



**Series 5000 Troubleshooting and Parts Book**

## Series 5000 Troubleshooting Guide and Parts Book

The Troubleshooting Guide is available on pages 3-15. The Parts Book is available on pages 16-18.

### System Check for Series 5000

These items are essential for the operation of the Series 5000:

- 1) eAPU Batteries ideally at 12.8 VDC- above 11.5 VDC to start/operate
- 2) No Red LED fault lights on controller
- 3) Ignition on the truck is turned off
- 4) No blown fuses
- 5) Clean DC harness connections
- 6) Clean Evaporator filter
- 7) DC converter output over 20 VDC
- 8) Compressor speed signal over 2 VDC at the compressor
- 9) Truck is not running from Start-Stop system operation
- 10) Correct amount of refrigerant in the system

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## Fault Conditions

## Controller has RED led light on for Low Pressure, system does not run.

Fault: Low Pressure

Symptoms:

- Total system will shut off
- Low pressure switch located in the evaporator
  - Check with multi meter for open/closed continuity to confirm if LED does not reset itself.
- Once the low pressure switch reaches operating pressure the whole system will automatically run again

Possible causes:

- low evap airflow
  - blower fan is not running (blown fuse)
  - dirty filter
  - frozen coil
- -low refrigerant pressure
  - Under-charged

Refrigerant Leak Fault: Blown Fuses

- Find the fault that caused the fuse to blow before replacing any fuses
  - Evaporator Fan 25A
    - In the condenser fuse box

## Controller has RED led light on for Low Voltage, system does not run.

Fault: Low Voltage Disconnect

- Batteries are drained to a point of no longer running
- Total system will shut off
- The controller will 'latch' when low voltage occurs
  - Once it gets below a threshold voltage the controller shuts off and will not turn back on by itself by design
- To reset the on/off button needs to be pressed twice to run again-
  - one will take it out of low voltage, the second will turn the system back on
- The system may run for a short time and shut off again if the batteries are not charged after a low voltage disconnect- **this is normal operation- the batteries need to be charged**
- The system may not turn back on due to low voltage at the batteries- switch may have poor performance turning the system on.
  - This is due to the batteries rebounding in voltage slightly when the load is removed- allowing an acceptable voltage for a short period of time
- The low voltage light can also come on if the input voltage is too high (>15VDC)
- Batteries should be charged for a few hours before trying to run the system again
- Check all DC harness connections for corrosion
  - Corrosion can lead to voltage drop and early LVD activation
    - Batteries
    - Cables from battery box to Condenser

- Condenser studs
- DC converter
- Condenser Harness
- Test all batteries in the system- both the truck and the eAPU batteries individually. Use a battery load tester to ensure all batteries are healthy and up to specifications from the battery manufacturer.
  - Suggested tester Midtronics EXP1000HD

### Evaporator blows warm air instead of cooling. High Ambient Temperatures

Fault: High Head Pressure

Pressure switch located in the condenser

- Check with multi meter for open/closed continuity to confirm if system does not reset and run.
- Condenser and Evap fan will continue to Run when switch is tripped
  - Ensure the Condenser fan is running – check the Condenser fan fuse in the fuse box in the condenser on the back of the cab.
  - Ensure there is no obstructions for the condenser fan- it should spin freely by touching with a screwdriver.
- Compressor will not run
- Compressor speed line runs through the high pressure switch
  - Compressor speed voltage will be anywhere from 1 VDC to 6 VDC if measured
- When pressure comes back down the compressor will start again automatically
- There is no warning light on the controller for high head pressure fault
- The Fan(s) may increase in speed when the high head pressure switch trips.

Fault: Blown Fuses

- Find the fault that caused the fuse to blow before replacing any fuses
  - DC Converter 150A
    - fuse between condenser stud and DC converter
  - Compressor Speed 2A
    - In the condenser fuse box
  - Condenser Fan 25A
    - In the condenser fuse box
    - Ensure the Condenser Fan is free of debris in the fan housing

### System Does not run/turn on

No Green LEDs on the controller lit. No Red LEDs lit.

- a. Fuses
  - Find the fault that caused the fuse to blow before replacing any fuses
    - i. Main power – 250A
      1. Located in the Battery Box
      2. Find the cause of the blown main fuse

- ii. Controller power- 5A
  - 1. Located in the fuse box in the condenser on the back of the cab
  - 2. Find the cause of the blown HVAC power fuse
- iii. If no blown fuses
  - 1. Harness – see harness trouble shooting section

### One Green LED on controller lit.

On/off button turns on 2<sup>nd</sup> green LED- but system does not run- with no RED LEDs lit

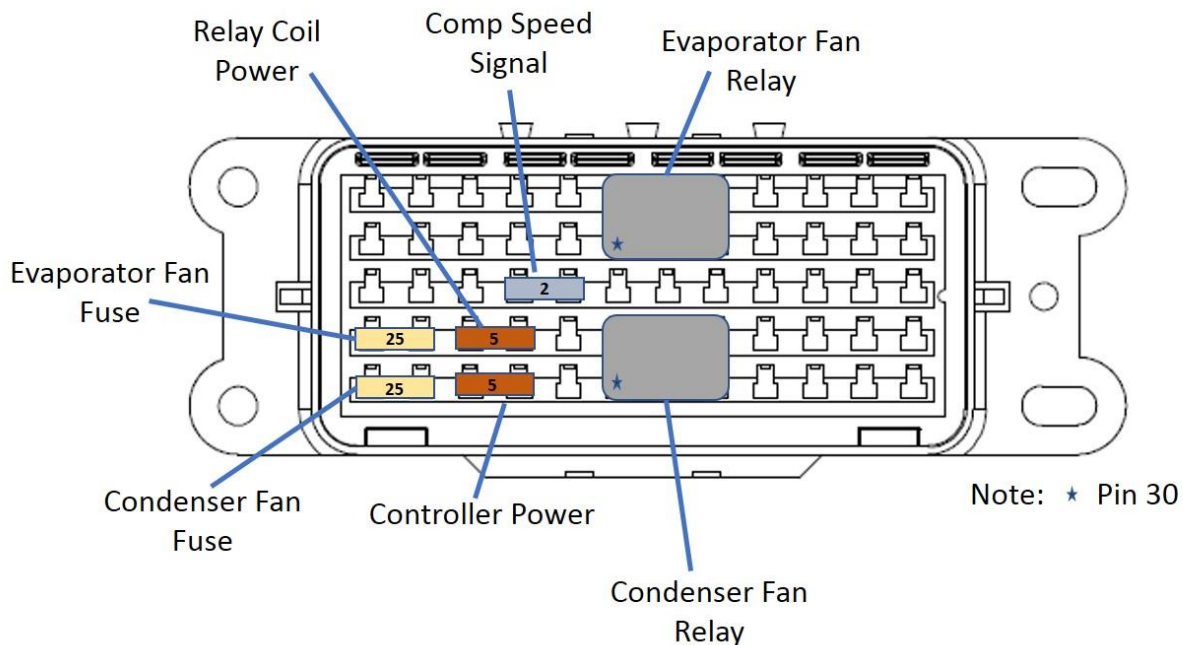
- Fuses
  - Find the fault that caused the fuse to blow before replacing any fuses
    - 1. Relay Coil Power fuse 5A
      - a. Located in the fuse box in the condenser on the back of the cab
      - b. Find the cause of the blown Relay Power fuse
    - 2. Evaporator Fan – 25A
      - c. Located in the fuse box in the condenser on the back of the cab
      - d. Find the cause of the blown Condenser fan fuse
        - i. Make sure condenser fan can spin freely- no obstructions
  - iv. Harness- see harness trouble shooting section
- b. On/off button does not turn on 2<sup>nd</sup> green LED
  - i. Ensure the truck ignition is off- remove keys
    - 1. Try the on/off button again – the system will not run with the ignition on
  - ii. Start-Stop system is running the truck
    - 1. Turn the rocker to the off position on the controller (Truck will shut off)
    - 2. Try the on/off button again- the system will not run when the truck is running
  - iii. Harness – see harness trouble shooting section

