



# KIT MODULE - SOFT START UPGRADE

100020-19 & -20



**Installation and servicing of Danfoss Turbocor® compressors by qualified and product trained personnel only. Follow these instructions and sound refrigeration/electrical/servicing practices relating to installation, commissioning, maintenance and service.**

<p>Consult the appropriate Danfoss LLC Service Manual on <a href="http://www.turbocoroem.com">www.turbocoroem.com</a> for detailed service instructions.</p>	<p><b>Never power compressor without covers in place and secured.</b></p> <p><b>Removing the mains input cover will expose you to a voltage hazard of up to 575V. Ensure the mains input power is off and locked out before removing cover.</b></p> <p><b>Before removing top cover, wait at least 20 minutes after isolating AC power to allow the high voltage capacitors to discharge.</b></p>	<p>Always wear appropriately rated safety equipment when working around equipment and/or components energized with high voltage.</p> <p><b>This equipment contains hazardous voltages that can cause serious injury or death.</b></p>	<p><b>Recover all refrigerant from compressor in accordance with local codes and ensure pressure is fully vented before the removal of refrigerant containing components.</b></p>
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1 - Introduction:

MODULE - SOFT START UPGRADE.

This kit contains the Open-Top Soft Start and required components and hardware. This instruction focuses only on upgrade steps not outlined in the Service Manual. **Please refer to our Service Manual for specific details regarding the replacement of the Soft Start.**

We have made the **TTS/TGS/TTH/TGH Service Manual** available to anyone. To access the manual, you may scan the applicable QR code below or you may go to our website at [www.turbocoroem.com](http://www.turbocoroem.com). At the top of the page there is a pull-down menu called "Quick Links." Click this menu and select the appropriate service manual.

Refer to the applicable QR code below to download the TTS/TGS/TTH/TGH Service Manual.

**English**



**Chinese**



The Soft Start included in this kit is noticeably different from the earlier Soft Starts. To identify the two (2) different Soft Start styles, refer to Figure 1 – Open-Top Soft Start and Figure 2 – Closed-Top Soft Start.

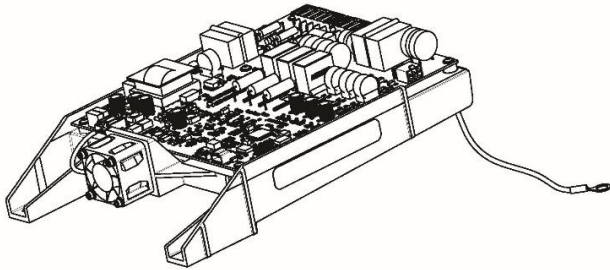


Figure 1 – Open-Top Soft Start

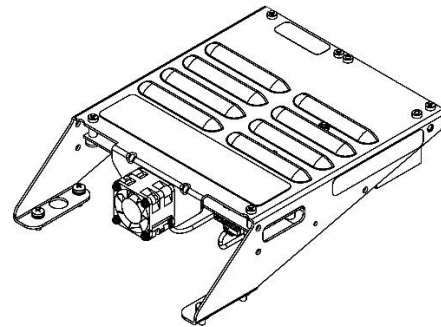


Figure 2 – Closed-Top Soft Start

One of the major components contained in this kit is the Open-Frame DC-DC Converter; this will replace the potted DC-DC. The DC-DC is included due to the fact that the new Soft Start no longer provides a 15VAC trigger signal, which is required for the potted DC-DCs. Because of the design change of the Soft Start and DC-DC, new cable harnesses are also included in this kit.

The removal and installation of the two (2) DC-DC variants is very similar. The open-frame style utilizes six (6) mounting screws while the potted style uses eight (8). The open-frame style utilizes three (3) connectors whereas the potted style uses four (4). As previously mentioned, the open-frame design no longer uses the 15VAC trigger signal from the Soft Start, thus eliminating the need for J3.

To identify the two different styles, refer to Figure 3 – Open Frame DC-DC Converter and Figure 4 – Potted DC-DC Converter.

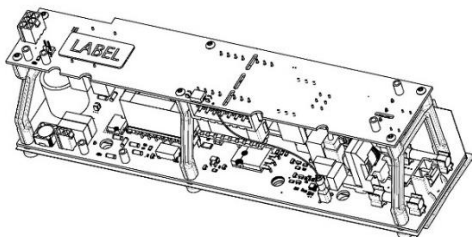


Figure 3 – Open Frame DC-DC Converter

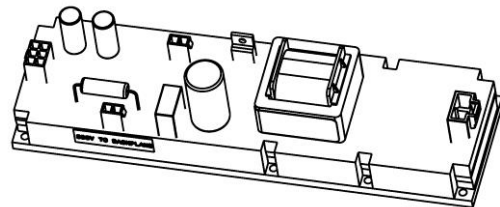


Figure 4 – Potted DC-DC Converter

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## 2 - MODULE - SOFT START Removal Instructions:

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1. Isolate compressor power as described in Section "Electrical Isolation of the Compressor" of the Service Manual (M-SV-001).
2. Remove the Service Side Cover.
3. Disconnect the J9 connection from Soft Start if equipped. Refer to Figure 5 – Closed-Top Soft Start.
4. Remove the Soft Start mounting fasteners.
5. Flip Soft Start over (board side up) and disconnect J1, J7, and J8 from the Soft Start. Refer to Figure 5 – Closed-Top Soft Start.

