



TTS/TGS/TTH/TGH Spare Part Kit

KIT DC BUS TEST HARNESS (SAFETY INTERFACE CABLE)

100326 & 100101



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 www.turbocoroem.com for detailed service instructions.</p> | <p>Never power compressor without covers in place and secured.</p> <p>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.</p> <p>Before removing top cover, wait at least 20 minutes after isolating AC power to allow the high voltage capacitors to discharge.</p> | <p>Always wear appropriately-rated safety equipment when working around equipment and/or components energized with high voltage.</p> <p>This equipment contains hazardous voltages that can cause serious injury or death.</p> | <p>Recover all refrigerant from compressor in accordance with local codes and ensure pressure is fully vented before the removal of refrigerant containing components.</p> |
|--|---|---|---|

1 - Introduction:

DC BUS TEST HARNESS (SAFETY INTERFACE CABLE) Removal and installation.

- ⚠ It is mandatory to use the DC Bus Test Harness when working on the Compressor power electronics. The Compressor contains hazardous voltages that can cause injury or death. Only qualified personnel should work on high-voltage electrical equipment. When servicing or replacing a Compressor, the high-voltage capacitors must be discharged before opening any of the Compressor access covers.

Please refer to our Service Manual for further information.

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. 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



2 - Purpose of DC Bus Test Harness:

The purpose of using the DC Bus Test Harness is to allow the following to be accomplished while three-phase AC power is connected to the Compressor and the Top Cover and Mains Input Cover are in place:

- Measurement of DC bus voltage
- Measurement of 15VAC output of the Soft Start Board (if applicable)
- Ensuring integrity of the HV DC-DC Converter fuse

3 - Description of DC Bus Test Harness:

All versions of the DC Bus Test Harness have male/female plugs to allow piggyback connection to the required voltage measurement points on the Soft-Start. Refer to Figure 1 – DC Bus Test Harness (Closed-Top Soft Starts). Voltage measurements are made via shrouded multimeter jacks on the opposite end of the cables. Cable and personal protection are provided by inline fast-acting fuses (1/4 x 1 1/4, 62 milliamp 250V) and current-limiting 100kΩ 3W resistors.

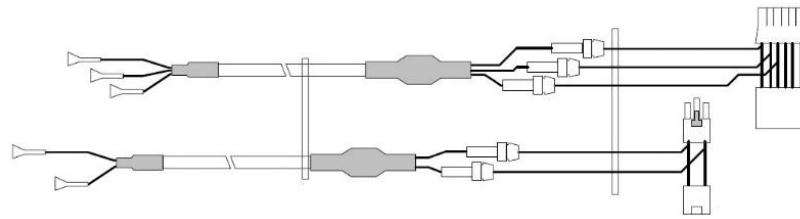


Figure 1 – DC Bus Test Harness (Closed-Top Soft Starts)

4 - Installation of the DC Bus Test Harness:

Follow the steps below to safely remove power from the Compressor and install the DC Bus Test Harness. There are two (2) different Soft Start versions referenced within these instructions. The steps below are organized based on which Soft Start is installed on the compressor.

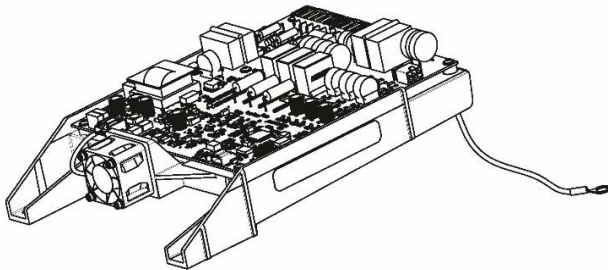


Figure 2 – Open-Top Soft Start

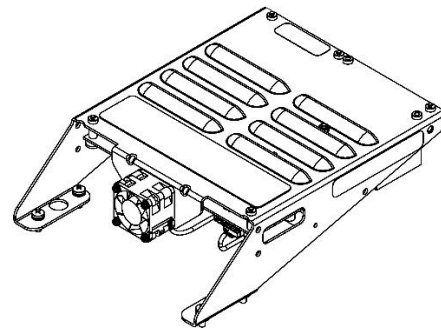


Figure 3 – Closed-Top Soft Start

- ⚠ Before using the DC Bus Test Harness, integrity of the fuses/resistors and cable must be checked. This will be accomplished when performing the steps below.

