

SCR/Diode Module Replacement for Fx09-Fx12/D1h–D8h/E1h–E4h

iC7 Series Frequency Converters and VLT® FC Series Drives

1 Overview

1.1 Description

Both iC7 Series Frequency Converters and VLT® FC Series drives contain 3 SCR/diode modules. SCR/diode module replacement kits contain the components required to replace 1 SCR/diode module. SCR/diode module conversion kits contain 3 SCR/diode modules along with busbars and fasteners required to upgrade the drive.

1.2 Kit Numbers

N O T I C E

MATCHING SCR/DIODE MODULES

If all 3 SCR/diode modules installed in a frequency converter are not the same type and manufacturer, the frequency converter can malfunction.

- Check that the replacement module matches the existing modules. If not, replace all 3 SCR/diode modules.
- If replacing multiple SCR/diode modules, verify that all kit numbers match.

Use these instructions with the following kits. See [Table 1](#) for iC7 Series kits. See [Table 2](#) and [Table 3](#) for VLT® FC Series kits.

Table 1: Kit Numbers for iC7 Series SCR/Diode Module Kits

| Kit number | Kit description | Frame/enclosure | Voltage | Current rating |
|------------|--------------------------------|---|------------------|------------------------------------|
| 176F8318 | Rectifier SCR/diode 181A 1600V | FA09/FK09a/FK09c/FB09a/FB09c | 380–480/500 V AC | 206A, 245A, 302A |
| 176F8320 | Rectifier SCR/diode 320A 1600V | FA09/FK09a/FK09c/FB09a/FB09c | 380–480/500 V AC | 385A |
| 176F6647 | Rectifier SCR/diode 700A 1600V | FA10-FA11/FK10a/FK10c/FB10a/FB10c/FK11/FB11 | 380–480/500 V AC | 395A, 480A, 588A, 658A, 736A, 799A |
| | | FA12/FK12/FB12 | 380–480/500 V AC | 893A, 1000 |
| 176F3934 | Rectifier SCR 1400A 1600V | FA12/FK12/FB12 | 380–480/500 V AC | 1120, 1260 |
| 176F4099 | Rectifier Diode 1400A 1600V | FA12/FK12/FB12 | 380–480/500 V AC | 1120, 1260 |

Table 2: Kit Numbers for VLT® FC Series SCR/Diode Module Kits

| Kit number | Kit description | Frame/enclosure | Voltage | Power rating |
|------------|--------------------------|-----------------|------------------|------------------------|
| 176F3426 | Rectifier SCR 429A 2200V | D2h/D4h/D7h/D8h | 525–690 V AC | N250, N315, N400 |
| 176F3859 | Rectifier SCR 320A 1600V | D1h/D3h/D5h/D6h | | N160 |
| 176F3860 | Rectifier SCR 586A 1600V | D1h/D3h/D5h/D6h | | N200, N250 |
| 176F6647 | Rectifier SCR 700A 1600V | E1h–E4h | 380–480/500 V AC | All |
| 176F6648 | Rectifier SCR 650A 2200V | E1h–E4h | 525–690 V AC | All |
| 176F8318 | Rectifier SCR 181A 1600V | D1h/D3h/D5h/D6h | 200–240 V AC | N45K, N55K, N75K, N90K |

| Kit number | Kit description | Frame/enclosure | Voltage | Power rating |
|------------|--------------------------|-----------------|------------------|------------------------------------|
| | | | 380–480/500 V AC | N90K, N110, N132, N150, N160 |
| 176F8529 | Rectifier SCR 165A 2200V | D1h/D3h/D5h/D6h | 525–690 V AC | N55K, N75K, N90K, N110, N132, N160 |
| 176F8530 | Rectifier SCR 280A 2200V | D2h/D4h/D7h/D8h | 525–690 V AC | N160, N200, N250 |

Table 3: Kit Number for VLT® FC Series SCR/Diode Module Conversion Kit

| Kit number | Kit description | Frame/enclosure | Voltage | Power rating |
|------------|---|-----------------|---------|--------------|
| 176F3890 | SCR Conversion Kit 568A N200T5/N250T5 HO | D2h/D4h/D7h/D8h | | |

1.3 Items Supplied

See [Table 4](#) for the parts included in SCR/diode module replacement kits. See [Table 5](#) for items supplied in conversion kits.

Table 4: Items Supplied in SCR/Diode Module Replacement Kits

| Item description | Quantity |
|---------------------------------|----------|
| SCR/diode module | 1 |
| 3 cc syringe of thermal grease | 1 |
| Fasteners for SCR mounting | 2–4 |
| Fasteners for busbar connection | varies |

Table 5: Items Supplied in SCR/Diode Module Conversion Kits (176F3890)

| Item description | Quantity |
|--------------------------------|----------|
| SCR/diode module | 3 |
| SCR input busbar | 3 |
| SCR-to-DC busbar | 2 |
| DC(-) busbar | 1 |
| DC(+) busbar | 1 |
| M6 x 24 mm Torx screw | 12 |
| M10 x 22 mm Torx screw | 6 |
| Standoff | 3 |
| 3 cc syringe of thermal grease | 3 |

2 Installation

2.1 Safety Information

NOTICE

QUALIFIED PERSONNEL

Only qualified, Danfoss authorized personnel are allowed to install the parts described in these installation instructions.