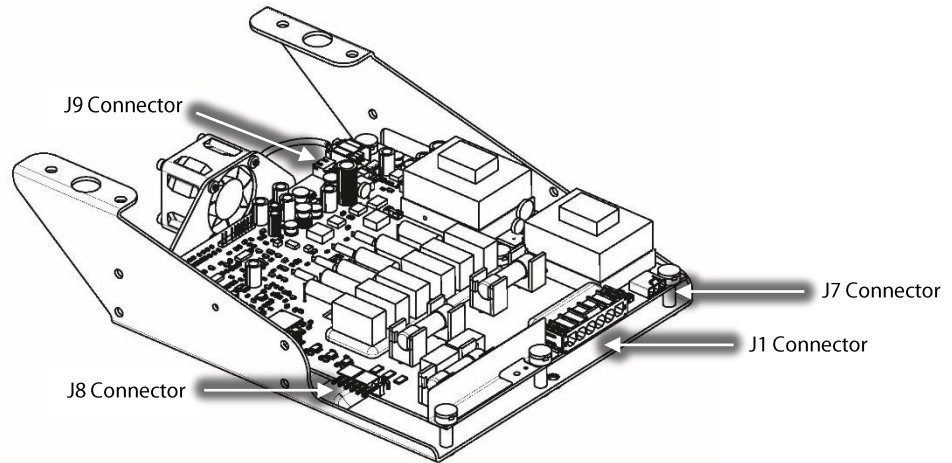


Figure 5 – Closed-Top Soft Start

6. Disconnect the Soft Start ground wire from the Mains Input Grounding stud.
7. Remove the Soft Start.
8. Inspect the Soft Start mating surface of the compressor and remove any remaining washers/spacers.
9. Remove Soft Start SCR Gate Cable (J8) from the SCR's.

**Soft Start SCR Gate Harness Removal**

- a. Remove the six (6) connectors from the Soft Start SCR Cable that plug into the SCR's. This may require the use of needle-nose pliers. Refer to Figure 6 – *Soft Start SCR Gate Cable Removal at SCR (TTS300/TGS230)* and Figure 7 – *Soft Start SCR Gate Cable Removal at SCR (All other TTS/TGS/TTH/TGH Models)* for the appropriate compressor model.

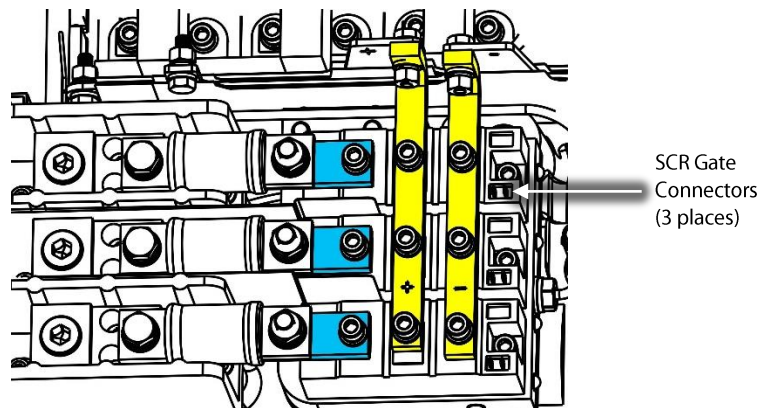


Figure 6 – Soft Start SCR Gate Cable Removal at SCR (TTS300/TGS230)

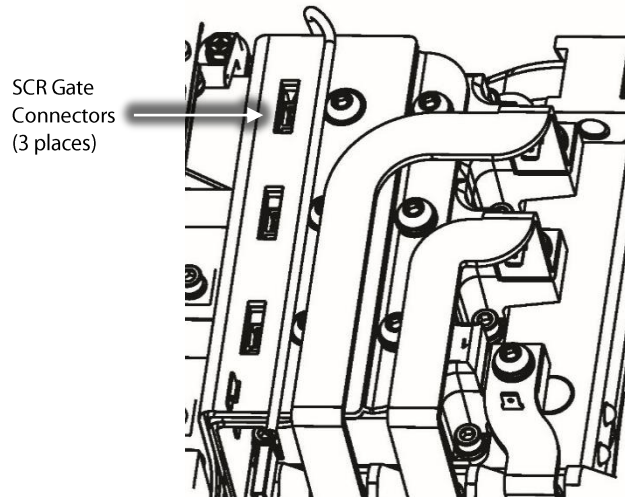


Figure 7 – Soft Start SCR Gate Cable Removal at SCR (All other TTS/TGS/TTH/TGH Models)

10. Remove the Soft Start AC/DC Harness.

**Soft Start AC/DC Harness Removal - TTS300/TGS230**

- a. Disconnect the three (3) ring terminals labeled L1, L2, and L3 from the AC bus bars. Refer to Figure 8 – L1, L2, & L3 Terminal Removal (TTS300/TGS230).

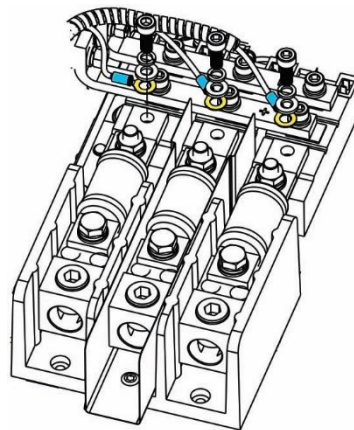


Figure 8 – L1, L2, & L3 Terminal Removal (TTS300/TGS230)

- b. Disconnect the two (2) -DC ring terminals from the -DC bus bar by removing the attaching hardware. Refer to Figure 9 – DC Ring Terminal Removal (TTS300/TGS230) for this and the following step.
- c. Disconnect the +DC ring terminal from the +DC bus bar by removing the attaching hardware.

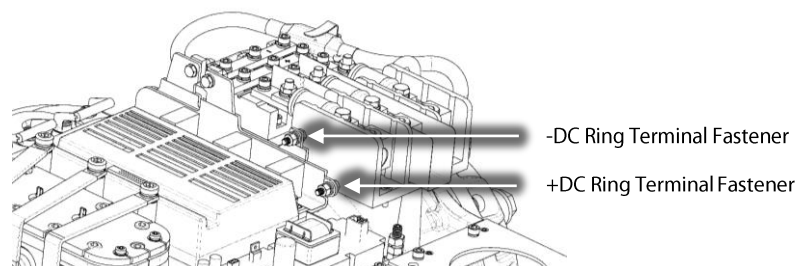


Figure 9 – DC Ring Terminal Removal (TTS300/TGS230)

- d. Remove connector J1 from the DC-DC. Refer to Figure 10 – *Potted DC-DC Converter Connector Locations*.