General Verification and Installation

1. Turn off AC power input to the Compressor.
2. Secure/tag off/lock out the isolating switch to ensure against accidental or unauthorized reapplication of the AC power.
3. Remove the Mains Input Cover by removing the four (4) fasteners that secure the cover.
4. Using an appropriately-rated volt meter, confirm the absence of AC voltage.
5. If AC voltage is **not** present, reinstall the Mains Input cover and wait at least 20 minutes before removing either the Mains Input or Top Side Cover. If AC voltage still exists, go back to Step 2 to determine why the compressor voltage is not isolated.

6. Remove the Mains Input and Top Cover, taking particular care not to touch ANY components underneath.
7. Using an appropriately-rated volt meter, check the DC Bus Bars for voltage level. If the voltage is above 5VDC, wait five (5) minutes and recheck until voltage is below 5 VDC. Refer to Figure 4 – DC Bus Voltage Test Points.

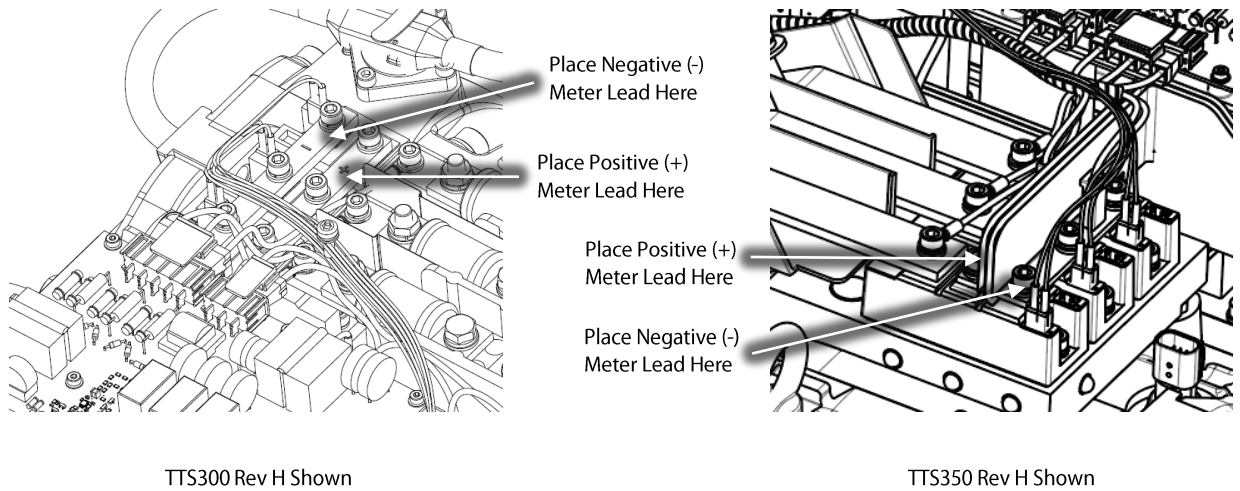


Figure 4 – DC Bus Voltage Test Points

8. Remove the Service Side Cover.
9. Use an ESD strap and attach it to the compressor housing while installing the Test Harness.

Technical Tip! This would be a good time to perform a visual inspection of the top-side electronics to determine if there is any visual damage present. Also at this time, it is suggested to verify the integrity of the fuses if you have a Closed-Top Soft Start.

10. Confirm integrity of the fuses/resistors in the DC Bus Test Harness by using a multimeter set to resistance. Check each cable individually. The reading for the resistor should be approximately 100k Ω and the reading for the fuse should be 29 Ω .
11. Continue to the appropriate section below based on the particular Soft Start.

Installation for Closed-Top Soft Start

1. Disconnect the J1 and J7 connectors on the Soft-Start Board. Refer to Figure 5 – Soft Start Connections.

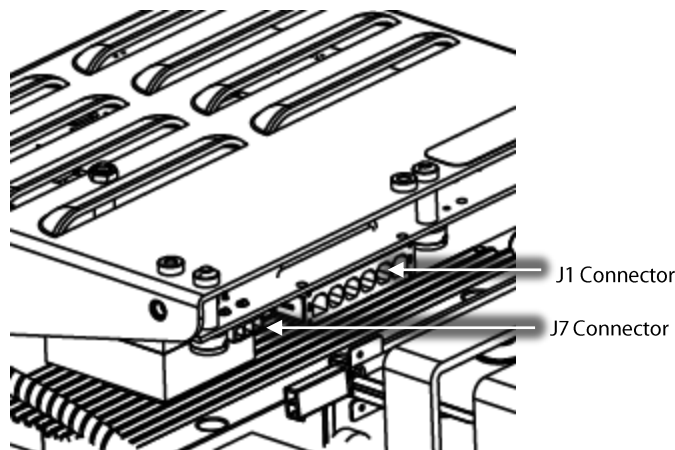


Figure 5 – Soft Start Connections

2. Connect the two (2) plugs of the Compressor cable harness into corresponding sockets of the DC Bus Test Harness. Refer to Figure 6 – Closed-Top Soft Start Connections and Figure 7 – DC Bus Test Harness Connection Diagram.