### Fuse Faults

- Find the fault that caused the fuse to blow before replacing any fuses
  - Main power – 250A
    - System will not run if blown or removed
    - Located close to the battery positive (+)
    - Green Power LED on the controller will not be on (Green power LED otherwise is always on)
  - Condenser Fan – 25A
    - Condenser fan will not run when compressor is running
    - This can lead to high head pressure trips
    - Ensure the condenser fan is clear of debris
  - Evaporator Fan – 25A
    - Blower fan in evaporator will not run when the system comes on
    - Blower should always run at its selected speed when the system is on and no other

- faults are present
  - This can lead to low pressure faults
- Variable speed – 2A
  - Compressor will not run
  - The controller runs the speed signal to the compressor through this fuse
- Controller Power- 5A
  - Controller will not turn on (Green power LED will not be on)
  - System will not run
- Relay Coil Power -5A
  - Condenser fan and blower fan will not run
  - compressor will run
  - supplies power to the coils of the relays in the PDC in the condenser
  - this can lead to high head pressure trips and/or low pressure trips
- Converter -150A
  - Compressor will not run – condenser and evaporator fans will run
  - Located in the condenser inline to the battery input into the DC converter (not in the fuse box)

### Fuse Box Diagram



### Harness Function Check

Inside the Evaporator – remove the cover bolts to access.

- 1) Unplug the harness at the black 6 terminal connection on the back of the controller.

- 2) Use a small jumper wire/pin small enough to go between the terminal contacts.
- 3) Jump the ground (Black) Terminal to the Yellow wire inside the connector momentarily.
  - a. The evaporator fan should turn on
- 4) Jump the ground (black) terminal to the green wire inside the connector momentarily.
  - a. The condenser fan should turn on



### Ignition Harness function check

Inside the Evaporator – remove the cover bolts to access.

- 1) Turn the truck ignition to the off position- remove keys
- 2) Check to see if the on/off button turns the system on/off
- 3) If it continues to not turn on/off – unplug the flat black four pin connector with the Violet, Orange, Blue and Green wires (note there are two black flat four pin connectors)
- 4) Try to start the system with the on/off button
  - a. If the system now turns on/off – measure the voltage on the four pin connector leading out of the evaporator. Use the Blower fan ground wire for ground reference.
  - b. There should not be voltage on the Violet or the Orange wires.
  - c. Turn the ignition on the truck to the On position.
  - d. There should now be voltage on the Violet Wire. Approximately 12 Volts.
  - e. If there are faults with these voltage readings, check the Start-Stop harness wiring and relay under the dash



### Start-Stop Ignition Harness

Under the dash check that all wires are plugged into the start-stop relay and the controller connections. Wiggle test for harness connections.

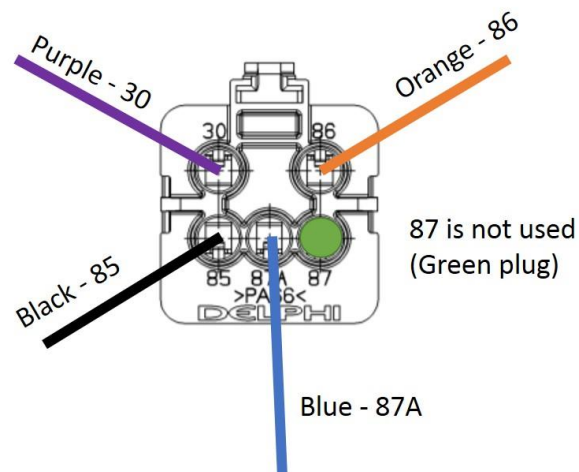
- 1) Turn the truck ignition to off- remove keys



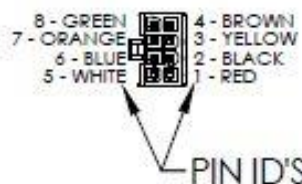
- 2) There should be no voltage on violet output wire
  - a. If there is voltage on the violet output wire check harness to truck ignition.
- 3) Turn the truck ignition to on
- 4) Voltage should be present on the Purple output wire.
  - a. If there is no voltage check the harness to the truck ignition
- 5) Using the IFS test harness (P/N 922029) Plug in the test harness
 

**Warning** the truck will start approximately 10 seconds after the harness is inserted, if all safeties are met (hood, parking break, ignition off, neutral gear)

  - a. Measure the output voltage on the orange wire into the relay.
    - i. There should be voltage present on the wire
    - ii. If not check the harness to the Start-stop controller
  - b. Check to make sure that the relay opens when voltage is present to the orange wire
  - c. There should be no voltage present on the output violet wire
    - i. If there is voltage on the violet wire check the relay connections, ground, power and all other connections including the fuse into the harness



- 6) Remove the test harness- the voltage on the orange wire should now not be present. (The truck should now shut off also)