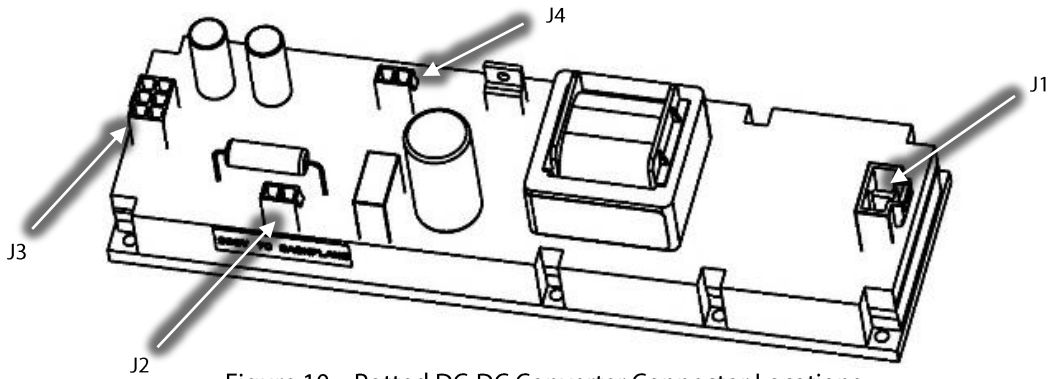


Figure 10 – Potted DC-DC Converter Connector Locations

- e. Remove the Soft Start AC/DC harness.

**Soft Start AC/DC Harness Removal (All TTS/TGS/TTH/TGH Models Except TTS300/TGS230)**

- a. Disconnect the three (3) spade terminals labeled L1, L2, and L3 from the AC bus bars. Refer to Figure 11 – L1, L2, & L3 Terminal Removal (All Other TTS/TGS/TTH/TGH Models).

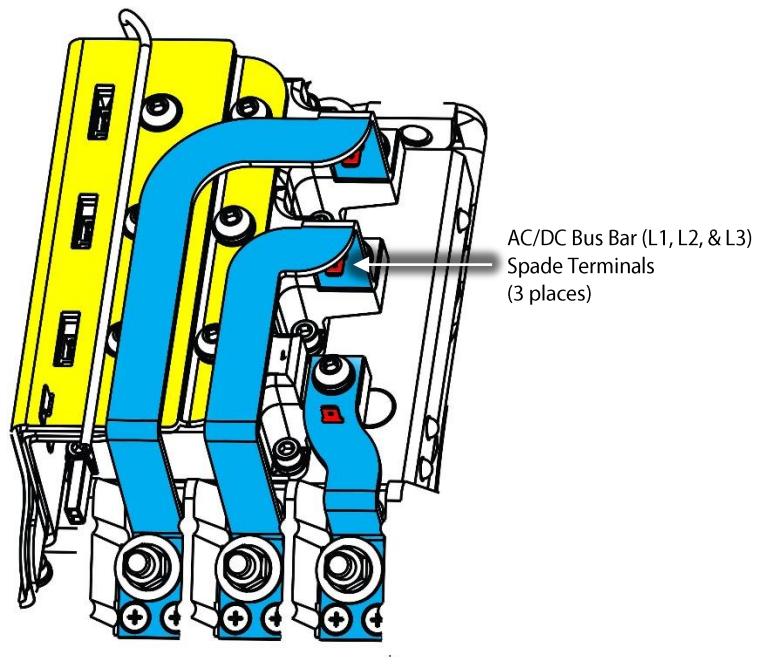


Figure 11 – L1, L2, & L3 Terminal Removal (All Other TTS/TGS/TTH/TGH Models)

- b. Disconnect the -DC and +DC spade terminals from the DC bus bar. Refer to Figure 12 - DC Spade Connector Removal (All Other TTS/TGS/TTH/TGH Models).

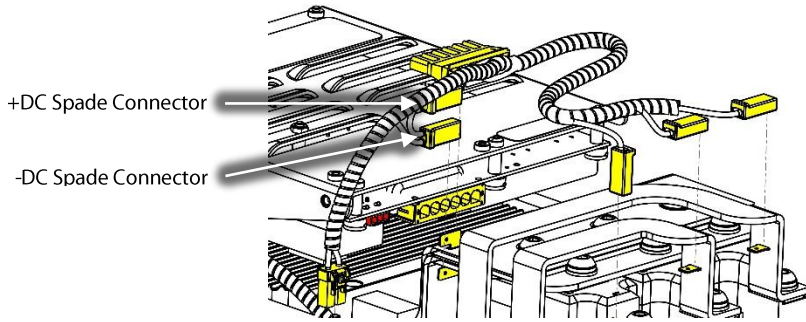


Figure 12 - DC Spade Connector Removal (All Other TTS/TGS/TTH/TGH Models)

- c. Remove connector J1 from the DC-DC. Refer to Figure 10 – *Potted DC-DC Converter Connector Locations*.
  - d. Remove the harness.
11. Remove the DC-DC.
- a. Remove the three (3) remaining connectors (250VDC (J2), 24VDC (J3), and 15VAC (J4)) from the DC-DC Converter. Refer to Figure 13 – *Potted DC-DC Converter Connector Locations*.

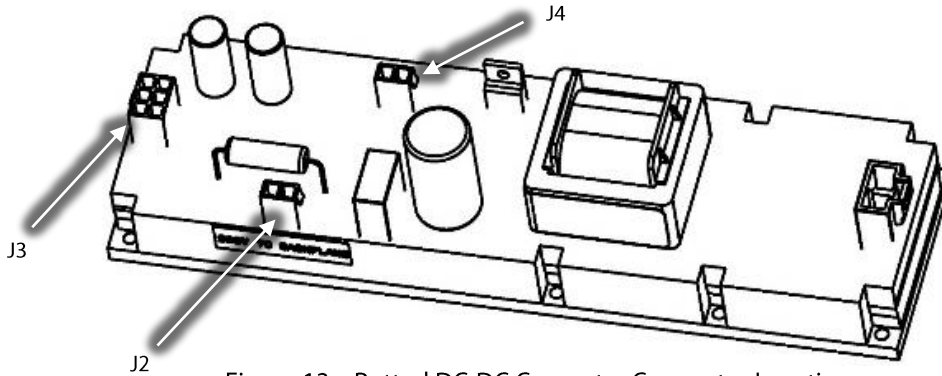


Figure 13 – Potted DC-DC Converter Connector Locations

- b. Loosen the fasteners that are located next to the Inverter. Refer to Figure 14 – *Potted DC-DC Converter Removal* for this and the next two (2) steps.
- c. Remove the fasteners located on the front side of the DC-DC Converter.
- d. Lift the DC-DC Converter on the front side and slide it clear of the rear fasteners.

