



Electric APU Troubleshooting Manual

Troubleshooting

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Inverter

12VDC to 120VAC
 Part # 35002
 1500 Watt, Sine Wave

Component Location
 UBB, lower level



Component History, Issues

1. GFCI will trip occasionally when the APU system is turned off suddenly by starting the truck.
 The user manual instructs drivers to turn OFF the air conditioner with the thermostat only.
2. The inverter may overload (red light condition) if the start capacitor is not properly connected to the run capacitor.
 The connection quality is a factor especially after a year of operation. Service is required for the electrical APU harnesses. Clean, tighten and corrosion prevention for all APU electrical connections is required.
3. The inverter may shut down if 1500 watts is exceeded or 3000 watts surge is exceeded.
 The inverter's maximum output is exceeded when the air conditioner is turned off for a few seconds and then turned back ON by turning the Ignition key ON and then OFF.

 This action forces the air conditioner to attempt to start; however, the pressure present on the high side Freon circuit may be too high for the inverter (output) to overcome. The correct procedure is to turn the air conditioner off using the slide switch on the face of the thermostat.
4. The inverter may overload if a microwave is used that exceeds the maximum output rating of the inverter.
 This tends to be the case on any microwave rated at >700 watts. The microwave rating is based on run watts, not the watts needed to start the microwave.
5. Understand the "Do's and Don'ts" when using the APU's air conditioner.
 The inverter will display LED lights that will show the reason for the inverter shut down. Learning to properly react to these indicators will eliminate most inverter issues.
6. A permanent label/sticker is affixed to the underside of the UBB Cover. This information label contains helpful information for troubleshooting the inverter.

TROUBLESHOOTING

Inverter

12VDC to 120VAC

Part # 35002

1500 Watt, Sine Wave

Component Locations

UBB, Lower Level

WARNING!



**Do not open or disassemble the inverter.
Attempting to service the unit yourself may result in a risk of electrical shock or fire.**

NO AC POWER OUTPUT STATUS illuminates the RED LED

Problems and Symptoms	Possible Cause	Solutions
No AC Power Output		
Status illuminates the Red Led		
Blinking Fast	Over input voltage (OVP)	<ul style="list-style-type: none"> • Check input voltage • Reduce input voltage
Blinking Slow	Low input voltage (UVP)	<ul style="list-style-type: none"> • Recharge battery • Check connections and cable
Blinking Intermittently	Thermal shutdown (OTP)	<ul style="list-style-type: none"> • Improve ventilation • Make sure ventilation openings in inverter are not obstructed • Reduce ambient temperature
Solid ON	Short circuit or wiring error Overload (OLP)	<ul style="list-style-type: none"> • Check A/C wiring for short circuit • Reduce load



TOP LIGHT
DC input voltage light

TROUBLESHOOTING

Inverter

12VDC to 120VAC
 Part # 35002
 1500 Watt, Sine Wave

Component Location
 UBB
 Lower Level

CENTER LIGHT INVERTER LOAD LEVEL					
LED STATUS	DARK	GREEN	ORANGE	RED	RED BLINK
SK1500	0 – 120W	120 – 495W	495 – 1125W	1125 – 1450W	OVER 1450W



CENTER LIGHT
Inverter Load Level

Center light will not be lit when the inverter is in stand-by mode, the inverter is turned off or if the GFCI outlet is tripped.

3-1-6 STATUS: DISPLAY POWER & FAULT STATUS		
GREEN LED	LED SIGNAL	STATUS
Solid (normal)	—————	Power OK
Slow Blink (power saving mode)	- . - . - . - . - .	Power Saving
RED LED	LED SIGNAL	STATUS
Fast Blink (plugged into shore power or reefer, running okay)	- - - - -	OVP
Slow Blink (out of battery power)	- . - . - . - . - .	UVP
Intermittent Blink (ventilation overheated)	- - - - -	OTP
Solid (inverter was overloaded)	—————	OLP



BOTTOM LIGHT

Status Light

This light is key to what is happening to the inverter.