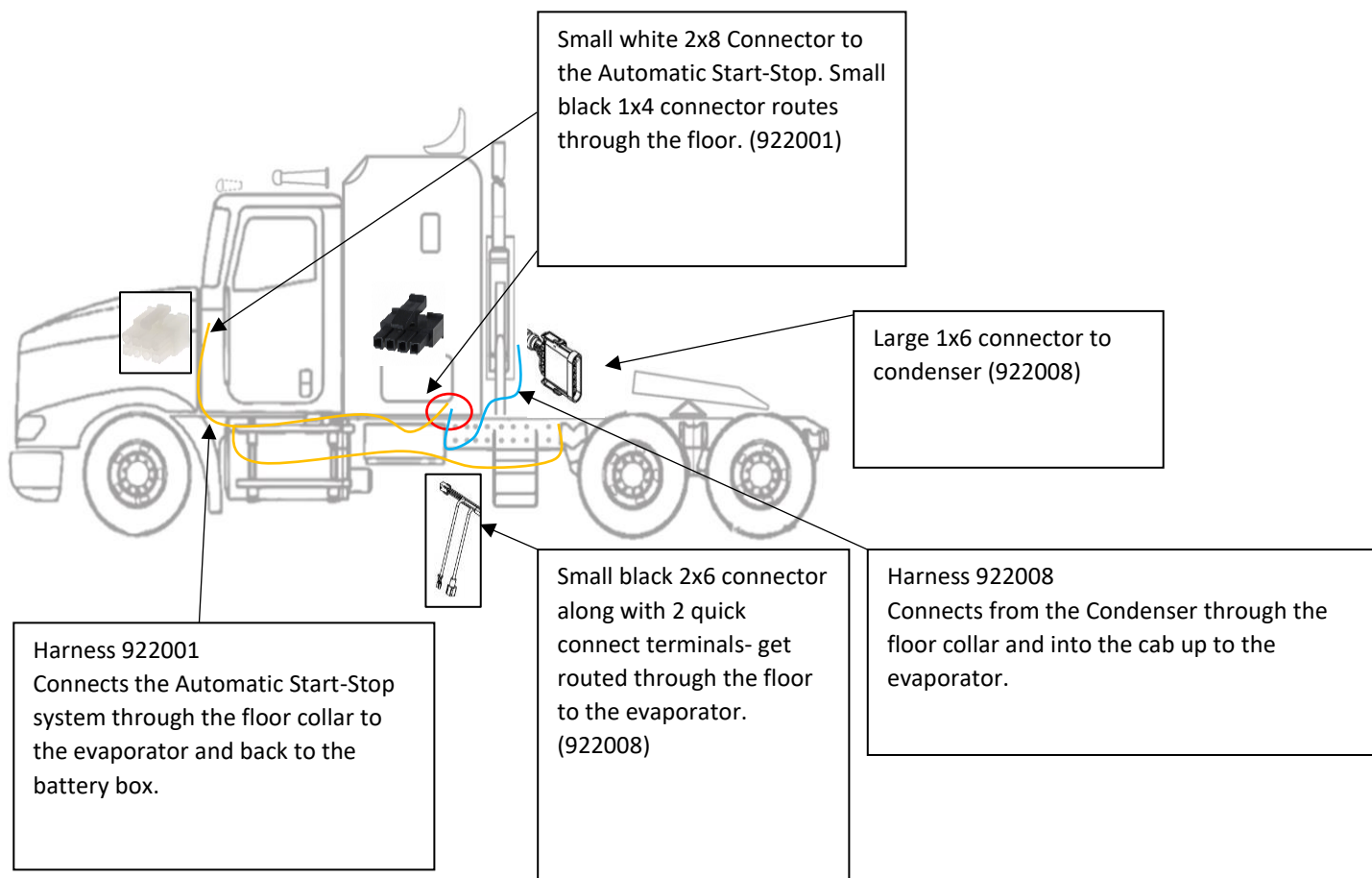
### Start-Stop Battery Box Harness

Under the dash check that all wires are plugged into the start-stop relay and the controller connections. Wiggle test for harness connections.

- 1) Unplug the 8 pin white connector going into the start-stop controller
- 2) Using a multi meter measure the voltage between the black and red pin wires
- 3) This voltage should match the voltage of the eAPU batteries in the battery box
- 4) If this does not match the voltage check the Start-Stop harness connections in the battery box and the harness integrity – harness runs under the cab from the battery box and into the front of the firewall on most installations.
- 5) Check the fuse in the battery box in the start-stop harness- should be an inline 10A fuse in a fuse holder on a red 18AWG wire leading to a ring terminal on the positive battery stud.