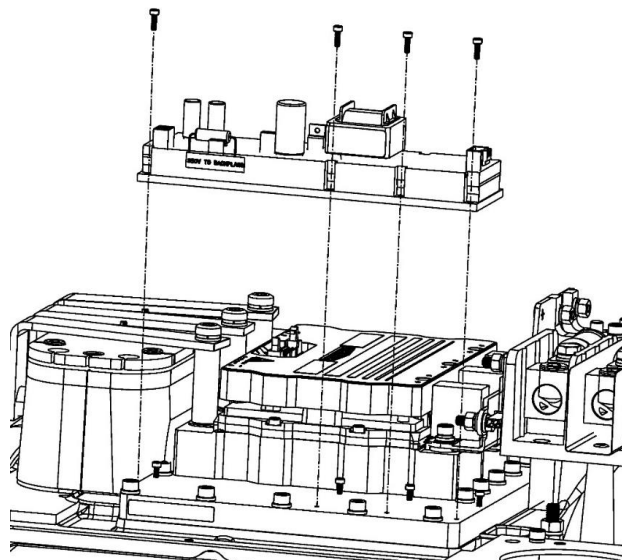


Figure 14 – Potted DC-DC Converter Removal

- e. After the removal of the DC-DC Converter, completely remove the four (4) DC-DC Converter fasteners closest to the Inverter. Refer to Figure 15 – *Rear Potted DC-DC Converter Fasteners*.

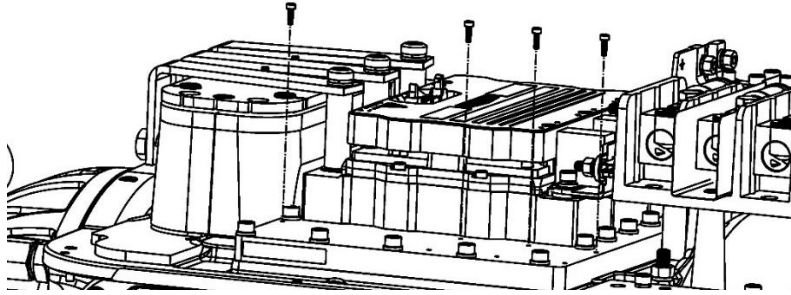


Figure 15 – Rear Potted DC-DC Converter Fasteners

- f. Disconnect the J4, J20, J24, and J22 (if present) from the Backplane. Refer to Figure 16 – *Backplane Connector Locations*.

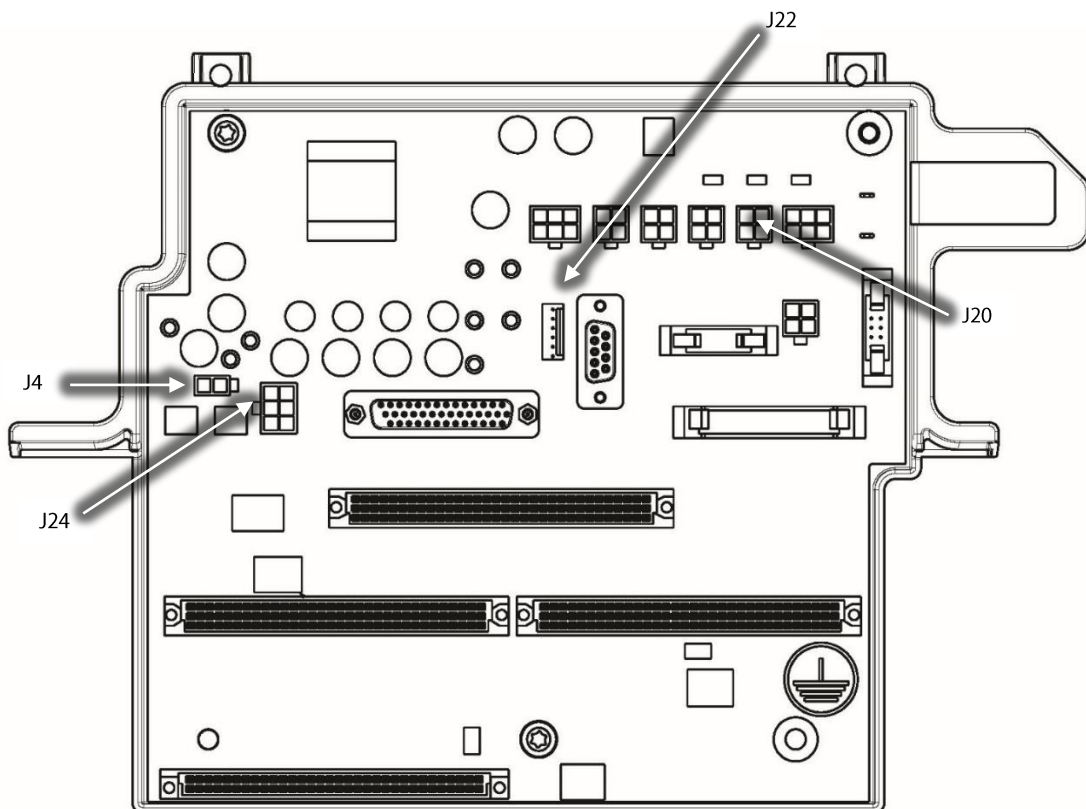


Figure 16 – Backplane Connector Locations

### 3 - MODULE - SOFT START Installation Instructions:

1. Install the new DC-DC.

**NOTE:** If you are installing this kit on a TTS300 or TGS230 compressor, it is suggested that you first install -DC and +DC ring terminals to the DC bus bar prior to installing the new DC-DC. This is due to limited clearance to the fasteners when the DC-DC is installed.