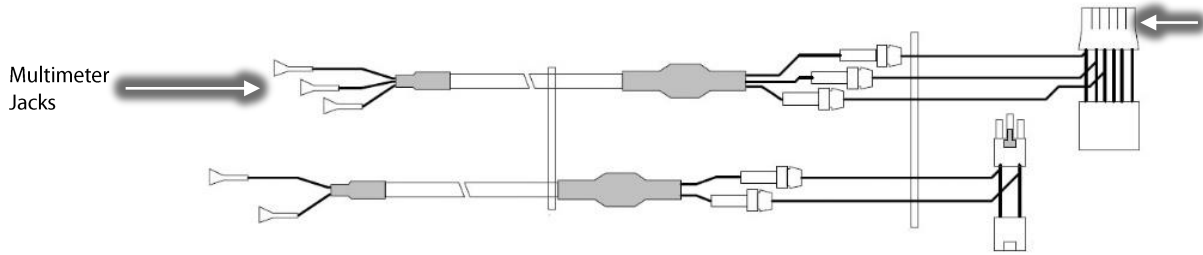


Figure 6 – Closed-Top Soft Start Connections

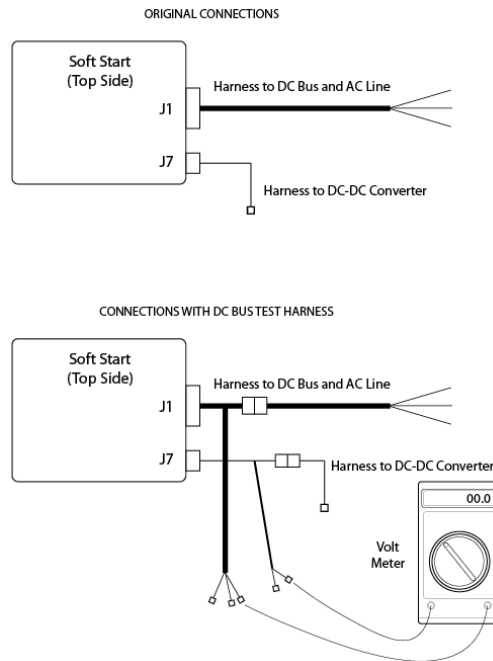


Figure 7 – DC Bus Test Harness Connection Diagram

3. Connect the two (2) plugs of the DC Bus Test Harness into the Soft Start. Refer to Figure 5 – Soft Start Connections.
4. Route the cable into the cable passage beside the DC-DC Converter, down into the service side. Refer to Figure 8 – Cable Passage.

NOTE: If the main housing has two cable passages, either passage can be used.

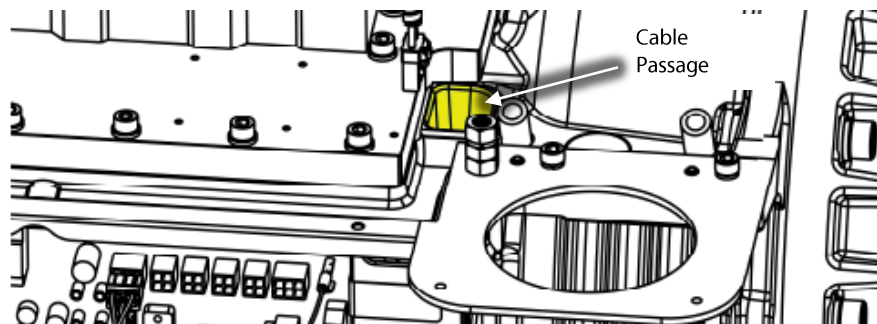


Figure 8 - Cable Passage

5. Carefully adjust the connectors and harness so that the Top Cover can be reinstalled.
6. Reinstall the Top Cover and Mains Input Cover and tighten all fasteners. Refer to the Cover Installation section at the end of this instruction.
7. Remove ESD strap from the compressor and yourself.