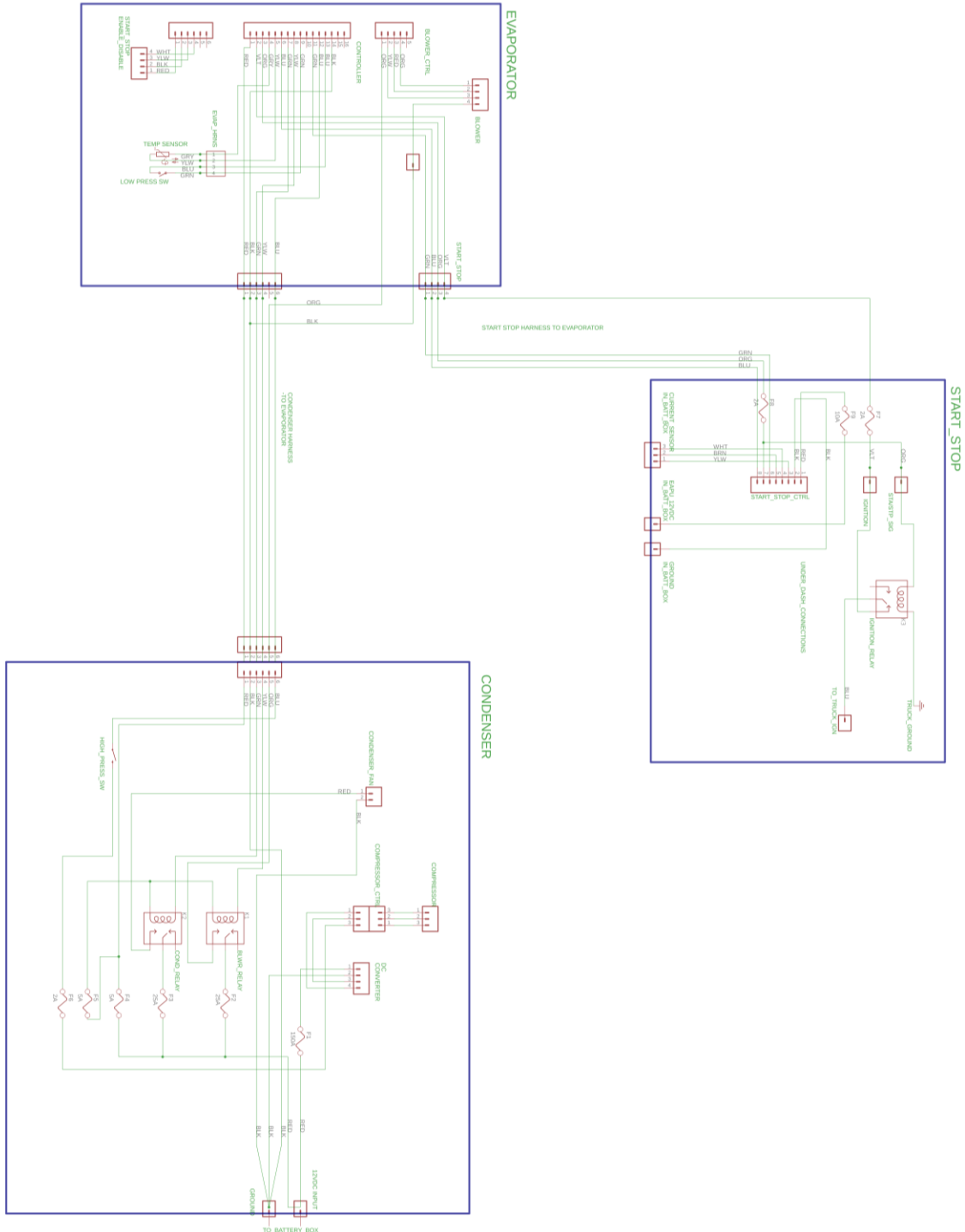


### Series 5000 Harness Layout



# Series 5000 Schematics

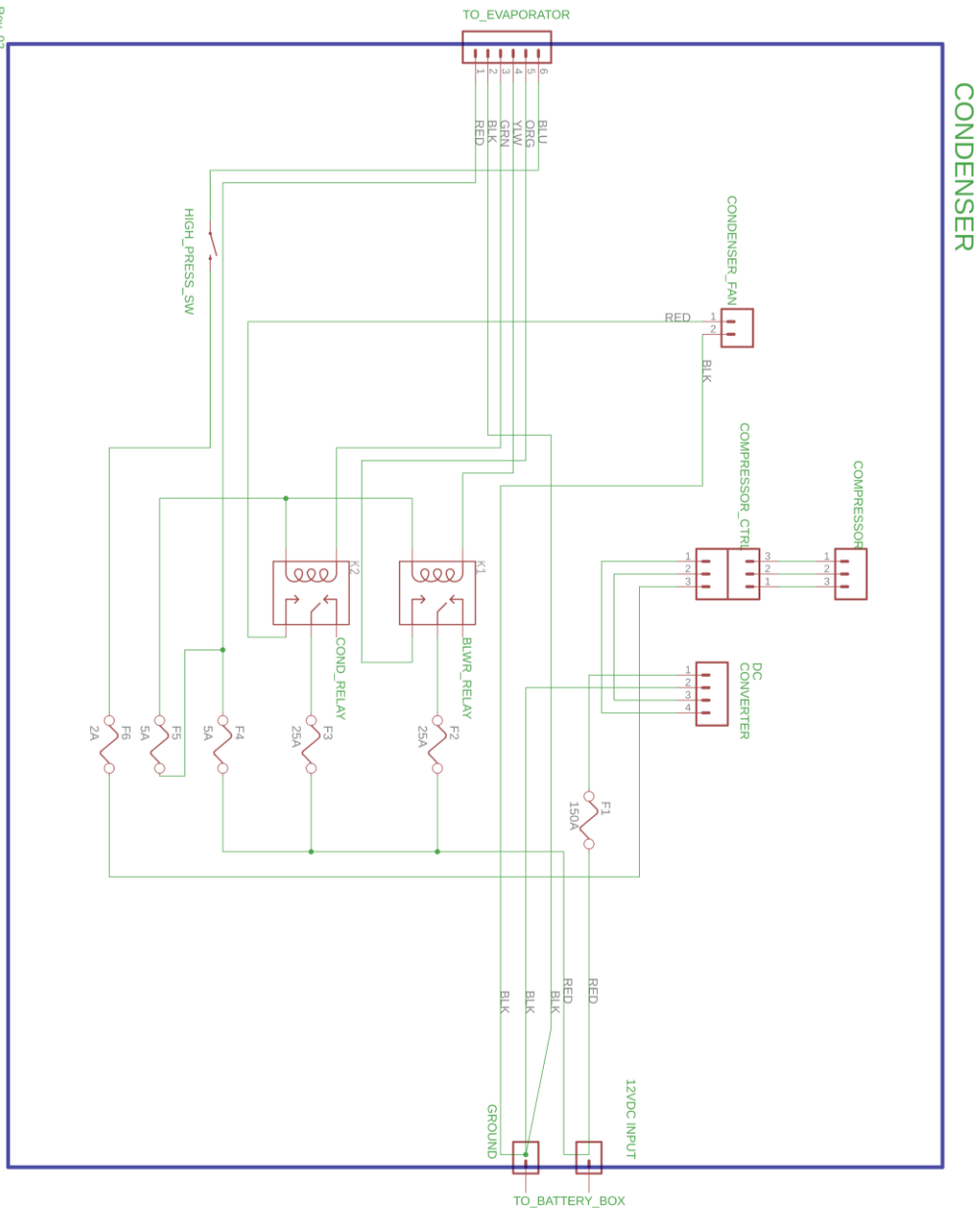
## Full System



REV 0

Condensate return lines, caps and drawings introduced in this document are strictly confidential and are subject to the understanding that they will be held confidential and not disclosed to third parties without the prior written consent of Idle Free and Volvo B&O.