TROUBLESHOOTING

Inverter

12VDC to 120VAC

Part # 35002

1500 Watt, Sine Wave

Component Location

UBB

Lower Level

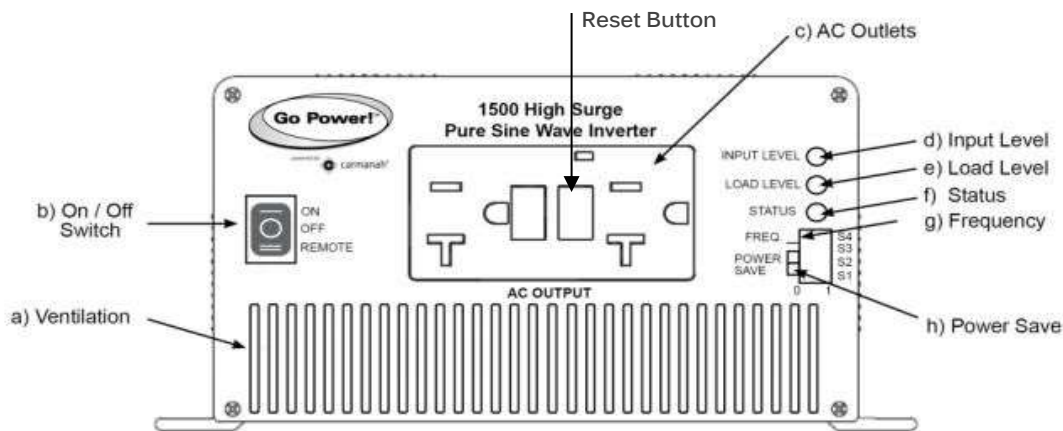
A permanent label/sticker is affixed to the UBB Cover. This information label contains helpful information.

GFCI Reset Procedures

1. Locate the GFCI Outlet, found on the end of the inverter.
2. Turn the inverter OFF using the black switch, located to the left of the white 120VAC outlet.
3. Turn the inverter ON using the black switch, located to the left of the white 120VAC outlet.
4. Push the Reset Button in within 5 seconds of turning the inverter switch to the ON position.

OR

1. Locate the GFCI Outlet found on the end of the inverter.
2. **Push and Hold** the Reset Button "IN".
3. Turn the inverter Switch to the OFF position.
4. Turn the inverter Switch to the ON position.



Letter Identifier	Component Name	Main Function
a)	Ventilation Ports	Do not obstruct, allow at least one inch for airflow
b)	ON/OFF Switch	Leave ON/OFF switch in the OFF position during installation. Leave in REMOTE position when using optional remote.
c)	AC Outlet	Ground Fault Protected (GFCI) Outlet sockets available (North America)
d)	Input Level	Displays input voltage. Green indicates normal battery level, yellow indicates mid to low battery level and red indicates under/over voltage.
e)	Load Level	Displays AC load watts. Green indicates normal operation; yellow indicates mid to high operation and red indicates overload levels.
f)	Status Level	The LED display indicates the power status of the inverter Solid Green: AC Power Okay Flashing Green: Power Saving Active Fast Red Blink: Over Voltage Protection (OVP) Slow Red Blink: Under Voltage Protection (UVP) Intermittent Red Blink: Over temperature Protection (OTP) Solid Red: Overload Protection (OLP)
g)	Frequency	Typical North American setting is 60 Hz. Set dip switch S4 to "0" for 50 Hz and "1" for 60 Hz.
h)	Power Save	Puts inverter to sleep until a load is present. Adjustable by the dip switches: S1, S2 and S3 on the front panel.

TROUBLESHOOTING

Inverter

12VDC to 120VAC	Component Location
Part # 35002	UBB
1500 Watt, Sine Wave	Lower Level

Inverter Diagnostics

The inverter has all the indicators in place to determine why it is or is not working.

The top indicator light is the Input DC voltage

The bottom indicator light is green or flashing green when the inverter is ON or in stand-by mode

The center indicator light is only lit when an inverter load is present, Green = Okay, Red = Too High

The GFCI has its own indicator light that replicates the bottom light (status) Green or Flashing Green.

If the bottom light is RED the GFCI indicator light will not be lit because the inverter is shut down when the status light is RED.

The inverter is fused internally with non-replaceable fuses. The inverter fuse power from the AGM battery bank is located in the APU, exterior frame mounted unit, above the battery separator.

The inverter can be used as a diagnostic tool.

