to insufficient power, a common occurrence when large numbers of vehicles are tied to one shore power source. If the energy storage pack still has remaining energy, the vehicle systems should remain operational.

BYPASS RELAY

The loads attached to the inverter output will operate directly from the external AC power line (shore power) independently of the inverter ON/OFF status. If the inverter is left ON (standby mode), the built-in bypass relay will automatically cycle back and forth between “Inverter Power” mode and “External Power” mode depending on the availability of the external AC power line.

System Storage and Deep Sleep

Preparations should be made to protect the life and performance of the HPS power system when not in use. When leaving the vehicle in storage it is recommended the HPS system be put into deep sleep.

DEEP SLEEP STORAGE:

1. Using one of the charging options available, charge the energy storage system to greater than 50% SOC as indicated on the inverter/charger display or integrated vehicle display.
2. Turn OFF all vehicle electrical features powered by the system. This includes DC and AC electrical features in the vehicle, as well as, inverters and converters by their control switch or display. See the vehicle user manual for assistance, as each vehicle varies in electrical feature content.
3. With the vehicle, and generator, off - press the round “System Enable” button on the HPS control panel. When you turn the button off, the green light on the button may stay lit while the system shuts down. This can last up to a couple minutes. The gauge may also blink blue during this time. You will know the pack is properly shut down when the lights on the button and gauge are completely off. At this time power should no longer be available from the system. The energy storage pack is now deactivated, and the pack is in deep sleep.
4. To eliminate the potential for accidental system activation, it is recommended the Master Circuit Key switch on the energy storage pack be turned counterclockwise to the OFF position. However, this is not required to put the pack into deep sleep.

During deep sleep the energy storage pack’s on board computer will wake up periodically to check pack status (including cell temperatures and voltages) and perform cell balancing if necessary. Although this check time is minimal, pack status checks will slowly use pack energy over time. Stellar Industries recommends the energy storage pack be turned on every three months to ensure the energy storage pack maintains a charge above Minimum Pack Voltage (10%, 48.7V), as read from the HPS control panel display. Long term storage without maintaining the correct voltage will reduce the life of the pack and possibly destroy the pack permanently. Improper storage is not covered under warranty. See next page for further details on temperature limits for the pack.

⚠ WARNING

If an HPS power system is stored in deep sleep in a low charge state for an extended amount of time, permanent damage to the energy storage pack may result.

Neglecting system maintenance and allowing the energy storage pack to come to this state will result in voiding the warranty for the energy storage pack.

⚠ WARNING

Failure to turn off the energy pack will prevent the packs from entering deep sleep mode. Even with no loads on the system this will cause the pack to deplete faster, which can cause permanent damage to the energy storage pack. The depletion rate accelerates further under cold conditions when the automatic heater engages.

System Temperature Limits

For optimal performance, and to maximize system life, it is important that the energy storage pack remain within temperature limits. The temperatures below are defined from within the pack and are automatically **measured by the system.**

Cold Temperature Operation and Storage

For normal system operation, the energy storage pack internal temperature must remain above the Minimum Operating Temperature. Below this temperature, the energy storage pack may enter a protection mode to prevent further charging or discharging. In most cases low temperature storage will not harm the system, however, the energy storage pack should not be exposed to temperatures below the Absolute Minimum Temperature. A breakdown of these temperatures is shown in Table 05.

Minimum Operating Temperature*	-4ºF (-20ºC)
3 Month Storage Temp Range *	-4ºF – 113ºF (-20ºC – +45ºC)
Maximum Operating Temperature*	131ºF (55ºC)

Table 05: Storage Temperature

*Exact temperatures can vary based on specific system implementation.

Operation of the HPS system in cold environments is possible, when the system is continually running, as internal self-heating will often maintain sufficient temperature inside the pack. Additional implementation of a heating unit can also help in cold conditions.

High Temperature Operation and Storage

The energy storage pack is designed with passive cooling. At temperatures above the Absolute Maximum Temperature, the energy storage pack will enter a protection mode and turn off power of the HPS system. Storage of the energy storage pack at elevated temperatures is not recommended as it will reduce the lifetime and capacity of the energy storage pack.

Temperature Reporting

The energy storage pack monitors maximum and minimum cell temperatures. This allows the pack to enter a protective shutdown mode should the temperatures experienced by the pack exceed a safe range.

Heating Elements

For system operation in cold environments, the energy storage pack is equipped with a heating element in the form of a heating pad. The heating element will operate if the System Enable push button on the side of the HPS control box is pressed and illuminated GREEN. There must be sufficient energy available from the energy pack to power the heating pads. If the pack has been in cold storage, applying either chassis or shore charging will activate the heating element, if needed. When the pack reaches operational temperature, the energy storage pack will automatically activate and provide power.

If at any time the heating pad becomes removed from the pack, the unit should be properly disposed of and replaced with a new heating pad. A heating pad should not be reattached if it has detached from a pack.

Vent Gas Conditions and Characteristics

The energy storage pack is equipped with a vent port in the pack housing to relieve pack pressure in the case of cell venting. The likelihood of cell venting is very low; however, this vent is a part of the safety system.

CONDITIONS THAT COULD CAUSE CELL VENTING

- Overheating of the energy storage pack beyond energy storage pack limits
- Overcharging the energy storage pack beyond energy storage pack limits
- Crush/penetration of the cell
- Cell internal short-circuit

The HPS system and energy storage pack monitor conditions that may lead to venting and will incorporate control parameters to mitigate these events.

GAS CHARACTERISTICS - SEE MATERIAL SAFETY DATA SHEET (MSDS)

- Total volume released from one cell is no more than 300 liters, STP
- Majority of the volume is released within the first 15 seconds
- Gas release temperature is in excess of 930°F (500°C)
- Released gases – concentrations are flammable
  - H2
  - CO
  - CO2
  - Methane
  - Ethane
  - Ethylene
  - Propylene

⚠ WARNING

Cell venting releases potentially harmful gases that are hot and flammable. Avoid interaction with the pack venting area if the pack has been exposed to a condition that may cause venting.

Chapter 3 - Maintenance

Maintenance is an important part of extending the life of any Stellar Industries Accessory. Performing key maintenance items on a scheduled program will prevent unnecessary downtime.

General Maintenance Guidelines

Before performing any maintenance to the HPS unit, consider the following:

- Place all controls in the off position and secure operating features from inadvertent motion. Follow all company directed lockout/tagout procedures.
- Remove the Master Circuit Key.
- Before any service or repair is performed, disengage the hydraulic power source and shut off the engine.
- Allow systems to cool before performing any maintenance.
- Before performing any maintenance on electrical components, disconnect the power source.
- Before performing any maintenance on hydraulic components, relieve hydraulic oil pressure from all hydraulic circuits. Move pedals and control levers repeatedly through their operating positions to relieve all pressures.
- **⚠WARNING** Do not disconnect hydraulic hoses while there is still pressure in those components.
- Replace parts with Stellar Industries approved parts only.
- Label or tag parts when disassembling.
- Immediately repair or have repaired any components found to be inadequate.

Energy Pack Maintenance

Except for extended periods of storage, no specific maintenance is required for the service life of the energy storage pack. In the event the energy storage pack has a breach of container integrity or has been submitted to abusive operating conditions (crush, short circuit, overcharge, over-discharge, submersion, evidence of combustion, exposure to fire, etc.), please contact your authorized Stellar Industries representative. Only approved technicians should service an HPS power distribution system.

⚠ WARNING

Do not attempt to service HPS System components. Only qualified technicians can service these components. Any attempt to service a system by unapproved personnel could cause damage to the system, voiding of the warranty, injury or harm.

The energy storage pack should be turned on every three months to ensure it maintains a charge above Minimum Pack Voltage (10%, 48.7V), as read from the HPS Control Panel display.

Scheduled HPS System Maintenance

Maintenance Operation	Daily	Weekly	Monthly	Hourly
Check hydraulic reservoir oil level	☐			
Drain and replace hydraulic oil*				6500
Replace hydraulic oil filter according to flow restriction gauge				
Tighten all hydraulic lines			6 months	
Check HPS air intake filter, clean as necessary		☐		

Table 06: General Maintenance

*See initial Hydraulic System break-in procedure below.

⚠ WARNING

Turn off System Enable button on HPS control box (Figure 04), remove Master Circuit Key (Figure 15), and disconnect fan harness (Figure 13) before removing cover to inspect or remove air filter for cleaning (Figure 11).

Hydraulic Oil/Filter Maintenance

Stellar Industries recommends the first filter change to occur after the first 250 hours of service. The second, and every subsequent change, should occur after every 1,000 hours of service. By following these guidelines, the hydraulic oil should last up to 6,500 hours.

Operating Condition	Temperature Range	Hydraulic Oil Recommendation
Arctic Climate	Below -5˚F	High VI, low pour, ISO 22, AW hydraulic oil
Normal Service	-5˚F to 90˚F	High VI, low pour, ISO 32, AW hydraulic oil
Tropical Climate	Above 90˚F	ISO 46, AW hydraulic oil

Table 07: Hydraulic Oil Recommendations

NOTICE

These recommendations are based on normal working parameters. If operating in less than favorable conditions excessive (dust, moisture, etc.), be sure to check the filter gauge often for filter change notice.