2. For TTS300/TGS230 compressors, connect the -DC and +DC ring terminals to the DC bus bar. Refer to Figure 26 – *Soft Start AC/DC Harness Ring Terminal Installation*.
  - a. Clean the Inverter Heat Sink Plate where the original DC-DC Converter was mounted.

- b. Install the new rear fasteners that secure the DC-DC Converter to the Inverter Heat Sink Plate. Do not tighten these fasteners; leave enough space under the fasteners to allow the DC-DC Converter to slide under the fasteners. Refer to Figure 17 – *Rear Fastener Installation*.

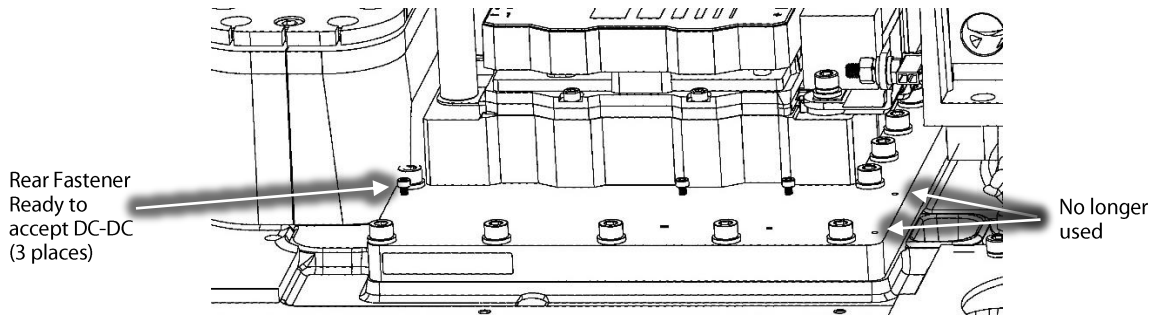


Figure 17 – Rear Fastener Installation

- c. Align the DC-DC Converter with the mounting holes on the Inverter Heat Sink Plate by sliding the DC-DC under the rear fasteners.
- d. Install the new front fasteners that secure the DC-DC Converter to the Inverter Heat Sink Plate. Torque all fasteners to 0.5 Nm (4 in.lb.).

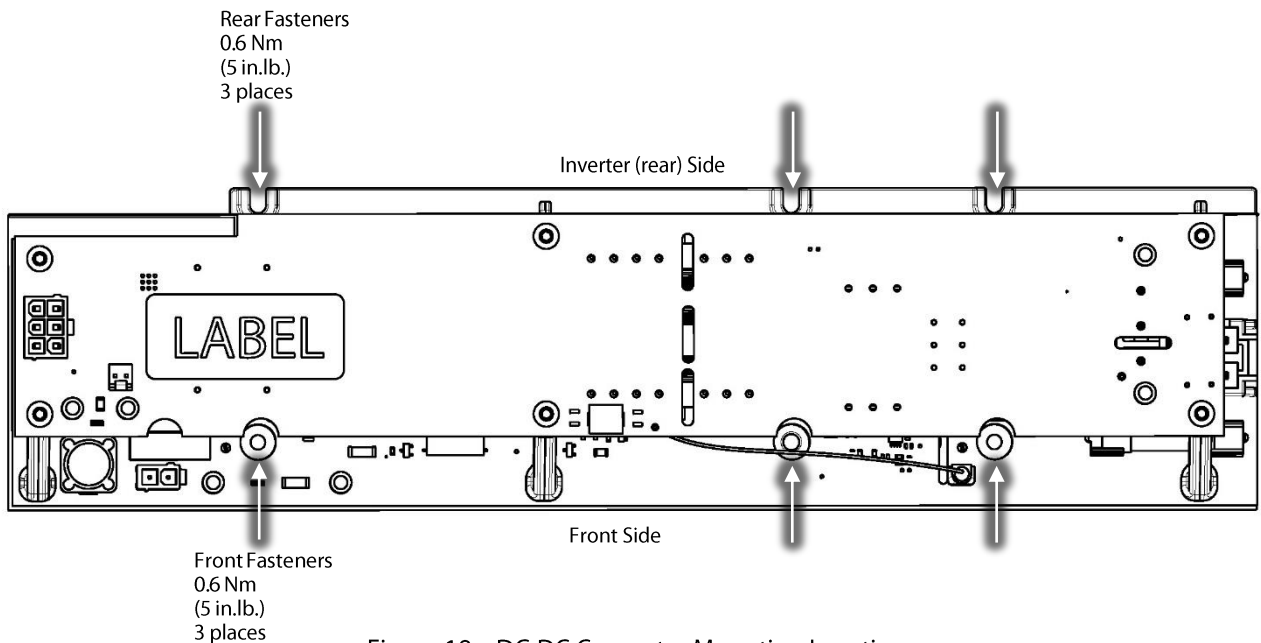


Figure 18 – DC-DC Converter Mounting Locations

- e. Remove the cable ties as necessary and adjust the DC-DC to Backplane Cable Harness so that you can connect to J4 (24VDC output) and J2 (250VDC Output) to the DC-DC Converter. Refer to Figure 19 – *DC-DC Converter Connector Locations* for this and the following step.



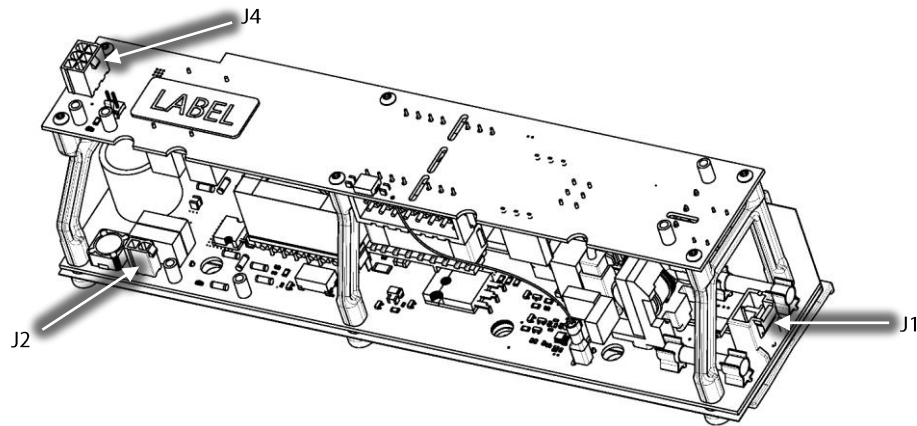


Figure 19 – DC-DC Converter Connector Locations

- f. Adjust the DC-DC to Backplane Cable Harness so that you can install connectors J4, J20, J24, and J22 (if present) to the Backplane.
- g. Once all connectors are installed, install cable tie as shown in Figure 20 – *Backplane Harness Cable Tie*.