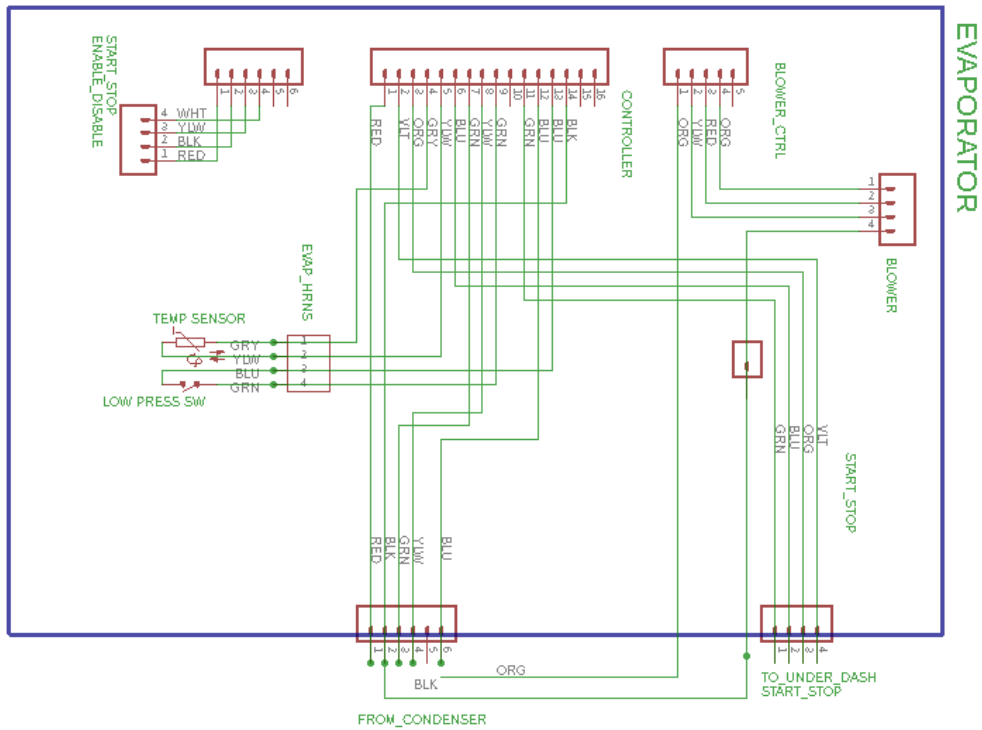
# Condenser



Rev\_02

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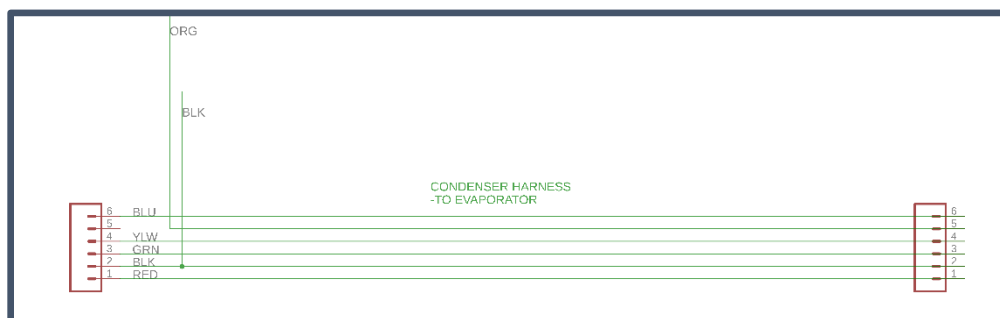
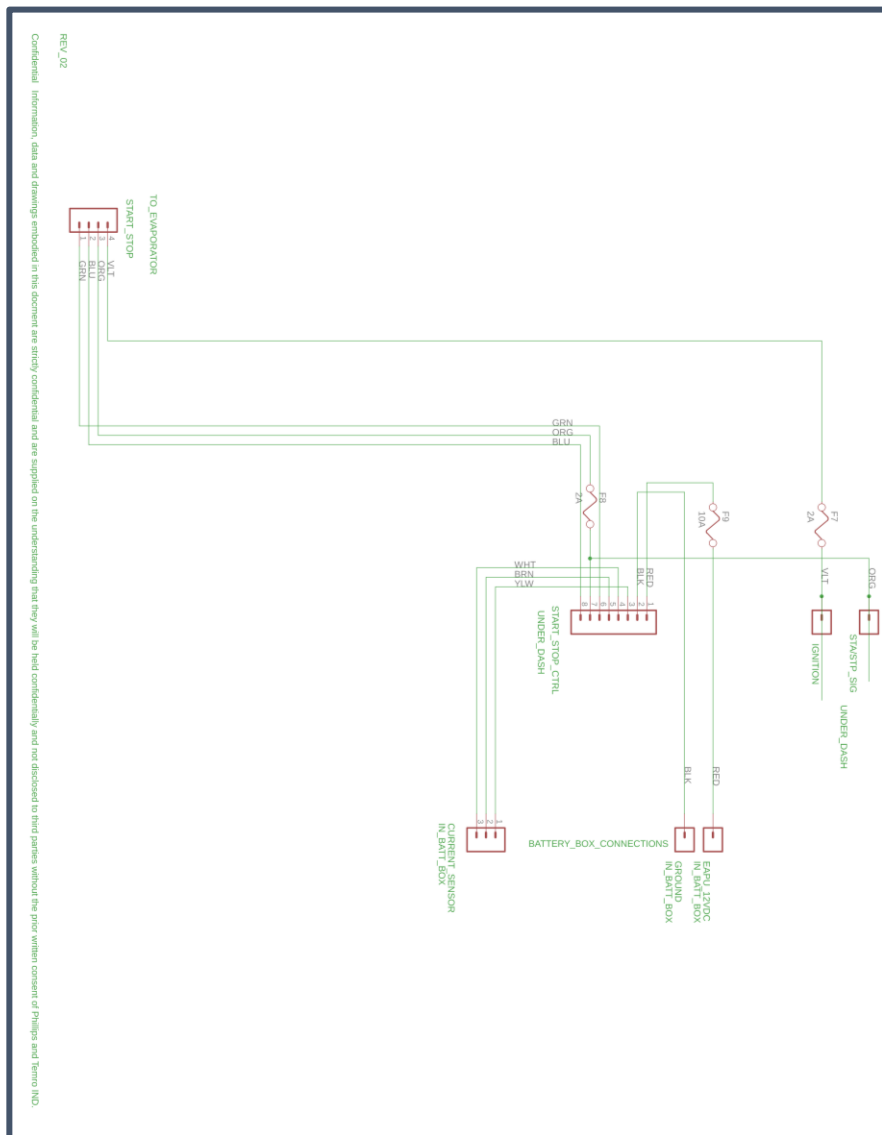
# Evaporator