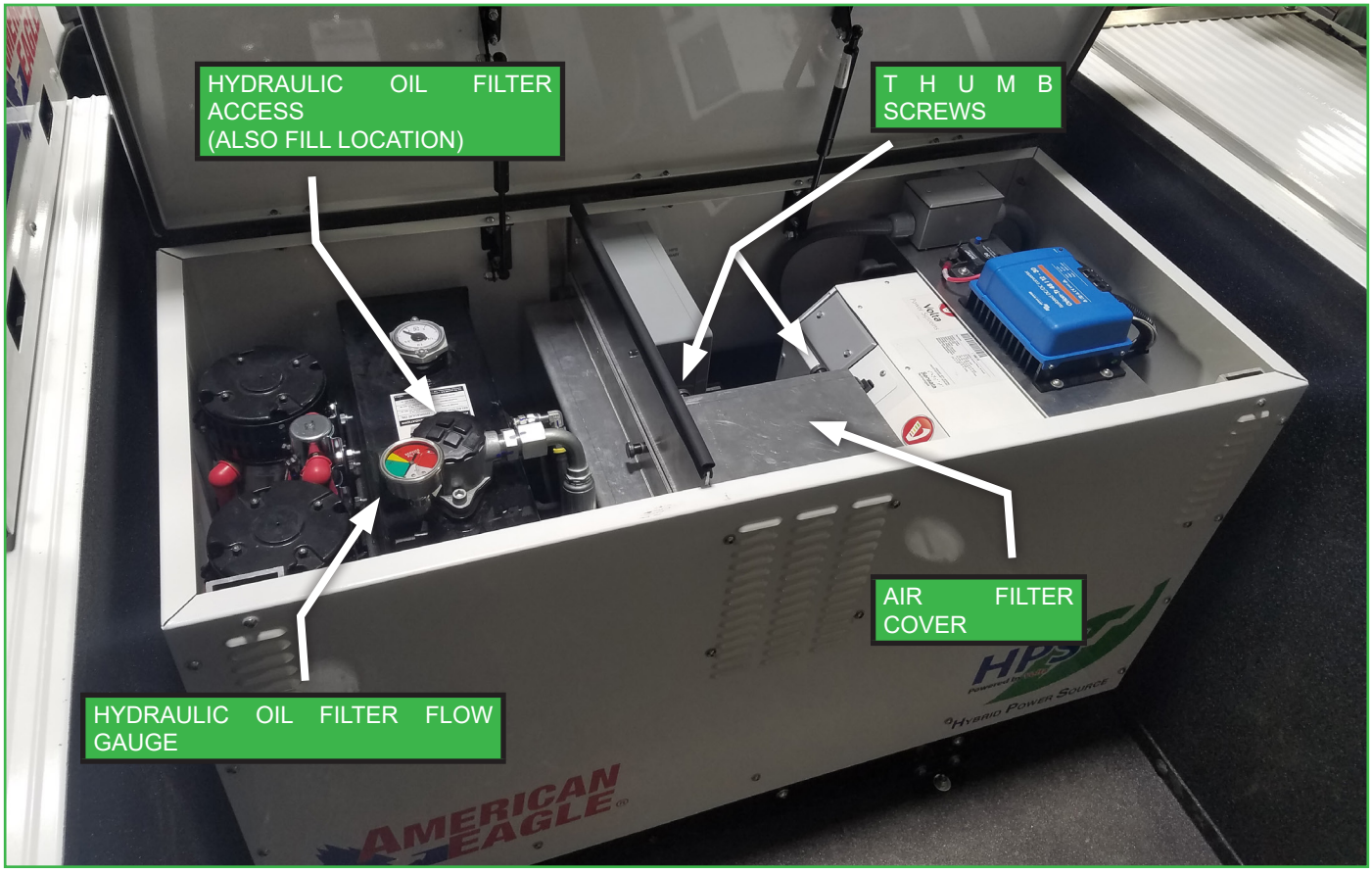


Figure 10: HPS System Cabinet - Maintenance Locations

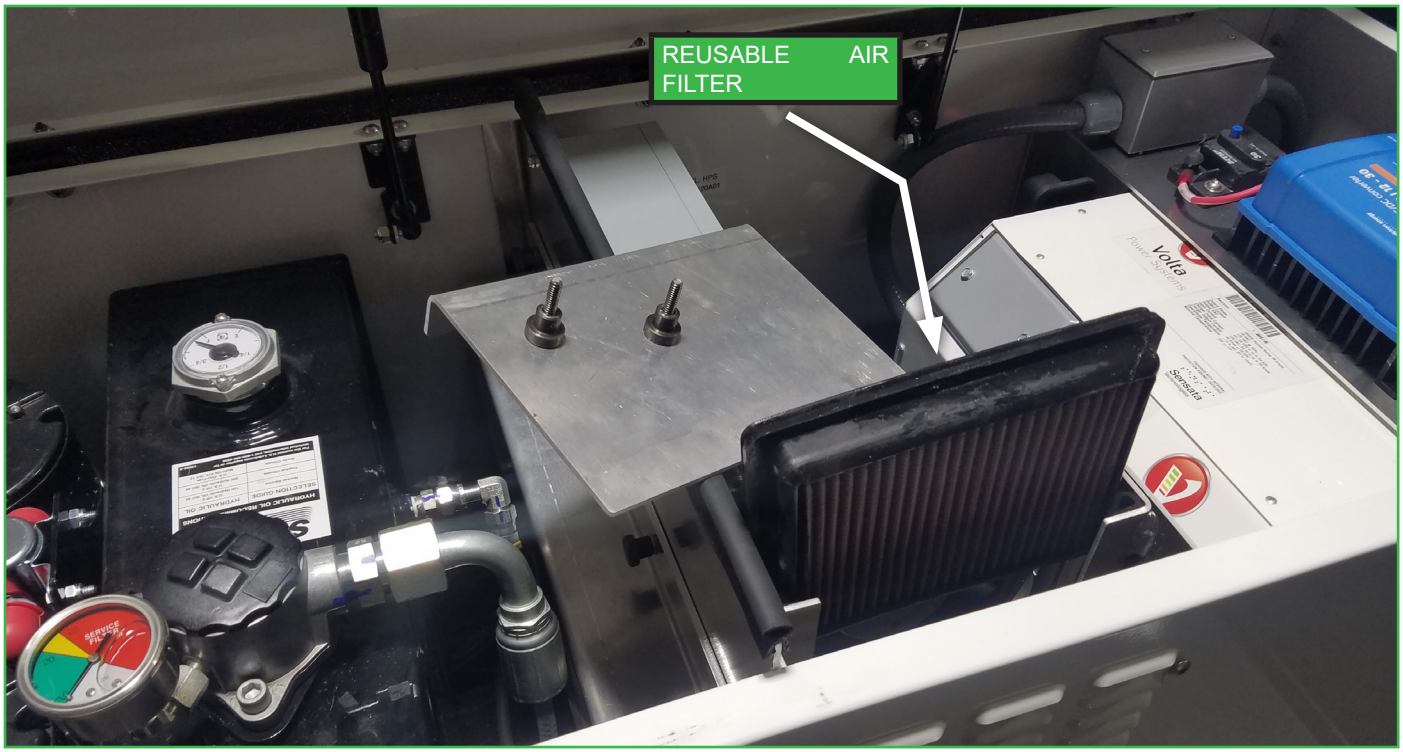


Figure 11: HPS System Cabinet - Air Filter

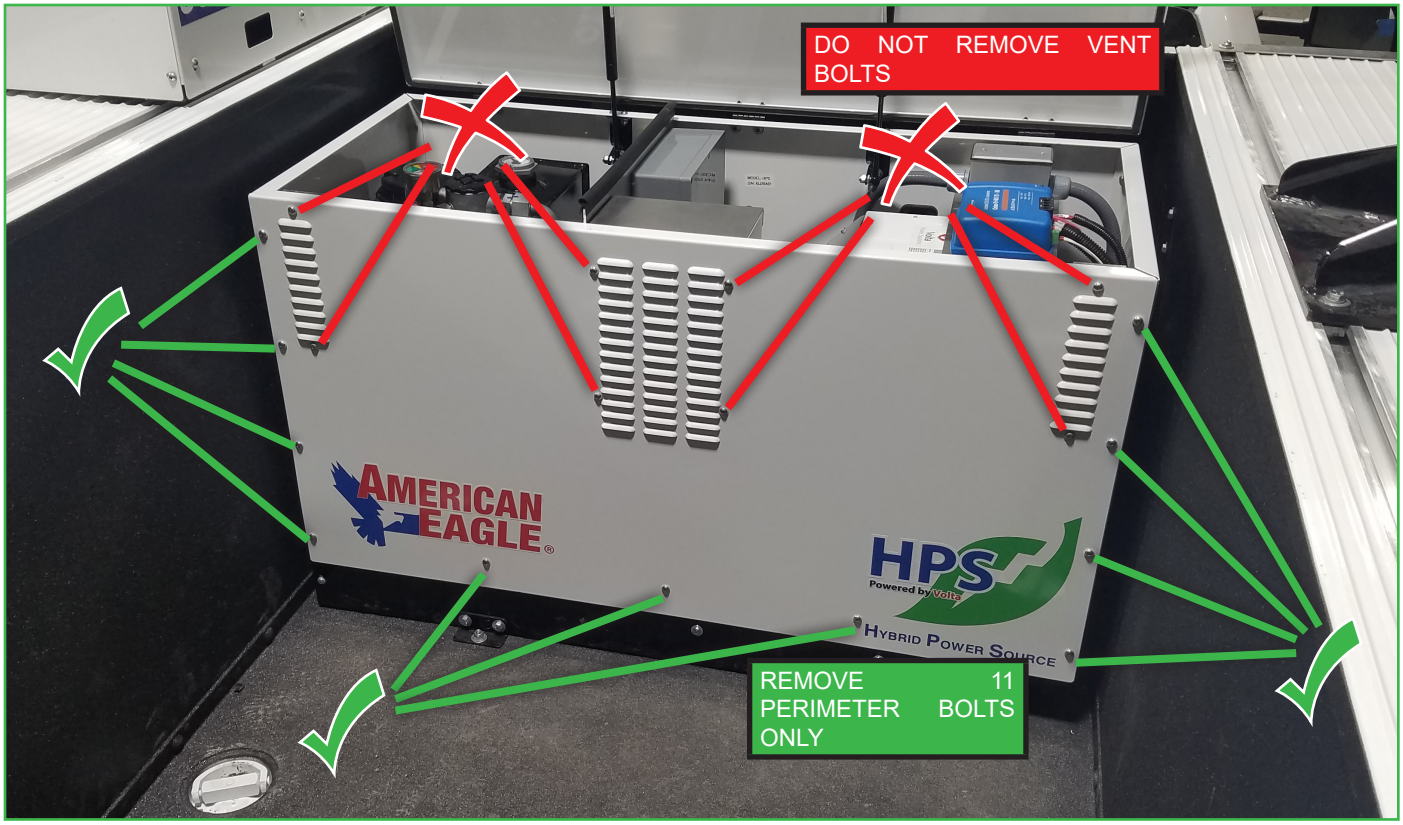


Figure 12: Remove cabinet front panel to gain access to lower components

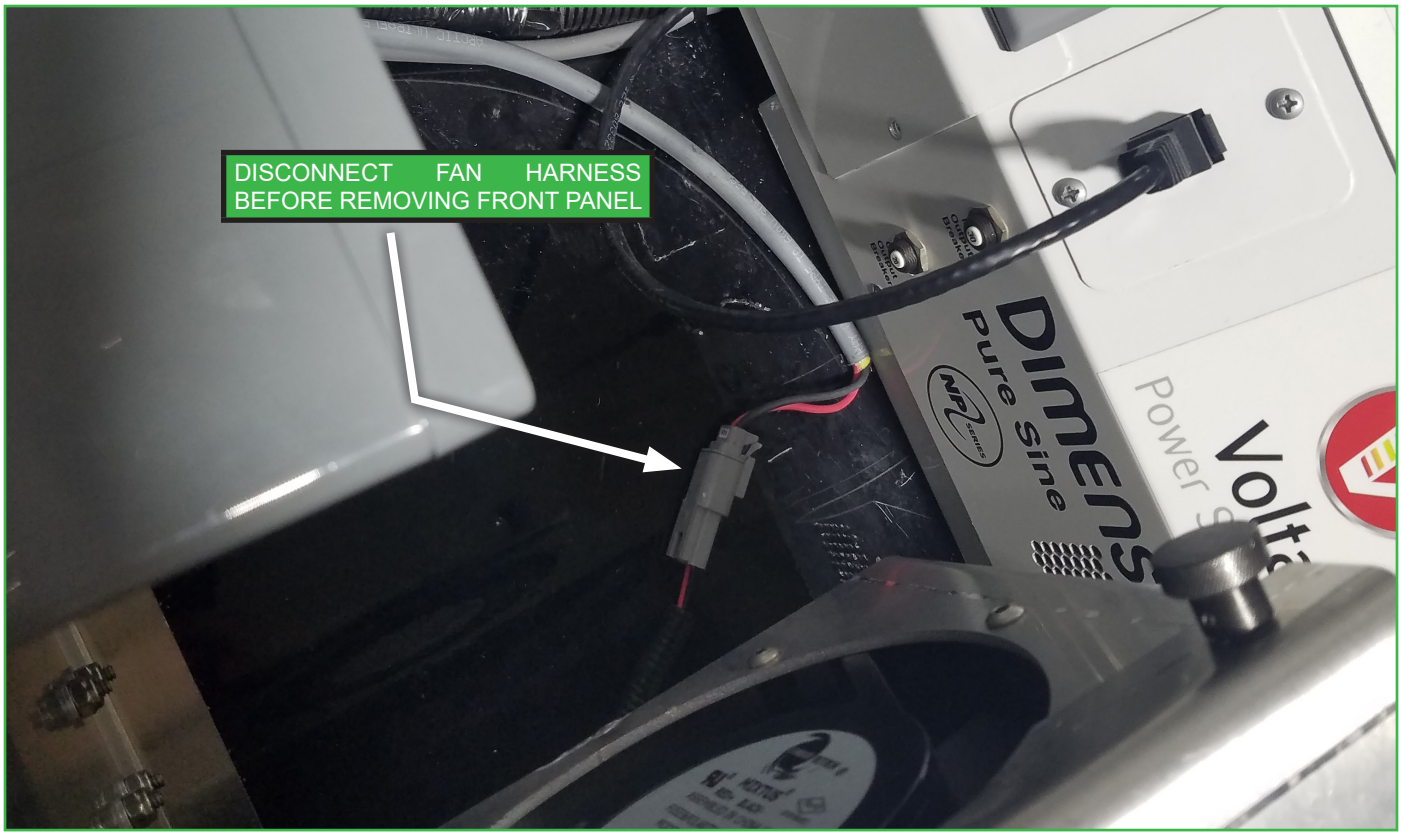