- The top light is for battery voltage level input
- The center light is for load light green = Okay, Red = Too High
- The bottom light is why the inverter shut down (Red Light = Overload), (Flashing Red = Battery voltage too low)
- The bottom light gives the current state of the inverter, Green = OKAY, Flashing Green = Stand-By

TROUBLESHOOTING Ignition Cutout Circuit

Component Locations

Connected to the back side of the UBB

Starts at a truck specific ignition source and powers the UBB ignition relay

1" Relay
is ignition

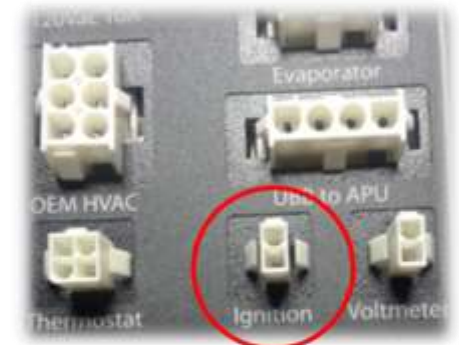


Description & Application

- The DC ignition cutout circuit is used to disable the APU system when the truck's engine is running.
- The ignition cutout circuit sends fused 12VDC power from the ignition source to the UBB.
- The ignition cutout circuit cuts the 12VDC power to the thermostat when the truck's engine is running.

Issues

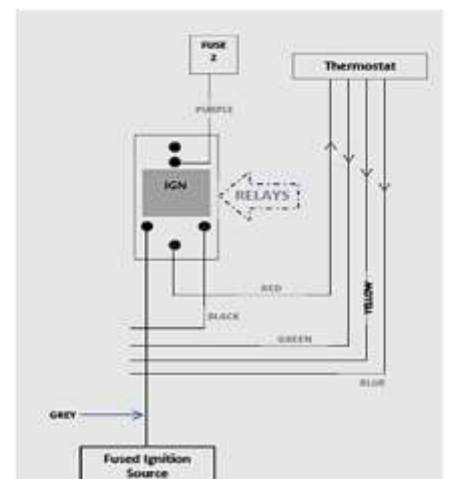
1. The ignition cutout circuit has been installed incorrectly on rare occasions. When the installation instructions are not followed, the ignition cutout circuit is connected to the accessory circuit instead of an **ignition only** circuit. This causes the APU air conditioner or heater to shut off whenever the truck's ignition key is moved to the accessory position.
2. The APU system user turns the ignition key to the ON position without turning the air conditioner to the OFF position (thermostat). When the user turns the ignition key back to OFF, the APU air conditioner is forced to start without a 5 minute delay. The air conditioner start attempt (forced) under these conditions may overload the inverter.



Ignition harness plugs
into the back of the UBB

Service

1. The ignition circuit does not require service.
2. The ignition cutout fuse location varies by truck application.
3. The ignition cutout fuse is located within 12 inches of the ignition connection point.
4. Freightliner and International trucks begin the ignition cutout circuit at the ignition key.
5. The Mack ignition cutout circuit begins at the dash panel (passenger side, top).
6. The Kenworth ignition circuit begins in the fuse panel, on the floor behind the brake pedal.



Do not use the truck's ignition to turn off the air conditioner.

Always use the thermostat switch to control air conditioning and heat functions.

TROUBLESHOOTING

Thermostat

Part # 37012

Component Locations

Bunk, Above Bed, Side Wall or Closet



Common Failure Issues

The user fails to understand that the left System switch in the A/C mode has a 5 minute delay between ON then OFF then ON. This causes confusion and is dealt with by instructing the driver to place the right switch in the AUTO position to see if the thermostat is in the 5 minute delay window. If the evaporator fan is not running when the System switch is in COOL mode, the thermostat is in the 5 minute delay mode.

Operate the thermostat with the Fan switch in the ON position. The ON position eliminates the need to start the evaporator blower fan and the compressor at the same time.

Description and Application

- The thermostat contains a LCD display and two slide switches.
- The thermostat uses two AA batteries to power the display and to send switch signals to the relay group.
- Do not use the truck's ignition to turn off the air conditioner. Always use the thermostat mode switch to control air conditioning and heat functions.
- The left slide switch, or System switch, is used to turn on the air conditioner or heat on. The center position of the left slide switch turns the system OFF.
- The right slide switch has two positions marked AUTO & ON.
- The AUTO position is used if the system user wishes to have the air conditioner's evaporator fan turn on and off with the air conditioning compressor circuit. Leaving this switch in the ON position will continuously run the evaporator fan regardless of the compressor's current mode.
- Place the Fan switch in the ON position for best system performance. Placing the thermostat fan switch in the ON position will eliminate 10% of the inverter start up power needs.
- A low Voltage Battery Indicator Icon is shown on the display when the AA batteries need to be changed.