Figure 20 – Backplane Harness Cable Tie

3. Install the new Soft Start with the new anti-rotation plates and fasteners. Torque the fasteners to 5 Nm (42 in.lb.). Refer to Figure 21 – *Soft Start Installation*.

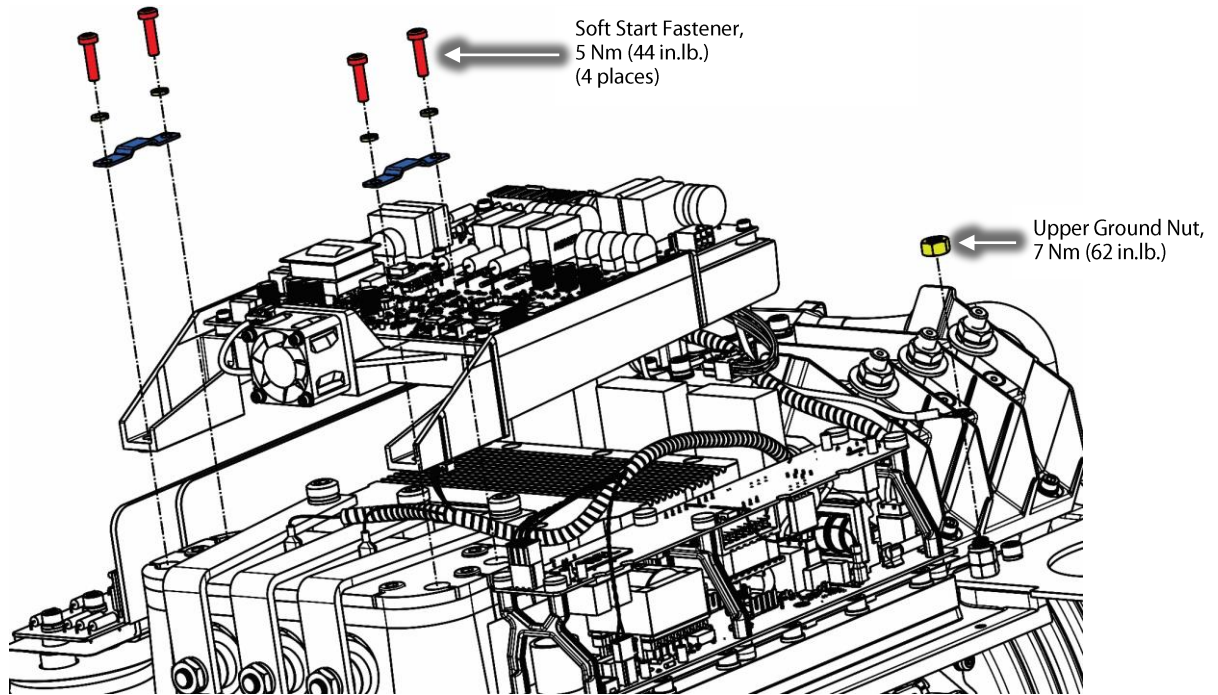


Figure 21 – Soft Start Installation

4. Connect the Soft Start Temperature Sensor Harness to the Soft Start. The connector is now J7 on the Open-Top Soft Start but was formerly J9 on the old Soft Start. Refer to Figure 22 – Open-Top Soft Start Connections for locations of all connectors used in this instruction.

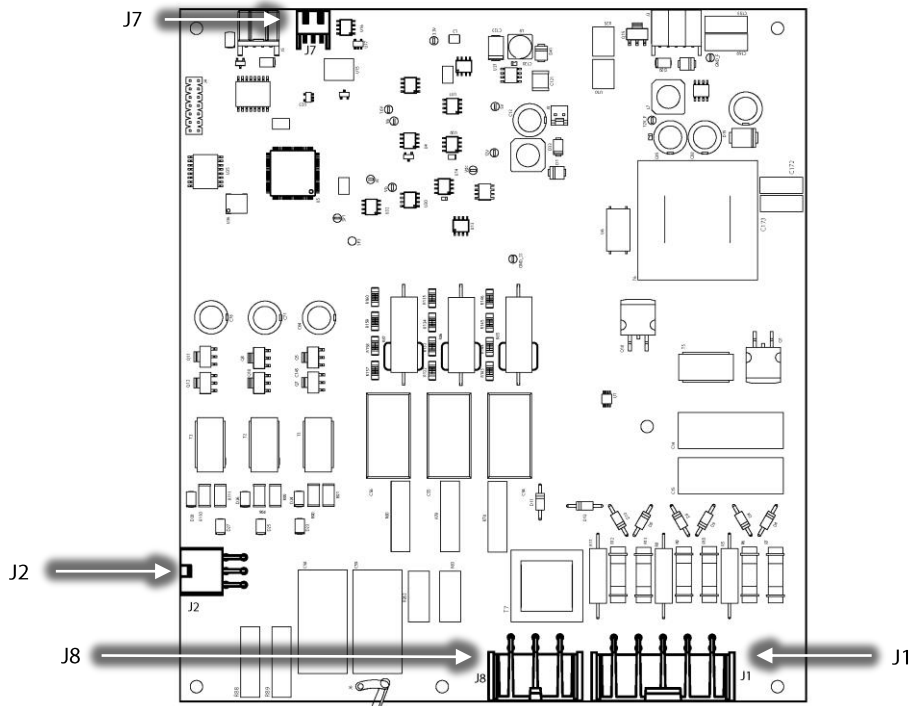


Figure 22 – Open-Top Soft Start Connections

5. Attach the Soft Start ground wire to the Mains Input Grounding stud and torque the nut to 7 Nm (62 in.lb).
6. Install the new Soft Start SCR Gate Harness.