Figure 13: Disconnect fan harness before removing front panel

Figure 14: HPS Hydraulic System - Power Unit Shutoff Valves

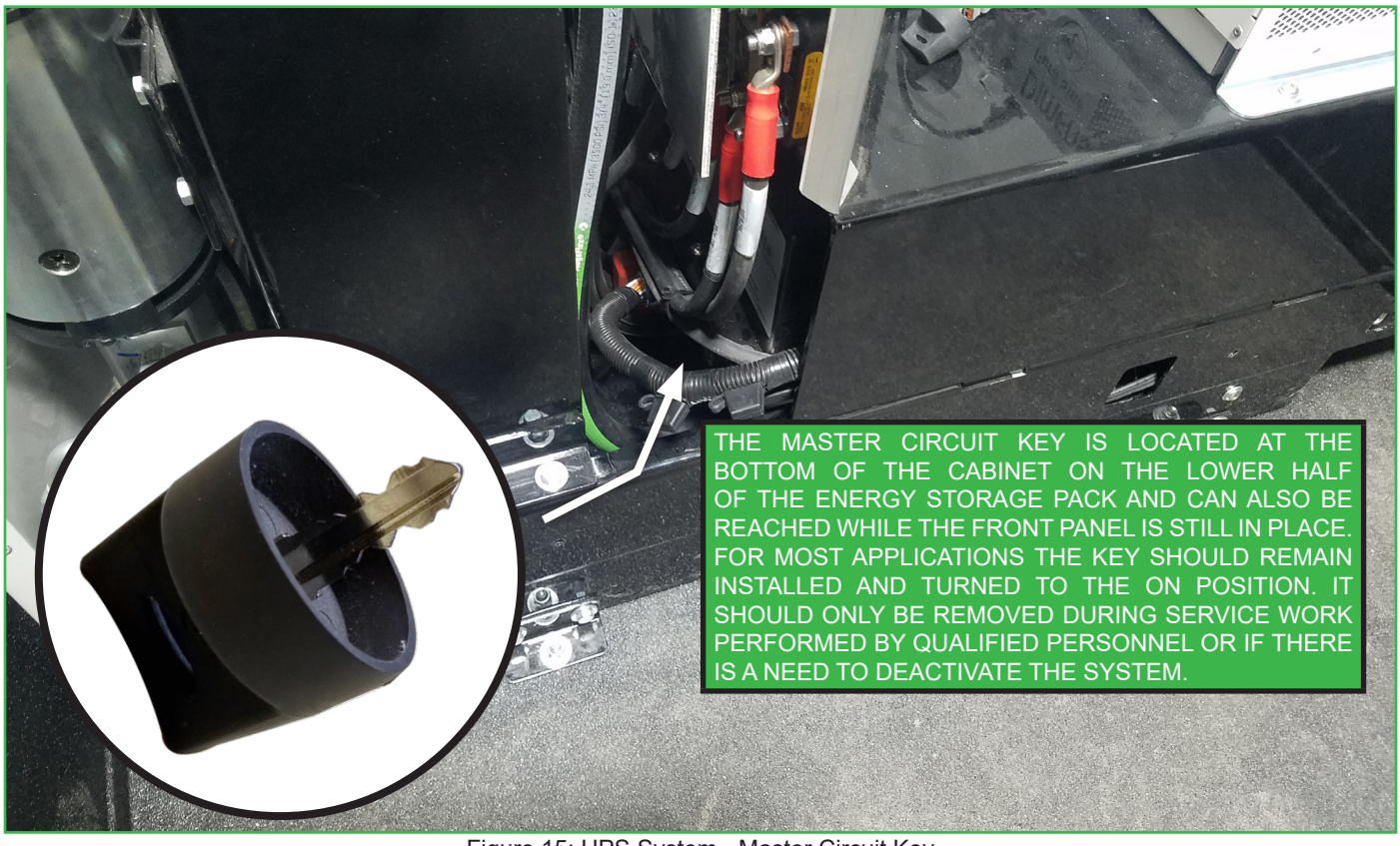


Figure 15: HPS System - Master Circuit Key

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Relay Box: Alternator Charging Faults