8. Reapply AC power to the Compressor.
9. Using an appropriately-rated voltmeter with the 1000VDC range selected, insert the positive voltmeter lead into the DC (+F) test harness lead, and the negative voltmeter lead into the DC (-) test harness lead. Refer to Table 1 – Compressor Voltage Ranges for the expected DC bus voltage. If the voltage corresponds to Table 1, the DC bus voltage is correct and HV DC (F1) fuse on the Soft Start is intact. This would imply that the Soft Start and SCRs are functioning correctly; proceed to step 12. If the voltage measurement is not as expected, go to step 10.

Table 1- Compressor Voltage Ranges

| Compressor Nameplate AC Voltage | Acceptable AC Voltage Range | Expected DC Bus Voltage |
|---------------------------------|-----------------------------|-------------------------|
| 575 VAC | 518 - 632 VAC | 700 - 853 VDC |
| 460 VAC | 414 - 506 VAC | 559 - 683 VDC |
| 400 VAC | 360 - 440 VAC | 486 - 594 VDC |
| 380 VAC | 342 - 418 VAC | 462 - 564 VDC |

10. Leaving the DC(-) test lead in place, relocate the positive (+) test lead to DC(+). If DC voltage is consistent with Table 1, this would imply that the Soft Start and SCRs are working correctly, but the HV DC fuse (F1) on the Soft Start is an open circuit, refer to the Service Manual to verify the DC-DC Converter.
 11. If the DC voltage is not present or is not consistent with Table 1, the incoming AC voltage should be verified to be between the acceptable AC Voltage Range listed in Table 1. Additionally the F2, F3, F4, F5, and F6 fuses need to be verified as well as the SCR Diodes and SCR Gates. Refer to the Service Manual for details.
 12. Reset multimeter scaling to read 15VAC and connect to the 15VAC leads of the DC Bus Test Harness. If the reading is zero, isolate the three-phase supply in accordance with Steps 1-8 in the **General Installation and Verification** section above. When access is safe, remove the four (4) fasteners that hold the Soft Start in position, and check fuses F2, F3, F4, F5, & F6 for continuity. If any fuse is found to be an open circuit, replace it and return to Step 6.
 13. If the 15VAC is not present, replace the Soft Start (refer to the Service Manual). If the 15VAC is correct, proceed to the next step.
 14. When finished, remove the DC Bus Test Harness. Refer to Section 5 – Removal of the DC Bus Test Harness.
- ⚠ The DC Bus Test Harness is not designed to be left in the Compressor during normal operation. When checks are complete, disconnect and remove the Test Harness.

Installation for Open-Top Soft Starts

1. Disconnect the J8 connector on the Soft Start. Refer to Figure 9 – J8 Soft Start Connection.

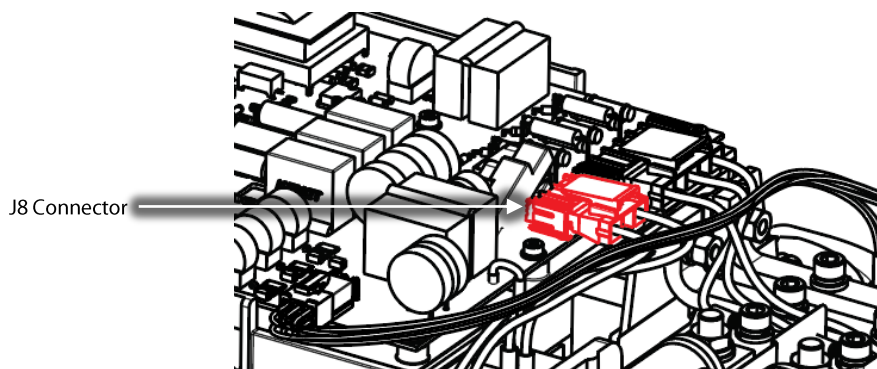
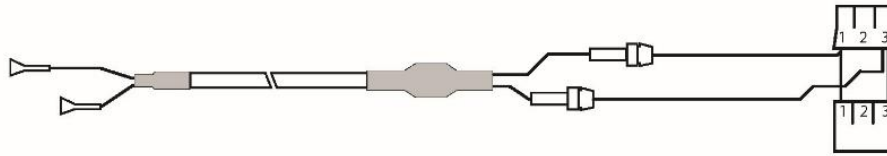


Figure 9 – J8 Soft Start Connection

2. Connect the plug of the compressor cable harness into the corresponding socket of the DC Bus Test Harness. Refer to Figure 10 – Open-Top Soft Start Connections and Figure 11 – DC Bus Test Harness Connection Diagram.