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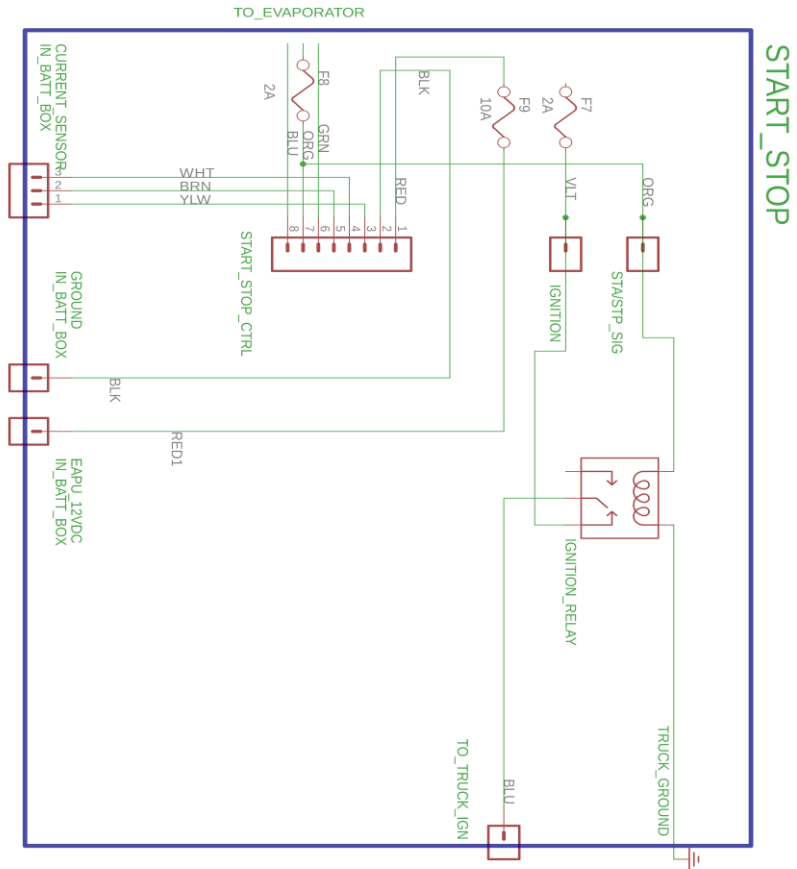
# Harnesses