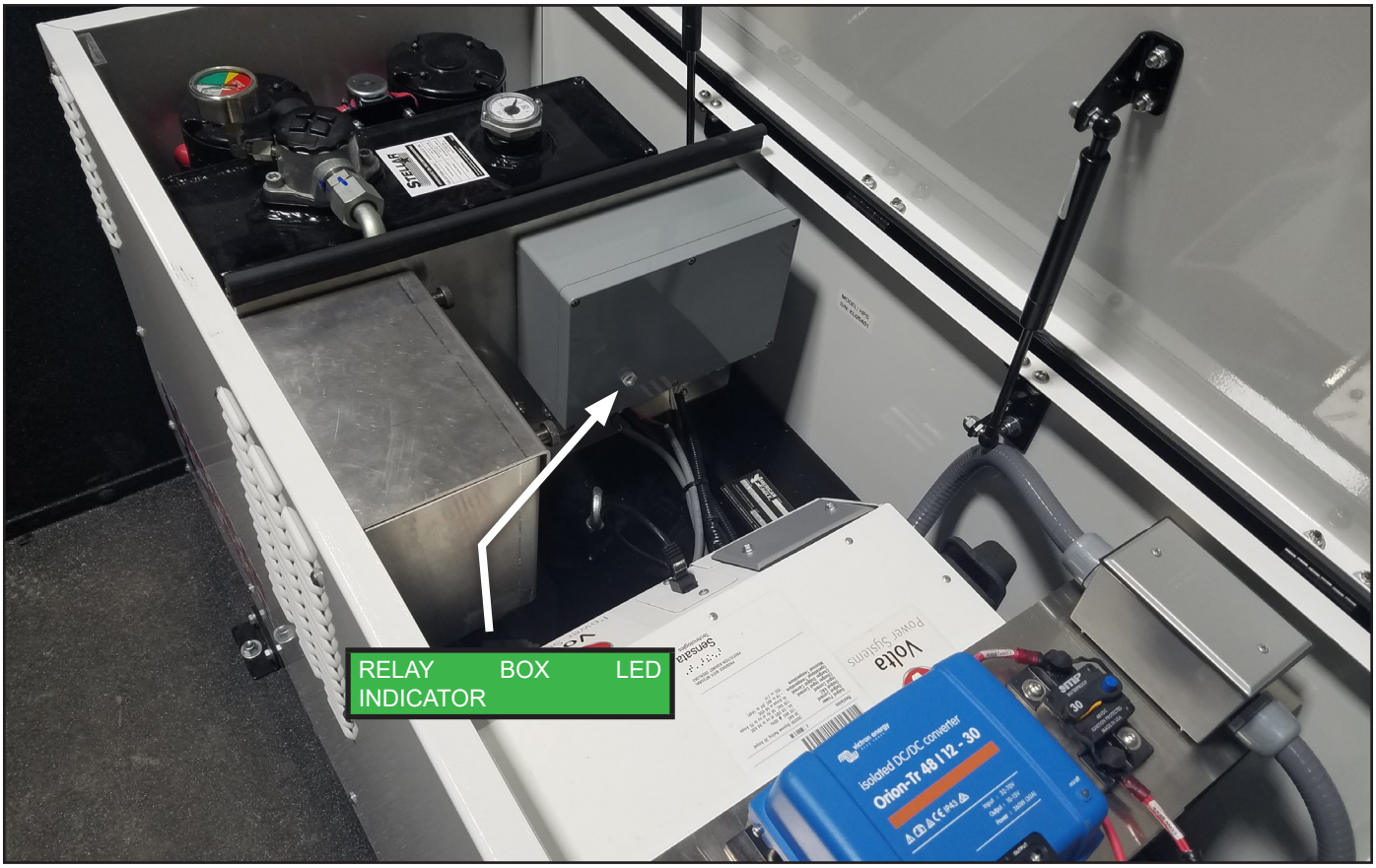


Figure 16: Relay Box LED

Repeating red blinks of the LED indicate that the regulator has shut down. The number of blinks indicated the error condition as follows:

No. of Blinks	System Status
2	High Regulator Temperature
3	Wiring Error - field positive common, or +/- battery connected incorrectly
4	Battery Voltage Too Low
5	Battery Voltage Too High
6	Power (IGN) Voltage Too Low
7	Power (IGN) Voltage Too High

Table 08: Alternator Control Box LED Blink Faults

Inverter/Charger Faults

Inverter/Charger faults will be indicated by the LED that can be viewed through the small window on the Converter mounting frame.

Figure 17: Inverter/Charger LED Color and Blink Faults

Status LED Normal States		
LED Color	LED State	Operating Condition
Green	1 blink	Constant Current Charge
Green	2 blinks	Constant Voltage Charge
Green	4 blinks	Local Management Active
Amber	1 blink	Inverting
Status LED Fault States		
None	OFF	No power to unit or internal fault
Any	Constant ON	Internal fault
Red	1 blink	Inverter low, battery shut down*
Red	2 blinks	Inverter overload shut down
Red	3 blinks	Transformer high temp*
Red	4 blinks	MOSFET high temp*
Red	5 blinks	Charger mode disable
Red	8 blinks	10 minute charger mode timeout
Red	9 blinks	Input DC transient clamp
Amber	3 blinks	High battery voltage*
Amber	4 blinks	System overload, reset required
Faults marked with* will self-recover when the condition returns to normal range		

Table 09 – LED fault codes for inverter/ charger*

*This table should be used for reference only. Codes may vary based on application. Please see your component specific manual for more details.

Inverter/Charger Faults

1. Low Battery Shutdown: Low Battery Shutdown is a protective measure to prevent deep discharge of the battery and/or to make sure that the starting batteries have enough power to start the vehicle. The low voltage threshold is set to 47.0VDC at the Inverter terminals. The Inverter restarts when the input voltage is increased to 49.6VDC, or if the remote on/off switch has been reset.
2. Overload: The Inverter is off due to an overload condition. Remove one or more loads from the output of the Inverter. Reset the Inverter via the remote ON/OFF switch.
3. High Temp: The Inverter is off due to a high internal temperature condition. The Inverter will turn back on when the internal temperature has lowered enough to be within its normal operating range.
4. Inverter Off High Battery: The inverter is off due to a high voltage condition (>60 volts) and the display reports the value. Inverter restarts at 46.0 volts. Check the vehicle alternator/regulator.
5. Charger Off High Battery: The charger is subjected to a high DC output voltage condition. Disconnect all other battery chargers or voltage sources and then restart the charger. Maximum charger output is 58.2VDC
6. Charger Disabled: The charger output may be disabled via the dry contacts on the rear of the inverter.
7. Charger Mode Timeout: The charger will automatically shut-down after being in CV mode for 10 minutes. The charger will restart once the battery voltage drops below 57.0VDC.

Display Warnings and Error Messages

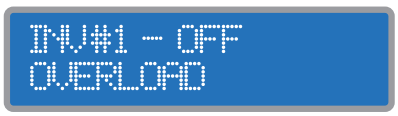
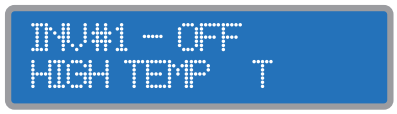
	ENERGY PACK LED DISPLAY	CONDITION	POSSIBLE CAUSE	SOLUTION
1		INVERTER OFF (LOW BATTERY)	The inverter is off due to a low battery voltage condition. The red “READ DISPLAY” LED is on.	The inverter will turn back on when the voltage has recovered to greater than 49.6 volts.
2		INVERTER OFF (OVERLOAD)	The inverter is off due to an overload condition or output short-circuit. The red “READ DISPLAY” LED is on.	Remove one or more loads from the output of the inverter. Reset the inverter.
3		INVERTER OFF (HIGH TEMPERATURE)	The inverter/charger is off due to a high temperature condition. The Red “READ DISPLAY” LED is on.	The inverter will turn back on when the temperature has decreased by about 15°C. If a “H” or “T” appears at the end of the message, it refers to either a heatsink high temp or a transformer high temp.
4		CHARGER OFF (HIGH TEMPERATURE)	The inverter/charger is off due to a high temperature condition. The Red “READ DISPLAY” LED is on.	The inverter will turn back on when the temperature has decreased by about 15°C. If a “H” or “T” appears at the end of the message, it refers to either a heatsink high temp or a transformer high temp.

Table 10: Pack Display Error Messages, continued on next page

Display Warnings and Error Messages

	ENERGY PACK LED DISPLAY	CONDITION	POSSIBLE CAUSE	SOLUTION
5		INVERTER HIGH DC VOLTAGE (WARNING)	The inverter input has exceeded 58.6V.	The inverter can tolerate voltages up to 63V+, but will eventually shut down as it approaches 65V. This is a warning message only.
6		INPUT DC TRANSIENT CLAMP	The inverter is off due to an extended over voltage event on the inverter DC input.	Reset the inverter with the remote ON/OFF to clear. See page xx for information.
7		CHARGER MONITOR MODE	The charger will automatically shut down and go into monitor mode after being in CV mode for 10 minutes.	The charger will restart once the battery voltage drops below 57VDC.

Table 10: Pack Display Error Messages, continued from previous page

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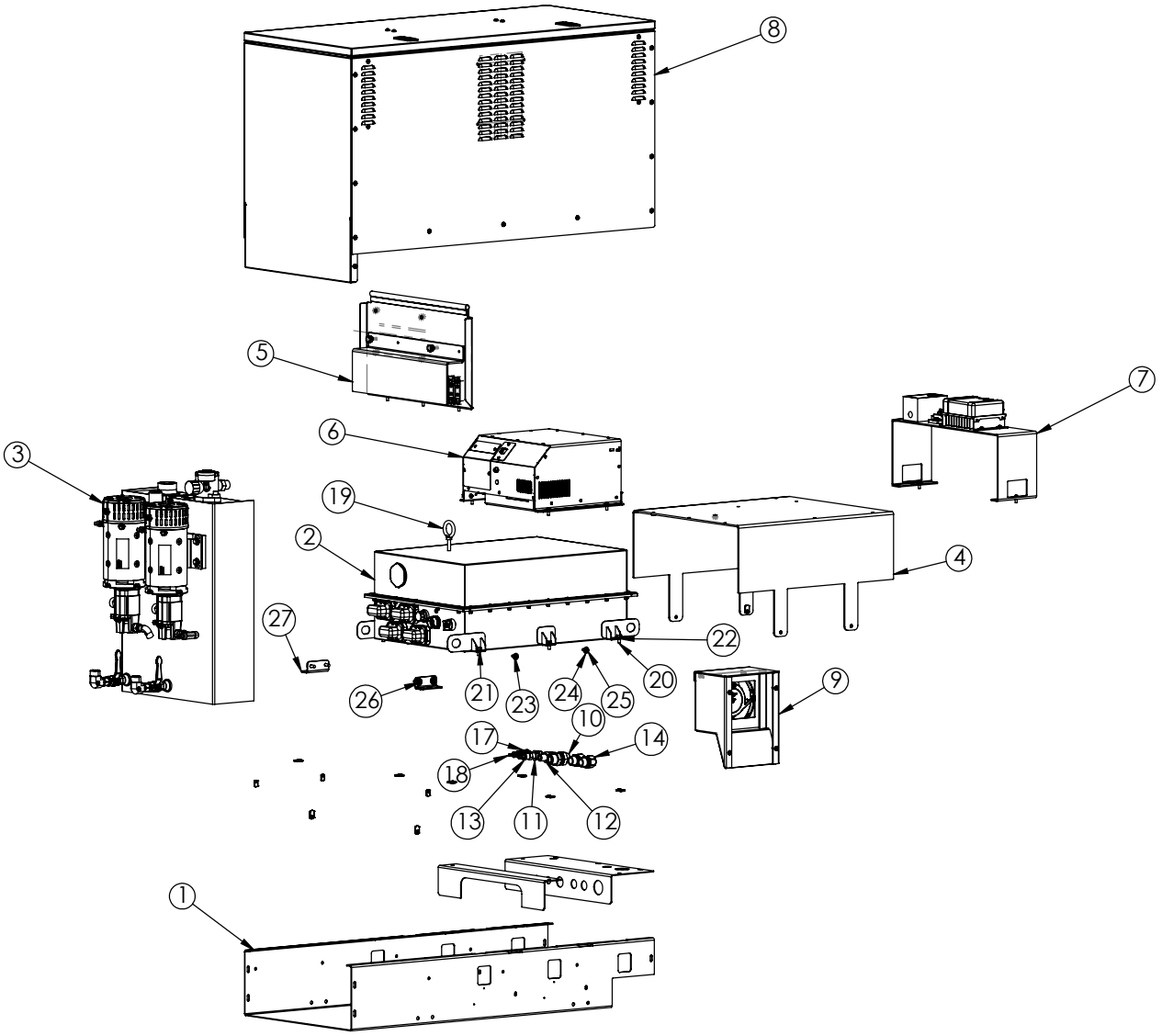
Chapter 5 - Assembly Drawings