Multimeter
Jacks

Figure 10 – Open-Top Soft Start Connections

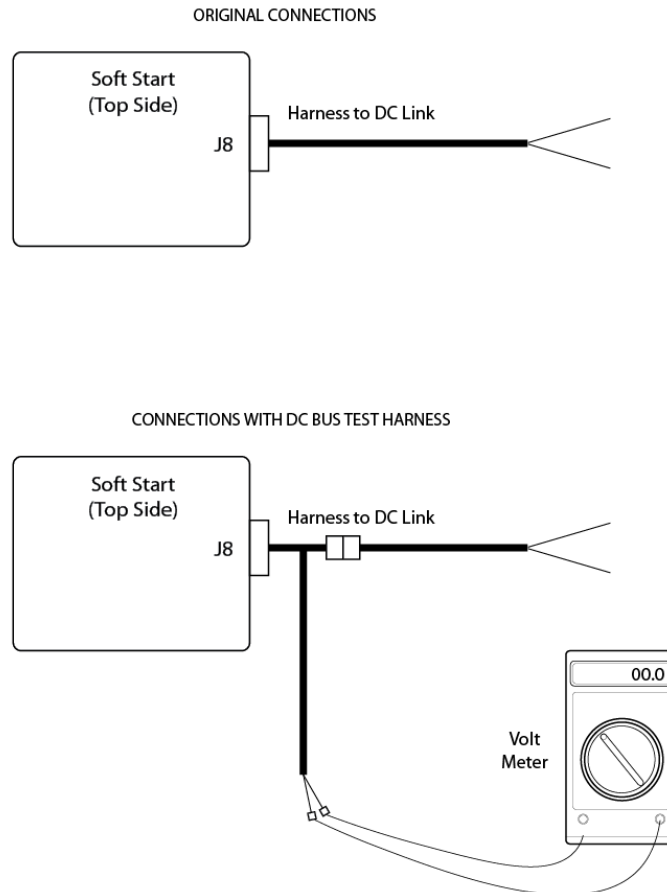


Figure 11 – DC Bus Test Harness Connection Diagram

3. Connect the plug of the DC Bus Test Harness into the Soft Start.
4. Route the cables through the cable passage beside the DC-DC Converter, down into the service side.

NOTE: If the main housing has two cable passages, either passage can be used.

5. Reinstall the Top Cover and Mains Input Cover and tighten all fasteners. Refer to the Cover Installation section at the end of this instruction.
6. Remove the ESD strap from the compressor and yourself.
7. Reapply AC power to the Compressor.
8. Insert the positive voltmeter lead into the DC (+) test harness lead, and the negative voltmeter lead into the DC (-) test harness lead. Refer to Table 2 – Compressor Voltage Ranges below for the expected DC bus voltage. If the DC bus voltage is *not* present, or if it is outside the “Expected DC Bus Voltage” range shown in Table 2, verify proper incoming AC input, verify SCR Gates, and verify SCR Diodes. If incoming AC power is correct, and the SCRs pass the diode and gate tests, replace the Soft Start.

NOTE: There are no replaceable fuses present in the Open-Top Soft Start.

Table 2 – Compressor Voltage Ranges

| Compressor Nameplate AC Voltage | Acceptable AC Voltage Range | Expected DC Bus Voltage |
|---------------------------------|-----------------------------|-------------------------|
| 575 VAC | 518 - 632 VAC | 700 - 853 VDC |
| 460 VAC | 414 - 506 VAC | 559 - 683 VDC |
| 400 VAC | 360 - 440 VAC | 486 - 594 VDC |
| 380 VAC | 342 - 418 VAC | 462 - 564 VDC |

9. When finished, remove the DC Bus Test Harness. Refer to Section 5 – Removal of the DC Bus Test Harness.

- ⚠ The DC Bus Test Harness is not designed to be left in the Compressor during normal operation. When checks are complete, disconnect and remove the Test Harness.