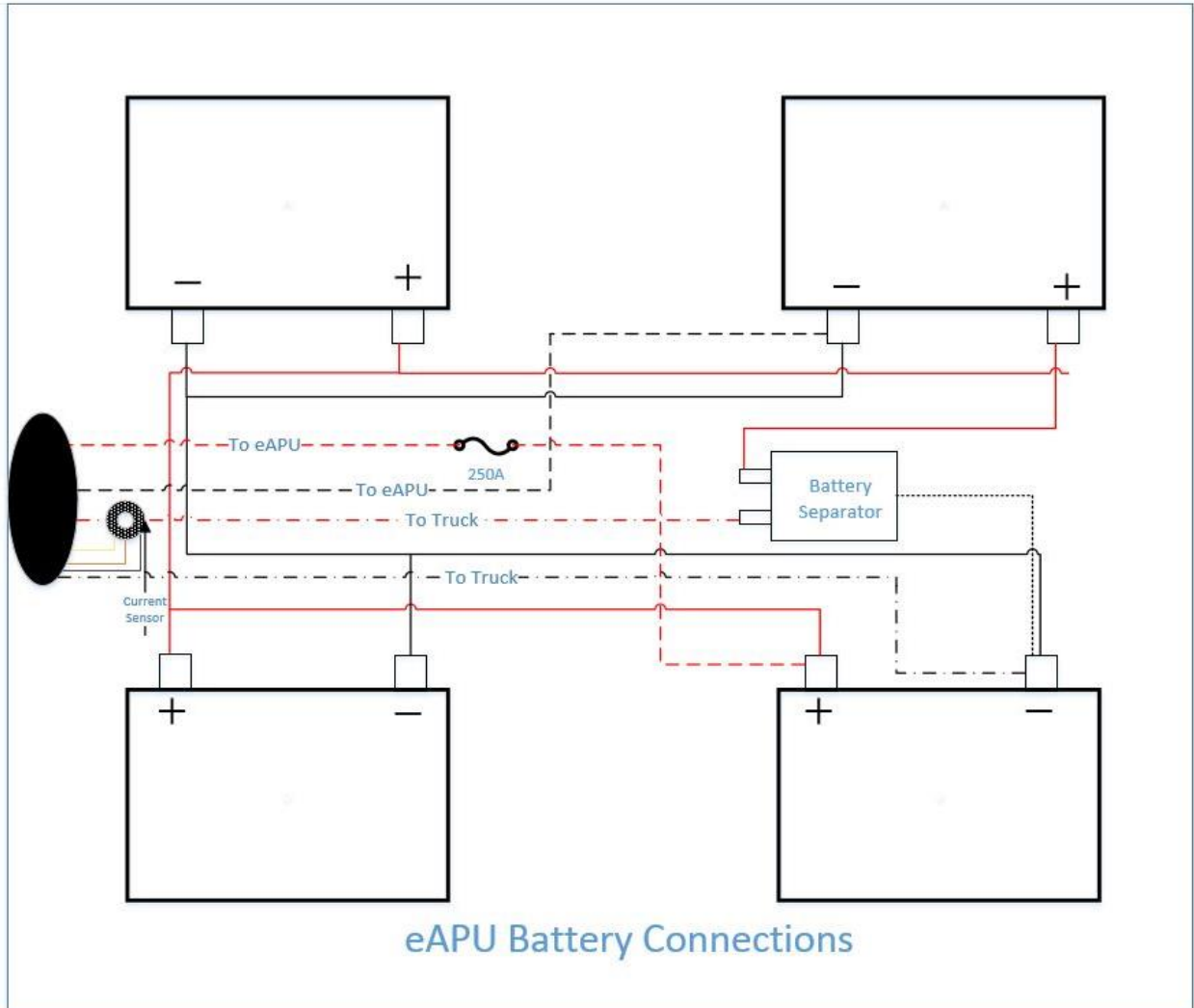
# Start-Stop System

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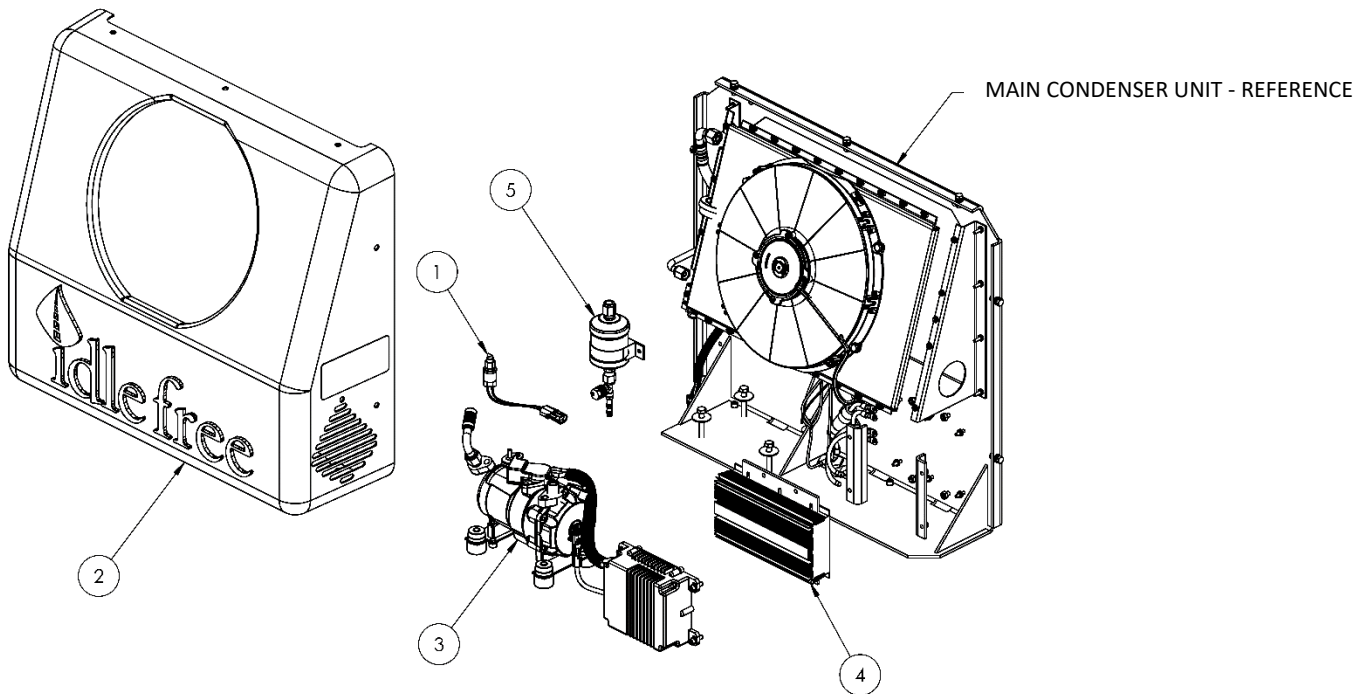
### Battery Box