HPS Assembly - 102832

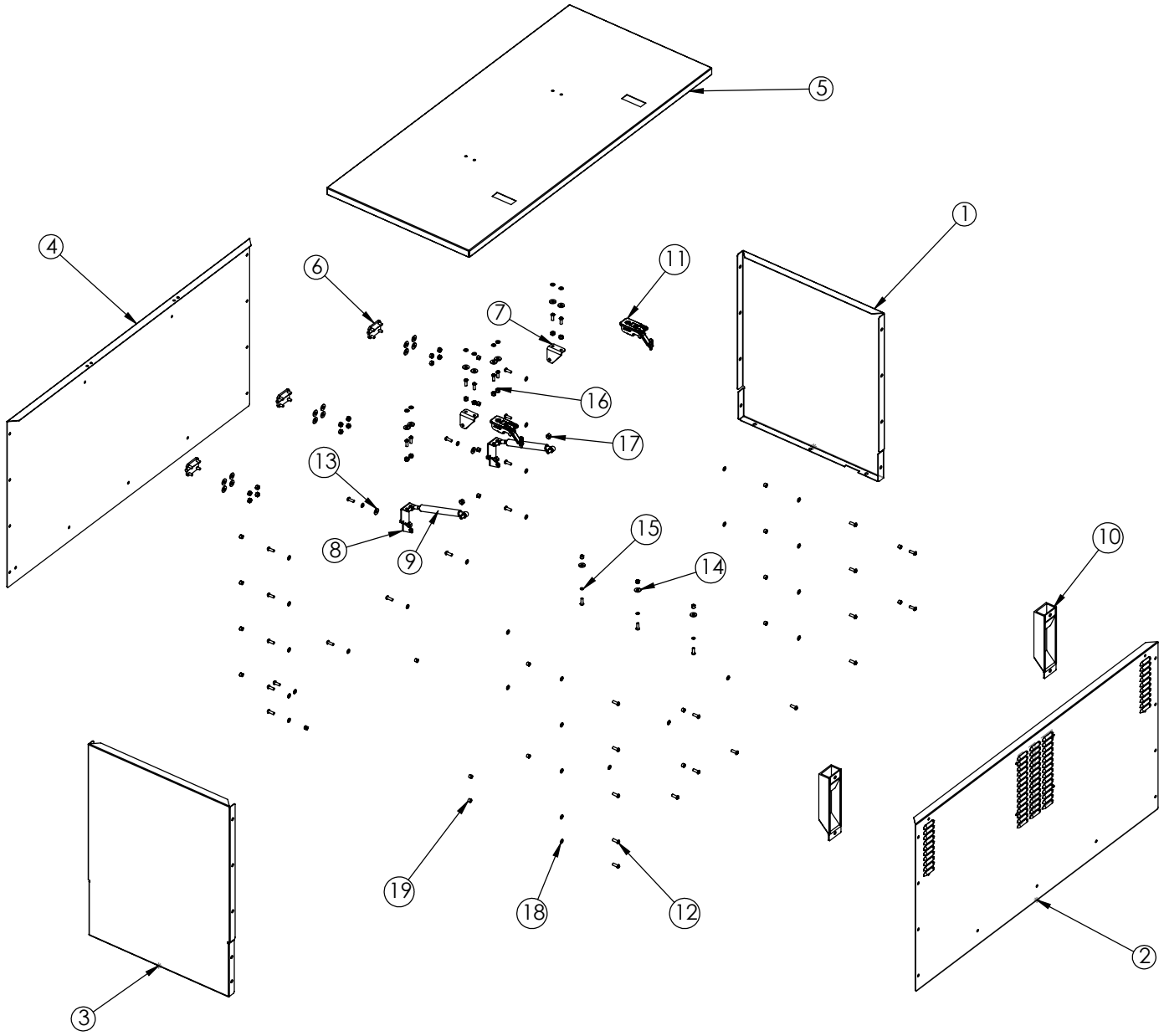


PN 102832

ITEM	PART No.	DESCRIPTION	QTY.
1	102830	BASE WLDMT EPS MOUNT	1
2	103805	POWER SYSTEM KIT 4M VIP	1
3	102787	RSRVR ASM EPS DUAL UNITS	1
4	102944	INVERTER STAND WLDMT EPS	1
5	109958	POWER DISTRIBUTION PANEL ASM HPS	1
6	109955	INVERTER ASM HPS 48VDC 120VAC	1
7	109956	VOLTAGE CONVERTER ASM HPS 48/12VDC 30A	1
8	105606	EPS SHROUD ASM V2	1
9	109966	INTAKE FAN ASM HPS	1
10	65025	FTG 12-12 MFS-MFS BULKHEAD UNION	1
11	D1299	FTG 6-6 MFS-MFS BULKHEAD UNION	1
12	D1318	FTG 8-8 MFS-MFS BULKHEAD UNION	1
13	52474	FTG HOSE 6-6 FFSS-PL SHORT	1
14	12868	STRAIN RELIEF .75 NPT .35-.63 CABLE	2

ITEM	PART No.	DESCRIPTION	QTY.
15	108742	CONNECT CAT5E RJ45 INLINE DUAL	1
16	18343	CONNECTOR CONDUIT END 0.50 90	1
17	12170	FTG 4-4 MFS-MFS BULKHEAD UNION	1
18	103385	FTG HOSE 4-4 FFSS-PL SHORT	1
19	12122	BOLT 0.38X1.00 EYE 567-23-ZN	1
20	0420	CAP SCR 0.31-18X0.75 HHGR5	6
21	0522	WASHER 0.31 LOCK	14
22	0343	WASHER 0.31 USS FLAT	14
23	0521	WASHER 0.25 LOCK	4
24	0340	WASHER 0.25 USS FLAT	4
25	C6021	CAP SCR 0.25-20X0.75 BTNHD SS	4
26	C0090	CAP SCR 0.31-18X1.00 BTN HD SS	8
27	106183	EPS MOUNTING BRKT LOADBED	4