- a. Install six connectors onto the SCRs. Plug each pigtail into its respective SCR making sure you line up the “key” on the pigtail connector to the “key” of the SCR itself. This may require the use of small forceps or needle nose pliers. Refer to Figure 23 – SCR Gate Connector Alignment.



Figure 23 – SCR Gate Connector Alignment

- b. Install the other end of the Soft Start SCR Gate Harness into the J2 connector on the Soft Start. Refer to Figure 24 – J2 Connection at Soft Start.

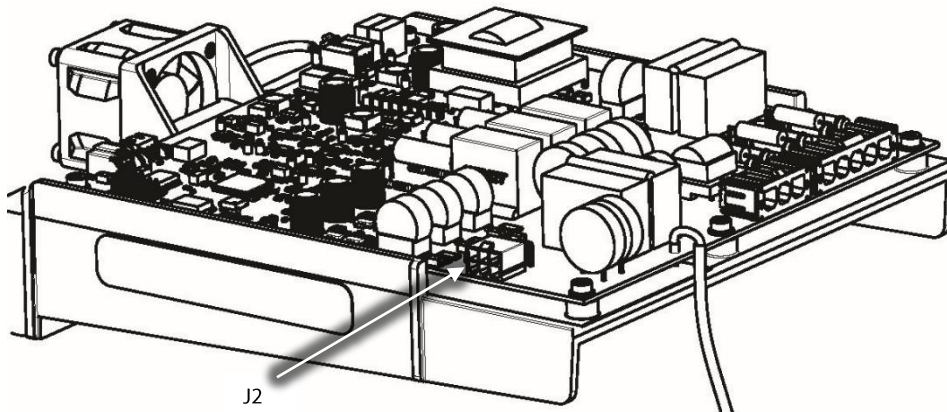


Figure 24 – J2 Connection at Soft Start

7. Install the new Soft Start AC/DC Harness.
  - c. Install the two (2) connectors (J1 and J8) to the Soft Start.

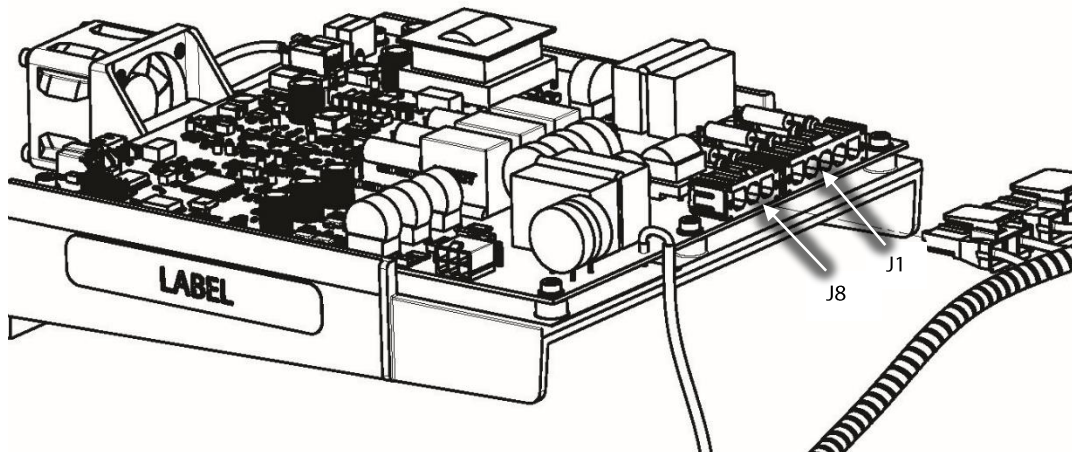


Figure 25 – J1 and J8 Connections at Soft Start

### Soft Start AC/DC Harness Installation - TTS300/TGS230

- a. Connect the three (3) ring terminals labeled L1, L2, and L3 to the AC bus bars. Refer to Figure 26 – Soft Start AC/DC Harness Ring Terminal Installation for this and the following step.

**NOTE:** Be sure to install the terminals based on the “L” designations (i.e., L1, L2, & L3) and not based on the wire color as that could vary.

- b. Connect the DC-DC to Soft Start Cable Harness to J1 (DC Bus Input)

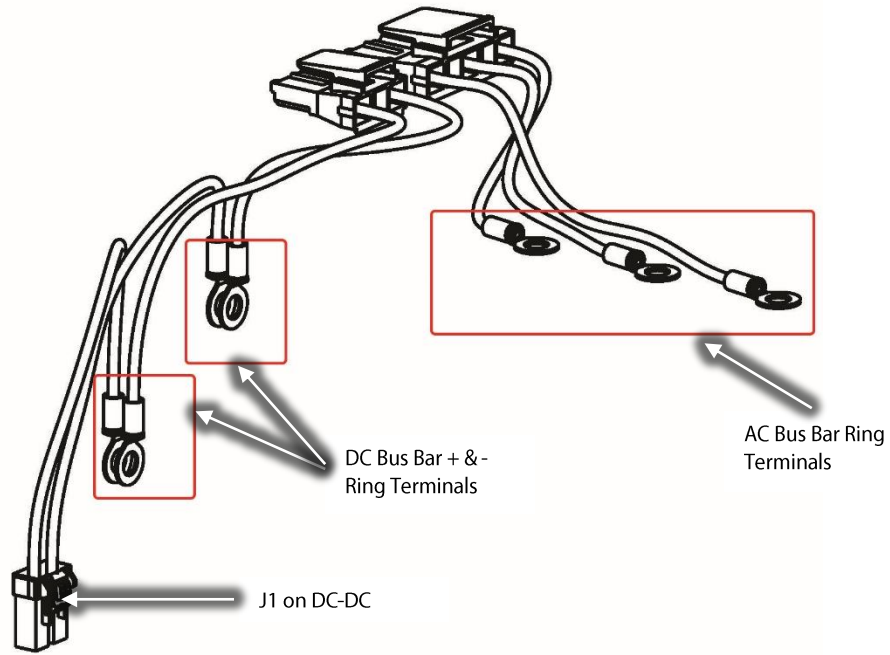


Figure 26 – Soft Start AC/DC Harness Ring Terminal Installation

**Soft Start AC/DC Harness Removal (All TTS/TGS/TTH/TGH Models Except TTS300/TGS230)**

- a. Connect the three (3) spade terminals labeled L1, L2, and L3 to the AC bus bars. Refer to Figure 27 – *Soft Start AC/DC Harness Ring and Spade Terminal Installation* for this and the following two (2) steps.
- b. Connect the -DC and +DC spade terminals to the DC bus bar.
- c. Connect the DC-DC to Soft Start Cable Harness to J1 (DC Bus Input)