Air Conditioning Mode

1. Move Thermostat mode switch to COOL
2. Move Thermostat fan switch to AUTO
3. Set the temperature at least 5 degrees below current room temperature

Heat Mode

The thermostat is used to turn on the coolant heater and the heat relay. When the thermostat is in the HEAT mode, 12V DC power is provided to the truck's bunk blower fan. **The temperature settings are NOT used in Heat mode, the truck's bunk controls are used to provide bunk heat temperature control.**

TROUBLESHOOTING

Thermostat

Part # 37012

Component Locations

Bunk, Above Bed, Side Wall or Closet

Technical Information

The thermostat can be separated from its mounting base.

The mounting base contains terminals for the wiring harness that runs between the thermostat and the UBB.

The thermostat is used to operate the relay group located in the UBB.

The thermostat is supplied with 12VDC Power from the 2AMP fuse located on the front of the UBB.

The 12 VDC power enters the thermostat base on the red wire, R terminal (jumped) to a second R marked terminal.

The thermostat switch positions determine where, how and when 12VDC power is sent to the UBB relay.

- G Terminal - Green wire; 12VDC to the Evaporator Relay
- Y Terminal - Yellow Wire; 12 VDC to the Compressor Relay
- B terminal – Blue Wire; 12VDC to the Heat Relay

The back side of the Thermostat includes three DIP switches that need to be in the proper position for the thermostat to function properly

1. CONV/HP = HP
2. F/C = F
3. HE/HG = HG



- 1** Room Temperature.....Displays the current room temperature
 - 2** Reset Button.....Resets thermostat back to factory defaults
 - 3** Low Battery IndicatorIndicates when the batteries need to be replaced
 - 4** System Switch.....Selects system preference
 - 5** Quick Reference InstructionsStored in slot at top of thermostat
 - 6** Fan IndicatorIndicates when the system fan is running
 - 7** System Status Indicator...Displays information about the status of the system
 - 8** Arrow ButtonsUsed to increase or decrease settings
 - 9** Set TemperatureDisplays the current set point temperature
 - 10** Fan Switch.....Selects the system fan mode
- Battery Compartment.....Located in the back of the thermostat

Switch	Factory Default
CONV / HP	CONV
F / C	F
HE / HG	HG

Thermostat
DIP Switch
Settings

Wiring Terminations

Terminal	
Rc	Red Wire, 12VDC IN from Thermostat harness
Rh	
O	Not Used
B	Blue wire, Heater ON
Y1	Yellow wire, Compressor ON
G	Green wire, Evaporator ON
W1	Not Used
C	Not Used

TROUBLESHOOTING

Shore Power

Location: Shore Power Plug, outside of the truck



Description and Application

1. The converter changes incoming 120V AC power (shore power) to 12V DC power. Shore power charges the AGM batteries and the truck's starter batteries.
2. The Power Converter (Shore Power) has a rated amperage output of 55 amps DC. The air conditioner uses less than 50 amps DC.
3. If the Power Converter's DC voltage rises past 13.2V DC, the battery separator closes and connects the battery bank to the truck's battery bank.
 - a. If the combined voltage of both battery banks remains above 12.8V DC, they will remain connected and receive a charge from the Power Converter.
 - b. The Power Converter's 120V AC circuit begins on the truck's exterior with a covered receptacle (male) that is used to receive the female end of an extension cord.
 - c. The Power Converter's DC circuit begins at the bulkhead DC connection posts on the lower back corner of the UBB.
4. Shore Power can be checked to verify proper operation by checking the voltage level of the AGM battery bank. The voltmeter will have more than three lights lit if shore power is working.
 - a. Before shore power is plugged in, check the voltage level of the AGM battery bank.
 - b. Count the number of lights lit on the voltmeter
 - c. Plug into Shore Power
 - d. Check the number of lights lit on the voltmeter. The number lit should be greater than the number lit prior to plugging into Shore Power.