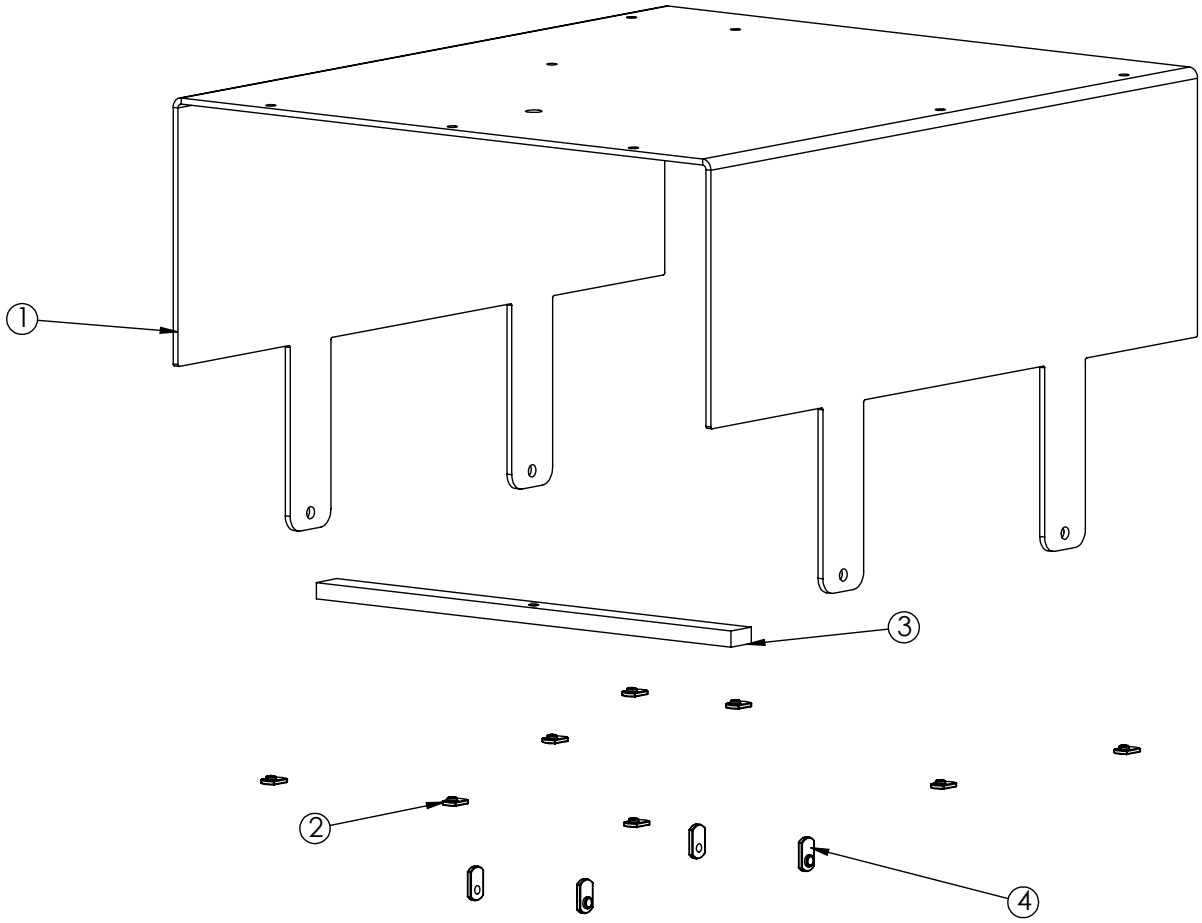
HPS Shroud Assembly - 105606



PN 105606

ITEM	PART No.	DESCRIPTION	QTY.
1	105602	PANEL FRONT HPS V2 PC WHITE	1
2	105277	PANEL SIDE LH HPS V2 PC WHITE	1
3	105603	PANEL BACK HPS V2 PC WHITE	1
4	105601	PANEL SIDE RH HPS V2 PC WHITE	1
5	102942	PANEL LID HPS SHROUD PC WHITE	1
6	70379	HINGE ZINC BLK FLUSH SURFACE MNT DC-50-P8	3
7	73654	BRKT LID GASPROP CPRSR SHROUD V2 PC BLACK	2
8	73653	BRKT LOWER GASPROP CPRSR SHROUD V2 PC BLACK	2
9	69103	GAS SPRING 7.50-12.00 30# FORCE	2
10	109830	HPS VENT WLDMT	2
11	109951	LATCH TRIGGER SEAL FLUSH 0.59-1.18 BLK	2
12	C6021	CAP SCR 0.25-20X0.75 BTNHD SS	42
13	D0917	WASHER 0.25 FLAT SS	22
14	0340	WASHER 0.25 USS FLAT	3
15	0521	WASHER 0.25 LOCK	3
16	0333	NUT 0.25-20 HHGR5 NYLOC	22
17	0342	NUT 0.31-18 HHGR5 NYLOC	4
18	19592	WASHER 0.25 FLAT NYLON	39
19	19589	NUT SERT 0.25-20X0.38 OD	25

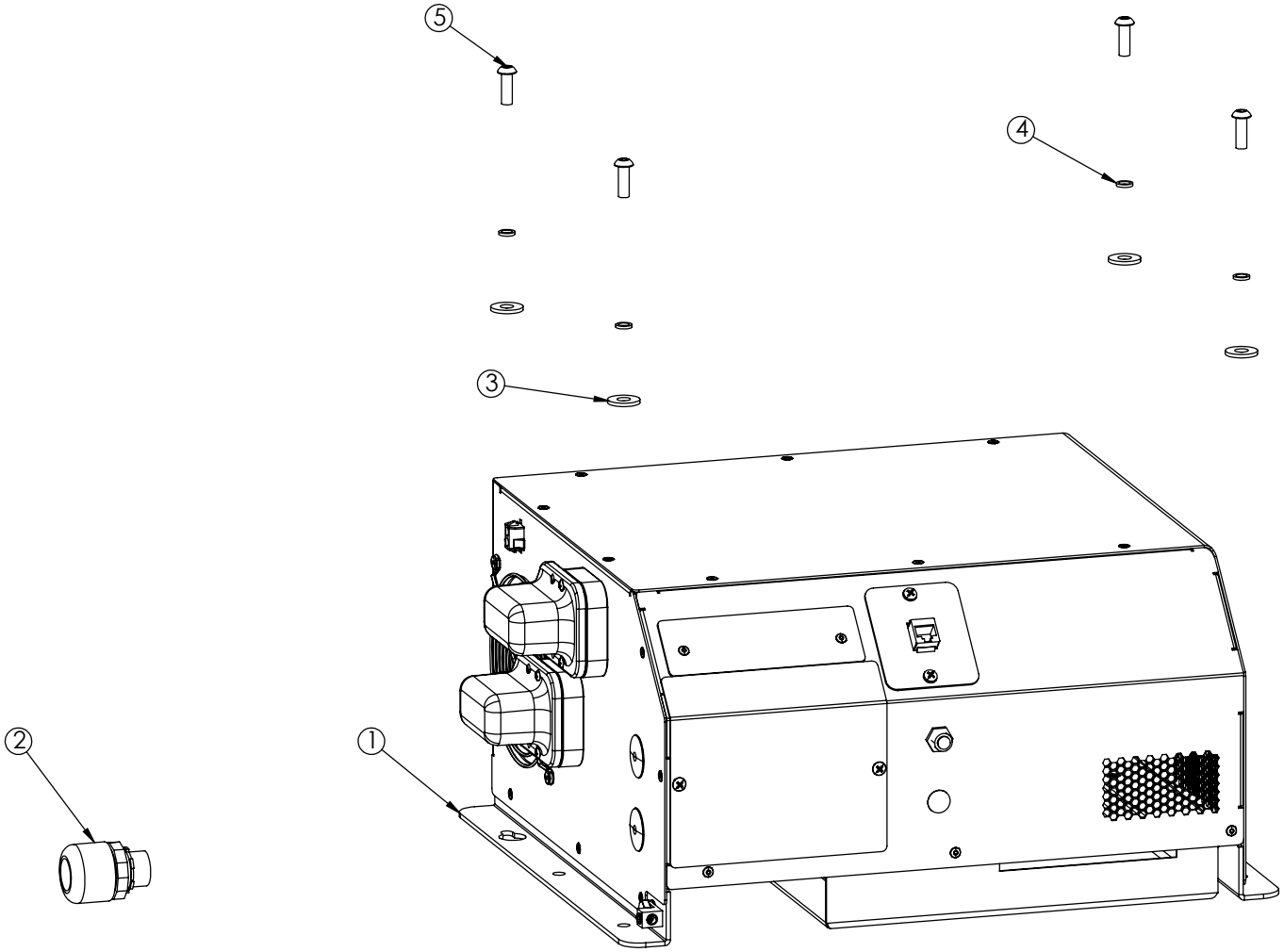
Inverter Stand Assembly - 102944



PN 102944

ITEM	PART No.	DESCRIPTION	QTY.
1	102943	PANEL INVERTER STAND EPS	1
2	C5936	NUT WELD 0.25-20 SGL TAB	8
3	105604	FLAT 0.50X1.00X16.00 W/TAPPED HOLE	1
4	C5937	NUT WELD 0.31-18 SGL TAB	4

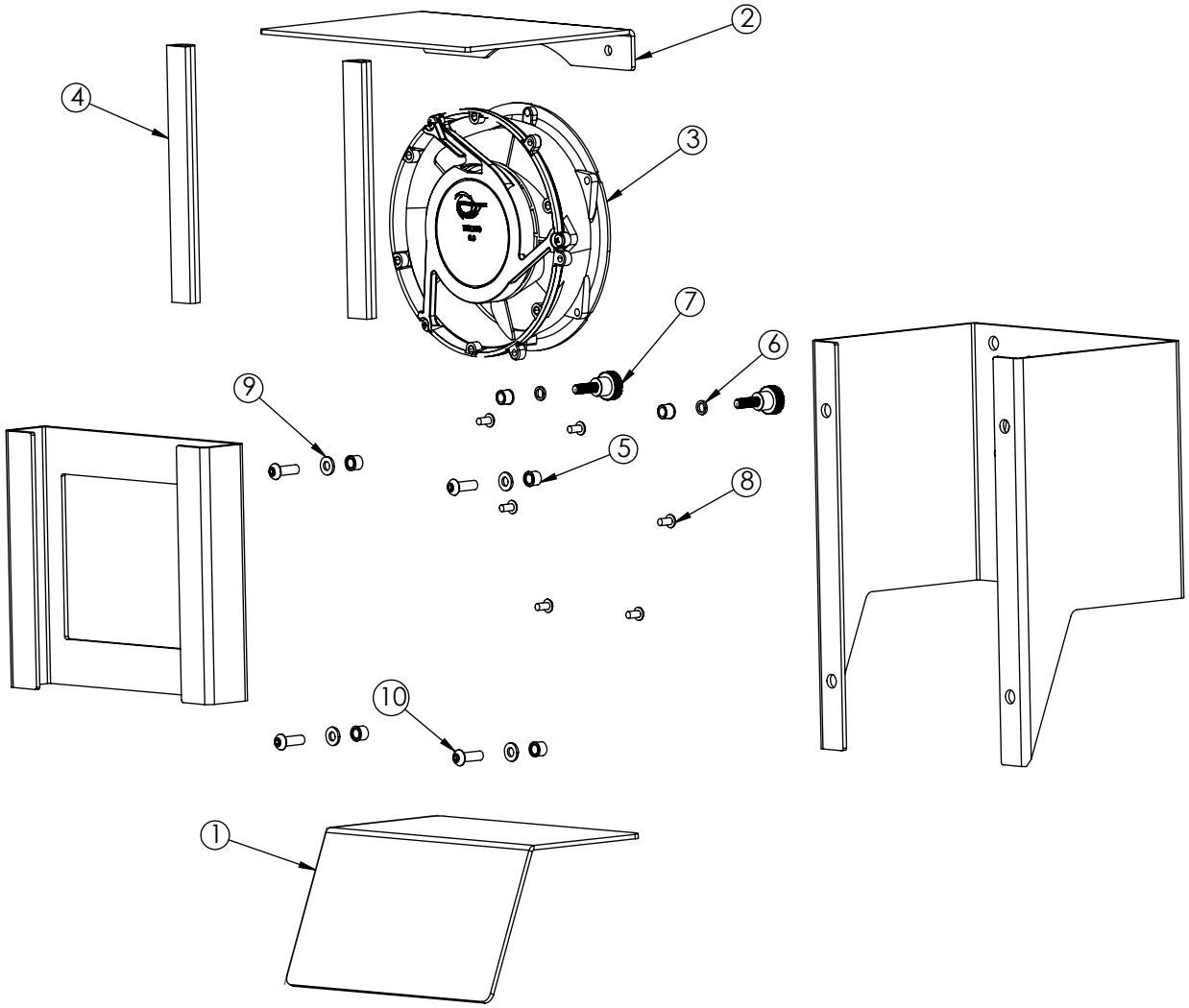
Inverter Assembly - 109955



PN 109955

ITEM	PART No.	DESCRIPTION	QTY.
1	48NP36HRQ_099	AC INVERTER/CHARGER	1
2	18342	CONNECTOR CONDUIT END 0.50 ST	1
3	0340	WASHER 0.25 USS FLAT	4
4	0521	WASHER 0.25 LOCK	4
5	C6021	CAP SCR 0.25-20X0.75 BTNHD SS	4