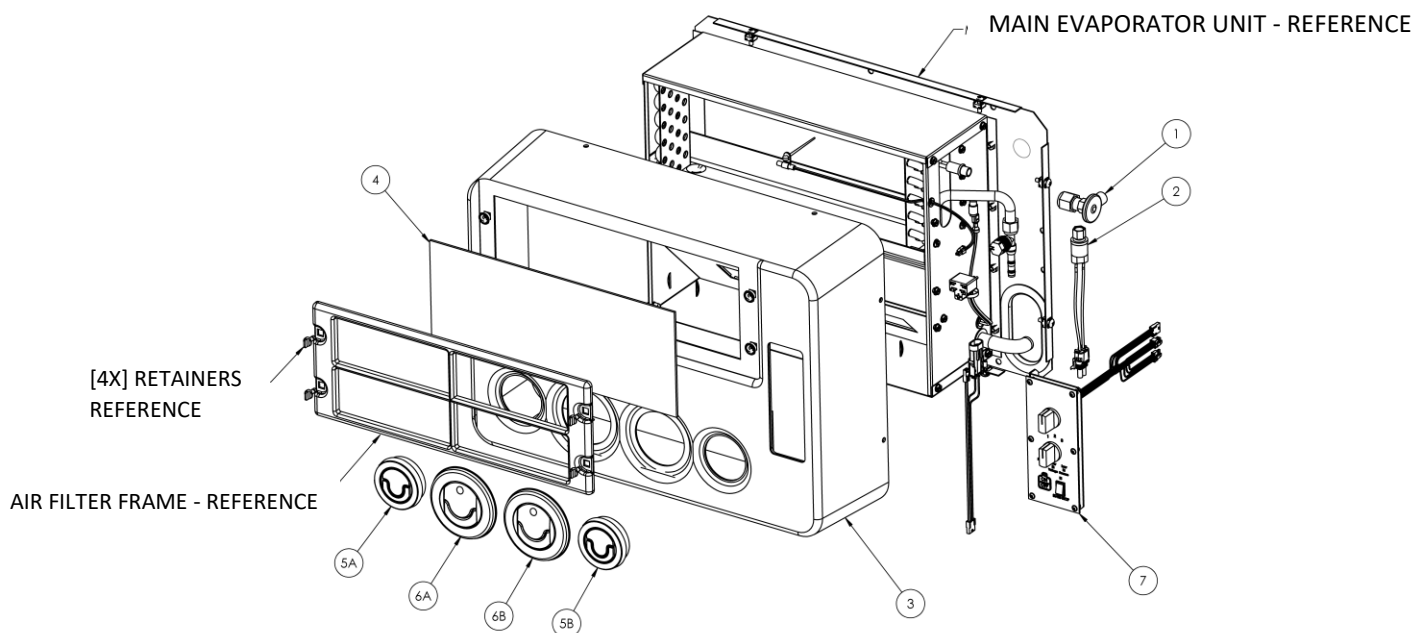
## Parts Book

### CONDENSING UNIT:



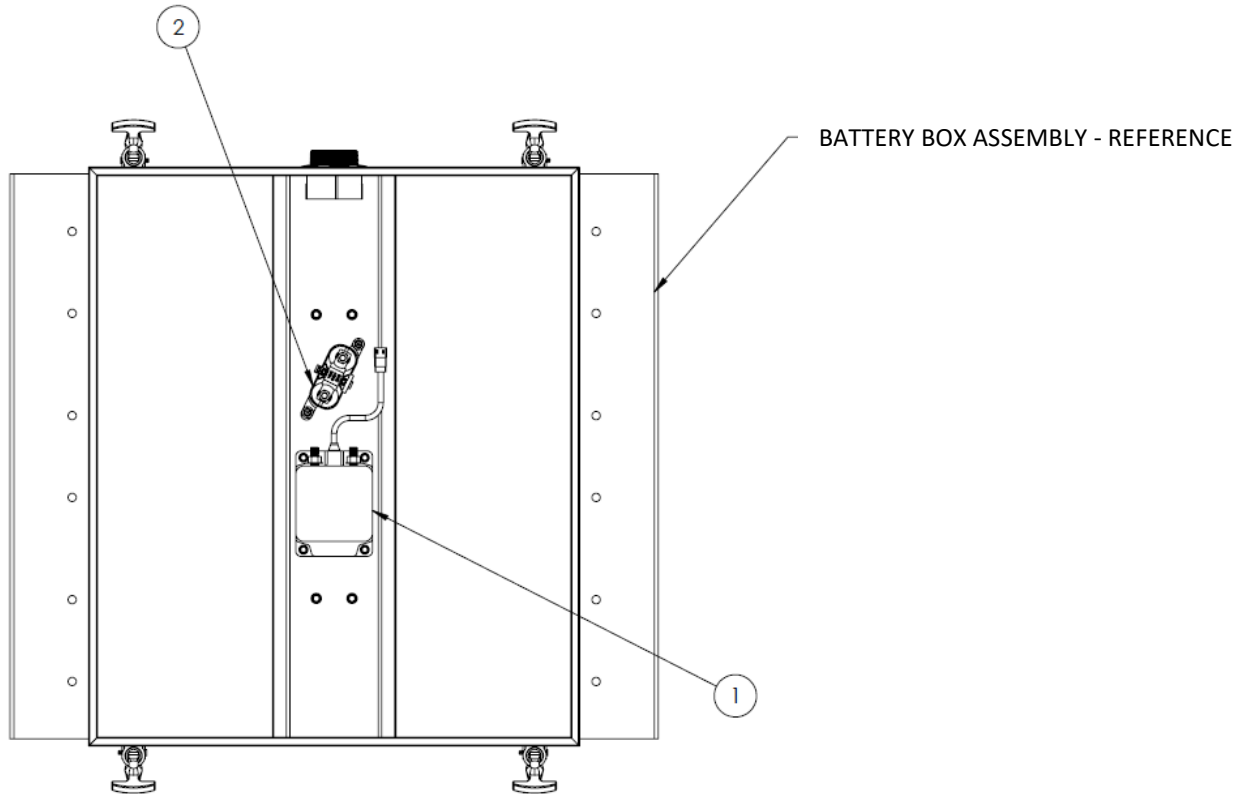
ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY
1	8720010	HIGH PRESSURE SWITCH	1
2	8720011	COVER KIT, CONDENSER, SPARE PART	1
3	8720015	COMPRESSOR	1
4	8720016	DC CONVERTER	1
5	8720017	FILTER, DRIER	1

# EVAPORATOR



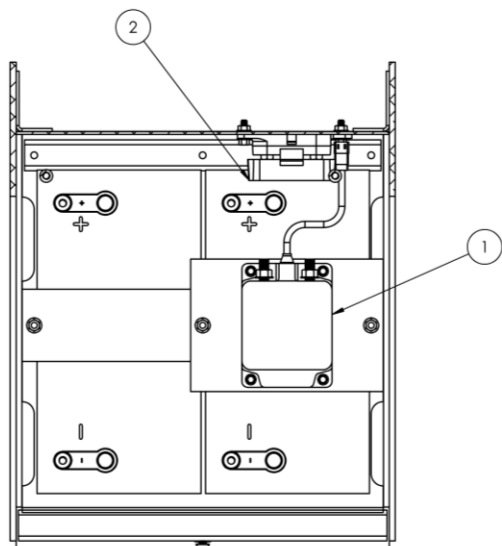
ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY
1	8720012	THERMAL EXPANSION VALVE, 1.5T	1
2	8720013	LOW PRESSURE SWITCH	1
3	8720014	COVER KIT, EVAPORATOR, SPARE PART	1
4	8720018	FILTER, MESH, BLACK	1
5	8720023	VENT, SMALL, EVAPORATOR	2
6	8720024	VENT, LARGE, EVAPORATOR	2
7	8720025	CONTROLLER ASSY	1

## POWER PACK, ON-FRAME

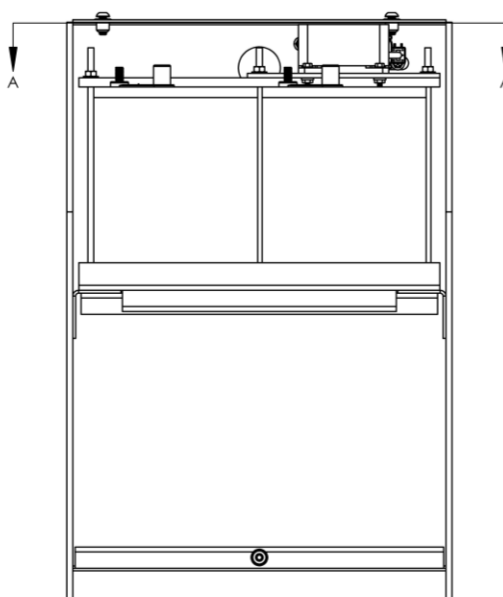


ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY
1	8720026	SEPARATOR, BATTERY, HD COMBINER	1
2	8720027	FUSE, 250A	1

# POWER PACK, RAIL MOUNT



SECTION A-A  
SCALE 1:4



ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY
1	8720026	SEPARATOR, BATTERY, HD COMBINER	1
2	8720027	FUSE, 250A	1

## Relay and Fuse Service Part List

<b>PART NUMBER</b>	<b>DESCRIPTION</b>	<b>QTY</b>
8720003	2A MINI FUSE	5
8720019	5A MINI FUSE	5
8720004	10A MINI FUSE	5
8720005	25A MINI FUSE	5
8720009	150A MIDI FUSE	5
8720008	RELAY, 25 AMPS	5
8720007	FUSE CIRCUIT, ATO/ATC	5
8720006	FUSE CIRCUIT, MINI	5

## Start-Stop Service Part List

<b>PART NUMBER</b>	<b>DESCRIPTION</b>	<b>QTY</b>
8720028	CONTROLLER	1
8720029	12V POWER HARNESS	1
8720030	HOOD SAFETY SWITCH	1
8720031	HOOD SWITCH HARNESS	1
8720032	UNIVERSAL IGNITION HARNESS	1
8720033	STANDARD IGNITION T-PLUG	1
8720034	INTNL/MACK IGNITION POSITAP	1
8720035	IGNITION T-PLUG, VOLVO	1
8720036	INLINE Y ECM HARNESS	1
8720037	ECM HARNESS, VOLVO/MACK	1
8720038	AUTOMATIC TRANS JUMPER	1
8720039	NEUTRAL SWITCH HARNESS	1
8720040	MANUAL TRANS SWITCH, METRIC	1
8720041	MANUAL TRANS SWITCH, IMP	1
8720042	TEST HARNESS	1