TROUBLESHOOTING

Coolant Heater

Part # 42001

Component Locations

Truck Exterior

Frame Rail Unit

Top Level, Left Side



The Coolant Heater consists of:

- Webasto TSL17 Coolant Heater
- Dosing Pump (Fuel Pump)
- Fuel Filter & Fuel Circuit
- Coolant Circuit

Service

1. The coolant heater module requires a fuel filter replacement at the beginning of each winter season, part # 42002.
2. The heater exhaust needs to be checked for restrictions and obstructions.
3. The heater combustion air intake needs to be checked for restrictions and obstructions.

Common Issues

The coolant heater module is trouble-free. However, issues exist that prevent the heater from starting after a period of non-use.

1. Check the fuel filter to make sure that fuel is present.
 - a. If the tank fuel pick-up tube is not properly located in the fuel tank or if the truck was run out of fuel, the fuel filter may be void of fuel. The fuel filter will need to be primed if the fuel filter does not have fuel present.
2. The coolant heater module will shut down if the heater overheats.
 - a. Overheating will take place if the coolant circuit has its coolant supply cut off (closed valves).
3. If the coolant heater shuts down 5 times, the heater will not attempt to re-start unless the 12V DC power plug is removed and re-installed into the socket (heater reset procedure).



Top of Coolant Heater
(Oval connector is power
connector, left)

TROUBLESHOOTING

Bunk Heat

Description and Application

- The APU heater warms the bunk using the bunk's heater core and blower fan.
- The heater does not control the bunk's temperature by the thermostat. The heater uses the truck's factory heat controls to warm the bunk area.

To test the coolant heater and bunk fans:

1. Turn the truck's key to the ON position
2. Turn on the bunk's blower fans and confirm operation in all speeds
3. Turn the truck's key to the OFF position
4. Turn the switch that controls the bunk's blower fans and confirm that the fans DO NOT operate.
5. Turn on the heater by moving the mode switch to HEAT
6. Turn on the bunk's blower fans and confirm operation in all speeds

If the bunk blower fans do not operate with the thermostat in the heat position:

1. Check the fuses located on the right front corner of the UBB
2. The lower 3 fuses control the bunk's blower fan when the heater is turned ON
3. Check the 6 wire connector at the back of the UBB – make sure it is plugged into the socket
4. Confirm that key is in the OFF position



TROUBLESHOOTING

Evaporator

Part #91307

Component Locations
 Bunk area
 In or on the closet
 On a Bunk sidewall



Description & Application

- The evaporator module contains an evaporator coil, an electric blower fan, and an expansion valve.
- The evaporator's blower fan is a single speed, 120VAC fan, controlled by the thermostat switch settings and the Relay Group.
- The evaporator coil and expansion valve control 134A refrigerant.
- The evaporator module has two refrigerant hoses, a drain hose and a power cord exiting out the bottom of the module.
- The refrigerant and drain hoses leave the bunk area through a 2.5" hole drilled into the base of the closet.
- The evaporator includes an aluminum filter (rear location).
- The evaporator module weighs 25#s.
- The evaporator module is installed into the living area of the bunk.

Service

The evaporator has a removable aluminum filter that must be cleaned (water) in order to maximize performance.

History of Issues

The evaporator must be maintained in a way that allows air to reach the rear side, filter.

Keep personal belongings away from the evaporator's air intake (coil & filter)

During installation, ensure that the screws used to secure the evaporator are not driven through the refrigerant core or the blower motor.

**Suggestion: place the right thermostat switch into the ON position, not the AUTO position.
 Leaving the thermostat in the ON position when in air conditioning mode
 will keep the room in a consistent temperature range.**

Trouble Shooting

- The evaporator fan receives its 120V AC power from the inverter. The inverter must have a green status light or a flashing green status light to enable the evaporator fan.
- The thermostat must have its fan switch in the ON position to activate this fan motor OR the thermostat must be in the COOL mode with a temperature set to below the current bunk temperature.
- The thermostat sends 12V DC to the evaporator relay.
- The evaporator relay (UBB, ice cube relay) passes through 120V AC when the relay coil receives 12V DC power (green wire) from the thermostat.
- The connection point for the evaporator is the UBB back side, 3 pin connector, 2nd from the top, marked EVAPORATOR.
- The outside pins are used to test for 120VAC power, red and white wires.