5 - Removal of the DC Bus Test Harness:

General Removal

1. Turn off AC power input to the Compressor.
2. Secure/tag off/lock out the isolating switch to ensure against accidental or unauthorized reapplication of the AC power.
3. Remove the Mains Input Cover by removing the four (4) fasteners that secure the cover.
4. Using an appropriately-rated volt meter, confirm the absence of AC voltage.
5. If AC voltage is **not** present, reinstall the Mains Input cover and wait at least 20 minutes before removing either the Mains Input or Top Side Cover. If AC voltage still exists, go back to Step 2 to determine why the compressor voltage is not isolated.
6. Remove the Mains Input and Top Cover, taking particular care not to touch ANY components underneath.
7. Using an appropriately-rated volt meter, check the DC Bus Bars for voltage level. If the voltage is above 5VDC, wait five (5) minutes and recheck until voltage is below 5 VDC. Refer to Figure 4 – DC Bus Voltage Test Points.
8. Use an ESD strap and attach it the compressor housing while removing the Test Harness.
9. Continue to the appropriate section below based on the particular Soft Start.

Removal for Closed-Top Soft Starts

1. Remove the DC bus test harness from the cable passage.
2. Disconnect the two (2) plugs of the DC Bus Test Harness from the Soft Start.
3. Disconnect the two (2) plugs of the compressor cable harness from the corresponding sockets of the DC Bus Test Harness.
4. Reconnect the J1 and J7 connectors into the Soft Start.
5. Remove ESD strap from the compressor and yourself.
6. Install all covers on the compressor. Refer to the Cover Installation section at the end of this instruction.
7. Return the compressor to normal operation.

Removal for Open-Top Soft Starts

1. Remove the DC Bus Test Harness from the cable passage.
2. Disconnect the plug of the DC Bus Test Harness from the Soft Start.
3. Disconnect the plug of the compressor cable harness from the socket of the DC Bus Test Harness.
4. Reconnect the J8 connector into the Soft Start.
5. Remove ESD strap from the compressor and yourself.
6. Install all covers on the compressor. Refer to the Cover Installation section at the end of this instruction.
7. Return the compressor to normal operation.

Cover Installation

1. Ensure that no dirt/debris is on the contact surfaces of cover and compressor casting.

Top and Mains Covers

- Place the Top Cover and secure it with the fasteners according to the following sequence. Follow the sequence twice. The first time, only thread the fasteners half way down to allow for adjustments. Torque to 13 in.lb. on the second pass. Refer to Figure 12 – Top Cover Install.

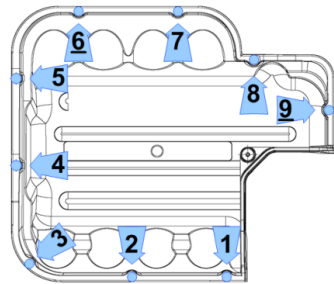


Figure 12 – Top Cover Install

- Ensure that no dirt/debris is on the contact surfaces of the Mains Input Cover and casting sides.
- Place the New Mains Input Cover and secure it with the fasteners. Tighten according to the following sequence. Refer to Figure 13 – Mains Input Cover Install.

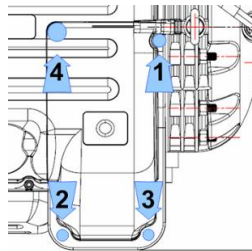


Figure 13 – Mains Input Cover Install

- Follow the sequence twice. The first time, only thread the fasteners to half way down to allow for adjustment. Torque to 13 in.lb. on the second pass. Fasten the # 4 fastener only once and use caution as to not overtighten this fastener.

Service Side Cover

- Place the new service side cover and secure it with the six (6) M5x15 screws according to the sequence shown in Figure 14 – Service Cover Install.

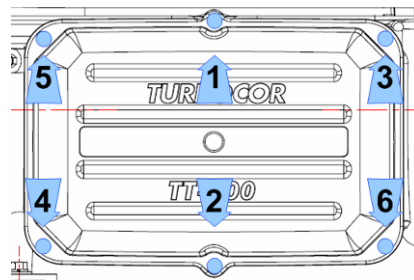


Figure 14 – Service Cover Install

- Follow the sequence twice. The first time, only fasten the screws to half way down to allow for adjustment. Torque to 13 in.lb. on the second pass.

6 - Kit Contents:

| Kit numbers | Compressor models | |
|-------------|---|------------|
| 100326 | All FIE Models (revision G and earlier) | |
| QTY | Part(s) Description | Picture(s) |

| | | |
|---|--|--|
| 1 | DC BUS TEST HARNESS KIT (FULLY-INTEGRATED) | |
|---|--|--|

| Kit numbers | Compressor models | |
|-------------|--|------------|
| 100101 | All FIE Models (revision H) | |
| QTY | Part(s) Description | Picture(s) |
| 1 | DC BUS TEST HARNESS KIT (FULLY-INTEGRATED) | |

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