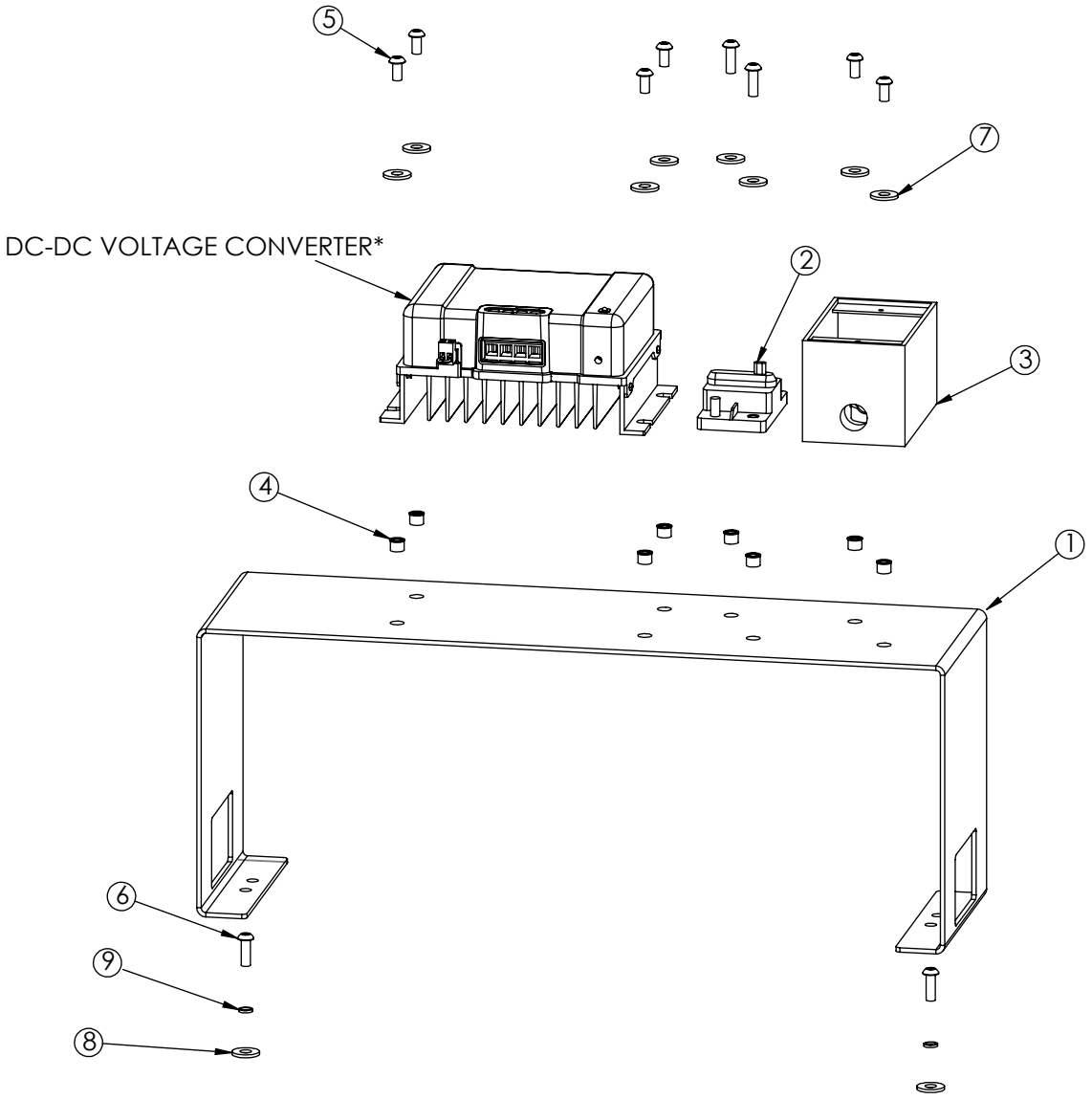
Intake Fan Assembly - 109966



PN 109966

ITEM	PART No.	DESCRIPTION	QTY.
1	105607	FAN/FILTER SHROUD ASM EPS	1
2	109986	SHT AL HPS FILTER LID	1
3	103960	FAN 6.74X2.00 PULL 48 VOLT 30P ELECTRIC	1
4	22427	WEATHERSTRIP D-SHAPED 0.58X0.70	2
5	19589	NUT SERT 0.25-20X0.38 OD	6
6	0521	WASHER 0.25 LOCK	2
7	109987	GRIP KNOB 0.25-20X0.75 BLK-OXIDE	2
8	40364	CAP SCR #10-24X0.38 BTNHD SS	6
9	19592	WASHER 0.25 FLAT NYLON	4
10	C6021	CAP SCR 0.25-20X0.75 BTNHD SS	4

Voltage Converter Assembly - 109956

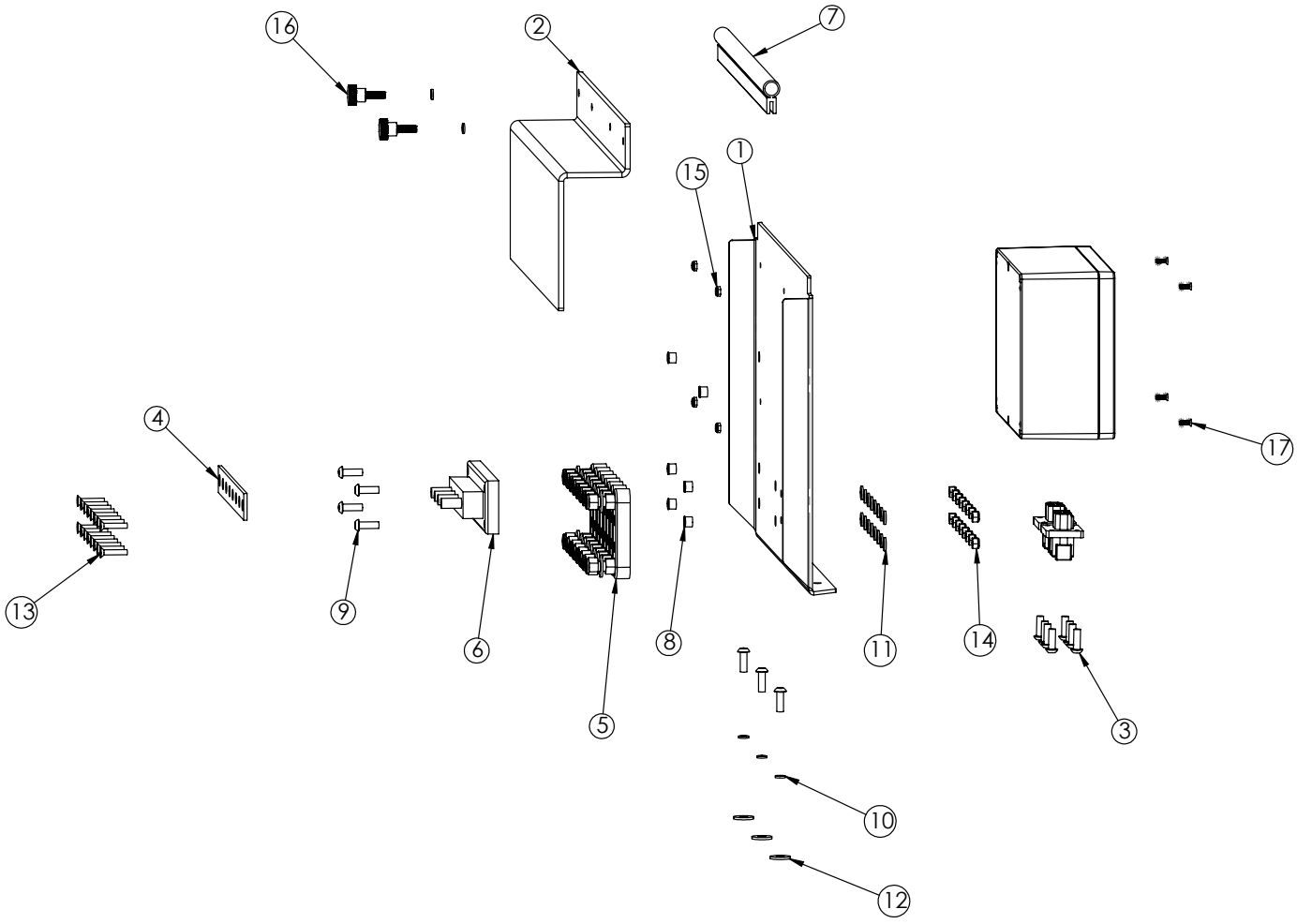


PN 109956

ITEM	PART No.	DESCRIPTION	QTY.
1	105605	INVERTER SURROUND EPS ASM	1
2	109957	CIRCUIT BREAKER 50A MAN RESET PTT SRFMNT	1
3	18339	BOX OUTLET 110V GFI	1
4	19589	NUT SERT 0.25-20X0.38 OD	8
5	D0561	CAP SCR 0.25-20X0.50 BTNHD SS	6
6	C6021	CAP SCR 0.25-20X0.75 BTNHD SS	4
7	D0917	WASHER 0.25 FLAT SS	8
8	0340	WASHER 0.25 USS FLAT	2
9	0521	WASHER 0.25 LOCK	2