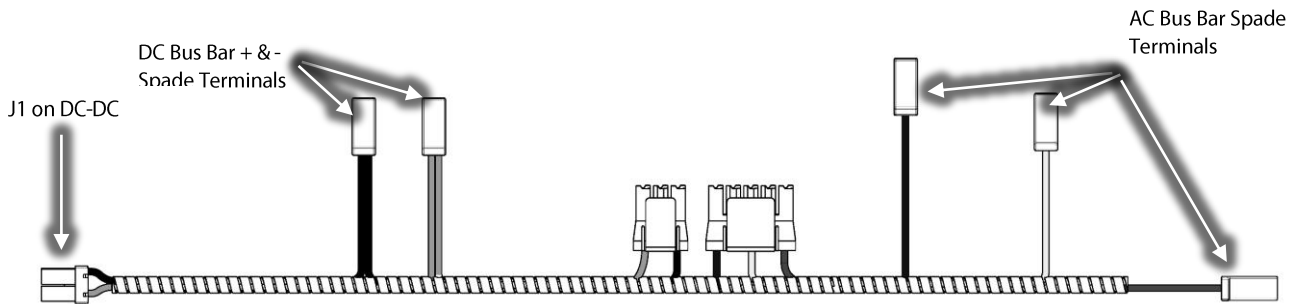
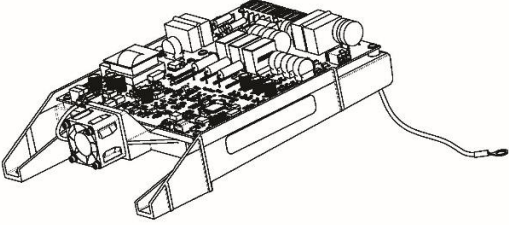
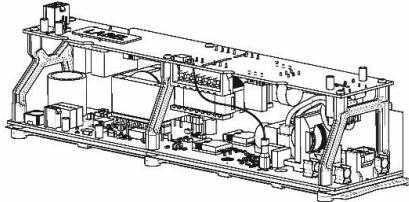
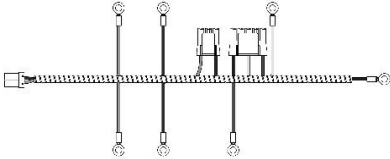
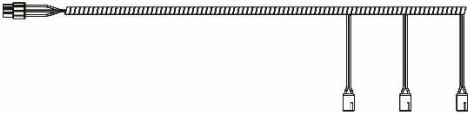



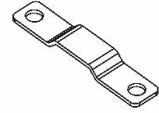


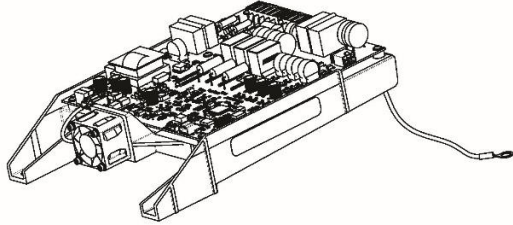
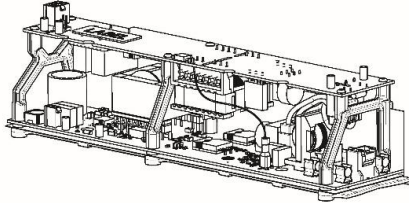

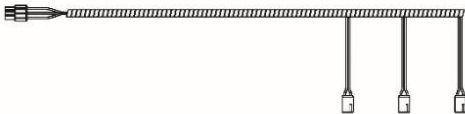



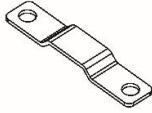
Figure 27 – Soft Start AC/DC Harness Ring and Spade Terminal Installation

- 8. Install the Service Side Cover.
- 9. Install the top covers.
- 10. Return the compressor to normal operation.

4 - Kit Contents:

**Note:** Any part numbers included in the kit contents are internal part numbers only. Please refer to our Spare Parts Manuals for any kit part numbers.

Kit numbers	Compressor models	
100020-19	TTS300/TGS230	
QTY	Part(s) Description	Picture(s)
1	MODULE - SOFT START	
1	DC-DC CONVERTER	
1	CABLE HARNESS, SOFT START AC/DC - 701795	
1	CABLE HARNESS, SOFT START SCR GATE - 701797	
4	SCREW, M5, TORX PAN HEAD - 902882	
6	SCREW, M3, SOCKET HEAD CAP - 902816	
4	WASHER M5, SPLIT - 902808	
2	ANTI-ROTATION PLATE	

Kit numbers	Compressor models	
100020-20	TTS350/TTS400/TTS500/TTS700/TGS310/TGS390/ TGS490/ TGS520/TTH375/TGH285	
QTY	Part(s) Description	Picture(s)
1	MODULE - SOFT START	
1	DC-DC CONVERTER	
1	CABLE HARNESS, SOFT START AC/DC - 701796	
1	CABLE HARNESS, SOFT START SCR GATE - 701797	
4	SCREW, M5, TORX PAN HEAD - 902882	
6	SCREW, M3, SOCKET HEAD CAP - 902816	
4	WASHER M5, SPLIT - 902808	
2	SPACER ANTI-ROTATE SOFTSTART MOUNT	

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