* CONTACT AMERICAN EAGLE CUSTOMER SUPPORT REGARDING ORION-TR-12V-360W DC VOLTAGE CONVERTER

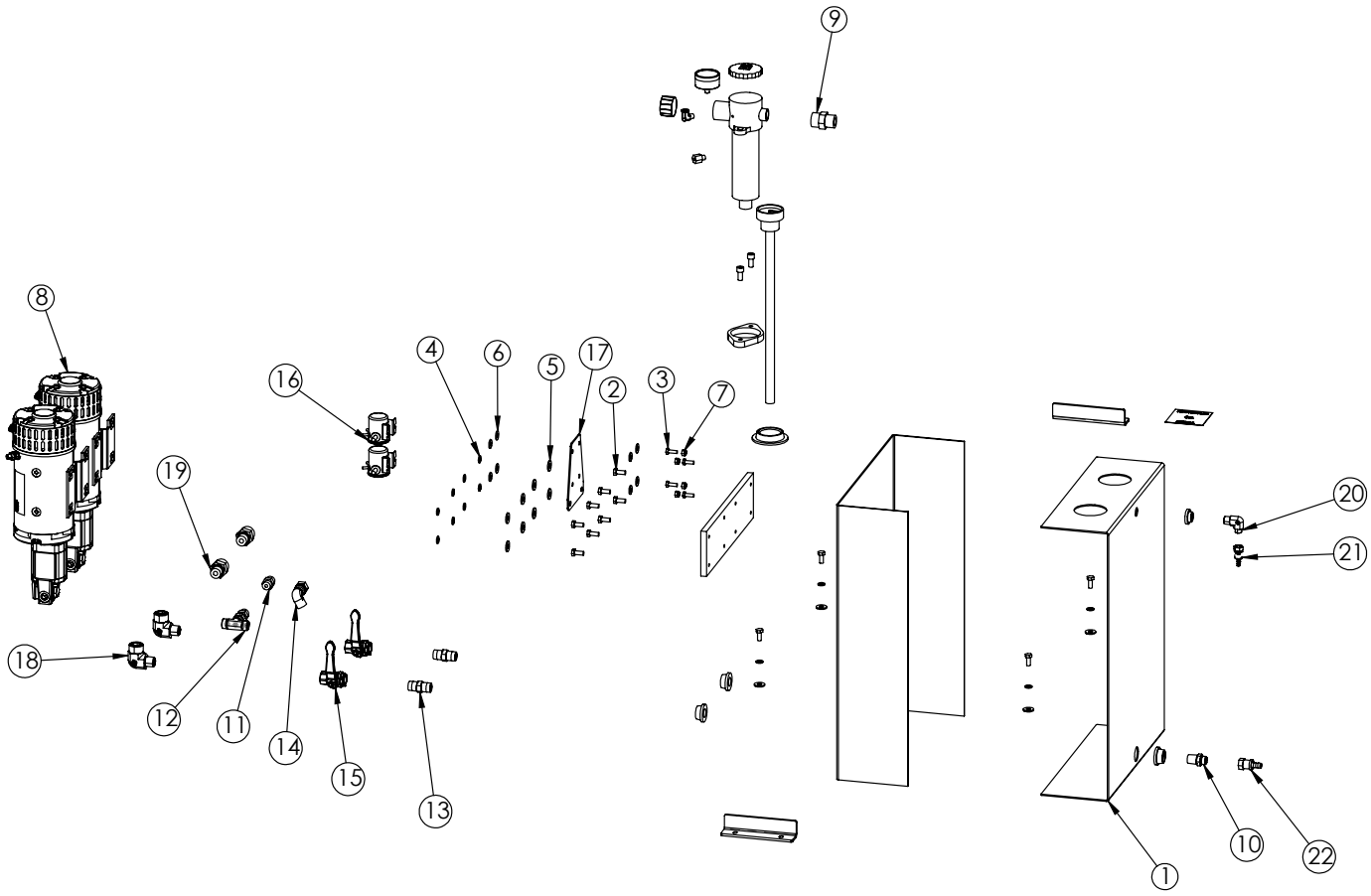
Power Distribution Assembly - 109958



PN 109958

ITEM	PART No.	DESCRIPTION	QTY.
1	106180	DIVIDER ALUM EPS ASM	1
2	108743	SHT AL HPS FUSE COVER	1
3	109831	RELAY CTRL BOX HPS	1
4	109961	COPPER BAR 110 0.13THK X 1.00WD (RM)	1
5	103812	FUSE HOLDER ANN/ANL 4161 SERIES THREADED STUDS	8
6	103814	BUS BAR 4 POSITION 3/8" STUDS	1
7	6539	TRIM EDGE 0.13X0.56 AL 0.44 BULB (RM)	1
8	19589	NUT SERT 0.25-20X0.38 OD	6
9	C6021	CAP SCR 0.25-20X0.75 BTNHD SS	7
10	0521	WASHER 0.25 LOCK	5
11	D0178	WASHER #10 SAE FLAT	16
12	0340	WASHER 0.25 USS FLAT	3
13	D1179	CAP SCR #10-24X1.00 FHSH SS	16
14	C4956	NUT #10-24 HH NYLOC SS	16
15	D0076	NUT #6-32 HH NYLOC SS	4
16	109987	GRIP KNOB 0.25-20X0.75 BLK-OXIDE	2
17	94503	SCREW #6-32X0.44 PH FHMS NOT HF96ZC	4

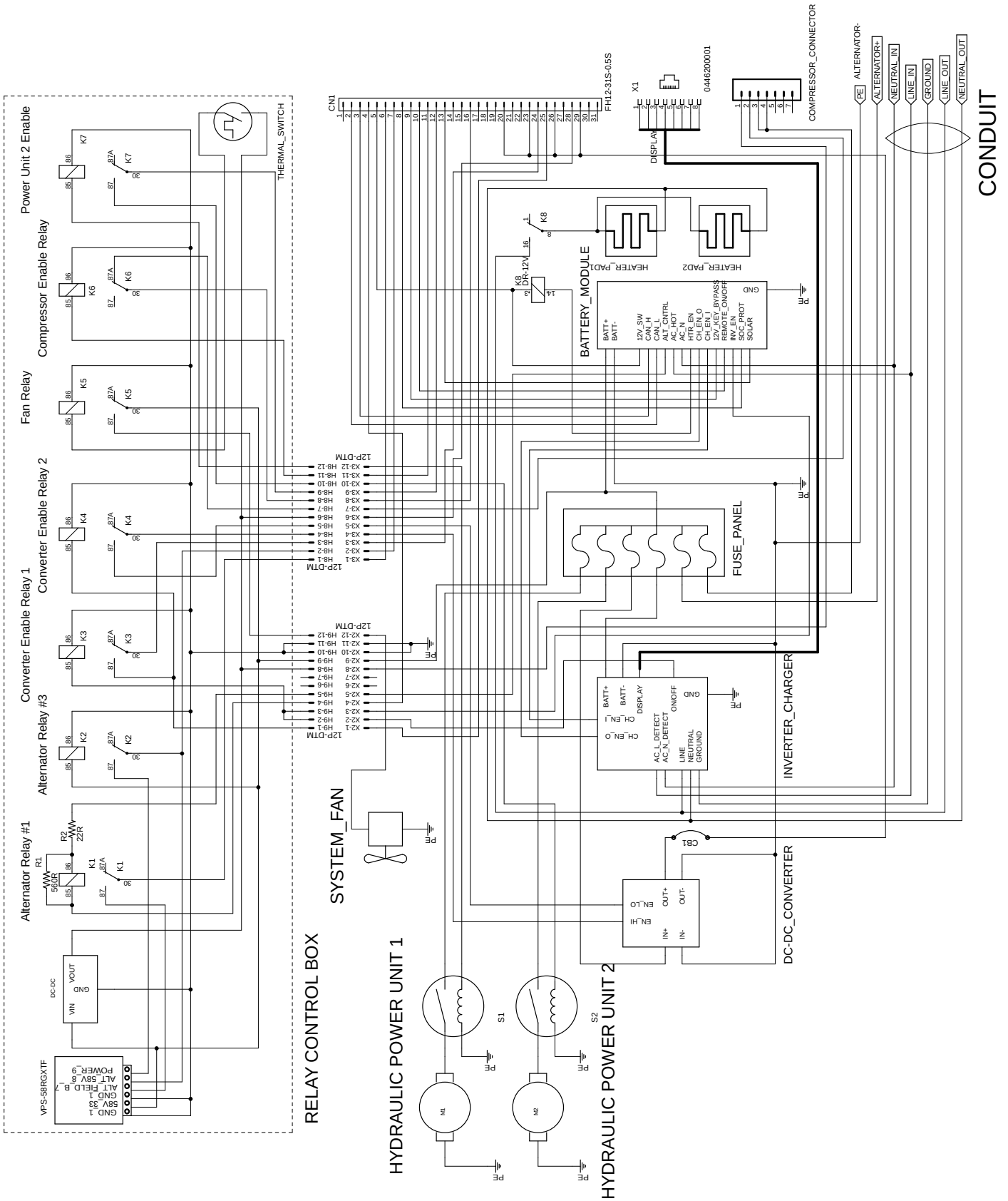
Hydraulic Reservoir Assembly - 102787



PN 102787

ITEM	PART No.	DESCRIPTION	QTY.
1	102788	RSRVR SUB-ASM EPS DUAL UNITS	1
2	0420	CAP SCR 0.31-18X0.75 HHGR5	12
3	0479	CAP SCR 0.25-20X0.75 HHGR5	4
4	0522	WASHER 0.31 LOCK	12
5	0343	WASHER 0.31 USS FLAT	12
6	0340	WASHER 0.25 USS FLAT	8
7	0333	NUT 0.25-20 HHGR5 NYLOC	4
8	103613	POWER UNIT 48V 3.5CC PUMP	2
9	C2142	FTG 12-12 MFS-MORB STRAIGHT	1
10	1863	FTG 6-8 MFS-MP STRAIGHT	1
11	103567	VALVE CHECK INLINE	2
12	C6222	FTG 8-8-8 MFS-MFS-FFSS BRANCH TEE	1
13	C6161	FTG 8-8 MP-MP HEX NIPPLE STRAIGHT	2
14	C2376	FTG 8-8 MFS-FFSS 90	1
15	4446	VALVE BALL 0.50 BRONZE APOLLO	2
16	18468	SOLENOID 12V 200 AMP CONT 24143	2
17	105389	BRKT SOLENOID DUAL MNT 200 AMPS EPS UNIT	1
18	105858	FTG 12-8 MFS-MP 90	2
19	D1435	FTG 12-10 MFS-MORB STRAIGHT	2
20	103386	FTG 4-6 MFS-MP 90	1
21	103385	FTG HOSE 4-4 FFSS-PL SHORT	1
22	52474	FTG HOSE 6-6 FFSS-PL SHORT	1

HPS System Wiring Diagram



Subject to Change without Notification.