- Disassembly and reassembly of the frequency converter must be done in accordance with the service guide.
- Use the standard fastener torque values from the service guide, unless the torque value is specified in these instructions.

⚠ WARNING ⚠

ELECTRICAL SHOCK HAZARD

Danfoss frequency converters contain dangerous voltages when connected to mains voltage. Improper installation, and installing or servicing with power connected, can cause death, serious injury, or equipment failure.

- Only use qualified electricians for the installation.
- Disconnect the frequency converter from all power sources before installation or service.
- Treat the frequency converter as live whenever the mains voltage is connected.
- Follow the guidelines in these instructions and local electrical safety codes.

⚠ WARNING ⚠

DISCHARGE TIME

The frequency converter contains DC-link capacitors, which can remain charged even when the frequency converter is not powered. High voltage can be present even when the warning LED indicator lights are off. Failure to wait the specified time after power has been removed before performing service or repair work can result in death or serious injury.

- Stop the motor.
- Disconnect AC mains and remote DC-link power supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.
- Disconnect or lock the motor.
- Disconnect any brake option.
- Disconnect any regen/load share option.
- Wait for the capacitors to discharge fully. The minimum waiting time is listed on the frequency converter label and also in the following discharge time table.
- Before performing any service or repair work, use an appropriate voltage measuring device to make sure that the capacitors are fully discharged.

Table 6: Discharge Time

| Frame | Minimum waiting time |
|-----------|----------------------|
| D1h-D8h | 20 minutes |
| Fx09-Fx10 | 20 minutes |
| E1h-E4h | 40 minutes |
| Fx11-Fx12 | 40 minutes |

NOTICE**ELECTROSTATIC DISCHARGE**

Electrostatic discharge can damage components.

- Ensure discharge before touching internal frequency converter components, for example by touching a grounded, conductive surface or by wearing a grounded armband.

2.2 Installing SCR/Diode Modules

NOTICE**THERMAL INTERFACE**

A proper thermal interface is required between the SCR/diode module and heat sink. Failure to follow these instructions results in a poor thermal bond.

- Ensure that the environment is free of airborne dust and contaminants while applying the thermal grease.

NOTICE**FASTENER SIZE**

For some spare part kits, 2 different sizes of screws are included.

- Use the screw size that fits the heat sink.

NOTICE**HEAT SINK DAMAGE**

A damaged heat sink can cause a frequency converter to malfunction. A clean and undamaged mounting surface allows proper thermal dissipation.

- Take care not to scratch or damage the heat sink when cleaning and servicing the frequency converter.

Refer to the service guide for SCR/diode module disassembly. To install replacement SCR/diode modules, use the following steps.

Procedure

1. Clean the heat sink using a cloth and isopropyl alcohol to remove debris and remaining thermal grease.
2. Verify that the thermal grease is not expired by checking the expiration date on the package.

If expired, order a new syringe of thermal grease (176F6769).

3. With the syringe, apply thermal grease to the bottom of the SCR/diode module in the pattern shown in [Illustration 1](#).

It is not required to use the entire syringe, but excess thermal grease is not a problem.

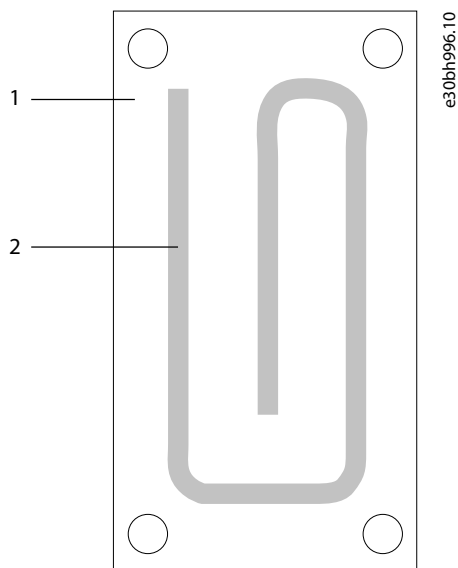


Illustration 1: SCR/Diode Module Thermal Grease Pattern

| | |
|---|------------------------------------|
| 1 | Bottom surface of SCR/diode module |
| 2 | Thermal grease |

4. Place the module on the heat sink, and twist it back and forth to spread the thermal grease evenly on the SCR/diode module and the heat sink surface.
5. Align the mounting holes in the SCR/diode module with the holes in the heat sink.
6. Insert the screws into the SCR/diode modules and hand tighten them.
7. Wait 1 minute.
8. Using a manual torque wrench to avoid over torquing the screws, follow the tightening sequence shown in [Illustration 2](#).

Apply 0.6 Nm (5.3 in-lb) of initial torque at a maximum of 100 RPM. Then apply final torque in the same sequence using the values listed in [Table 7](#).

9. Connect the gate lead to the cable connector on the SCR/diode module.

For SCR/diode module conversion kits, continue to [2.3 Installing the SCR/Diode Module Busbars](#) to install the rest of the kit. Otherwise, complete the frequency converter reassembly as described in the service guide.

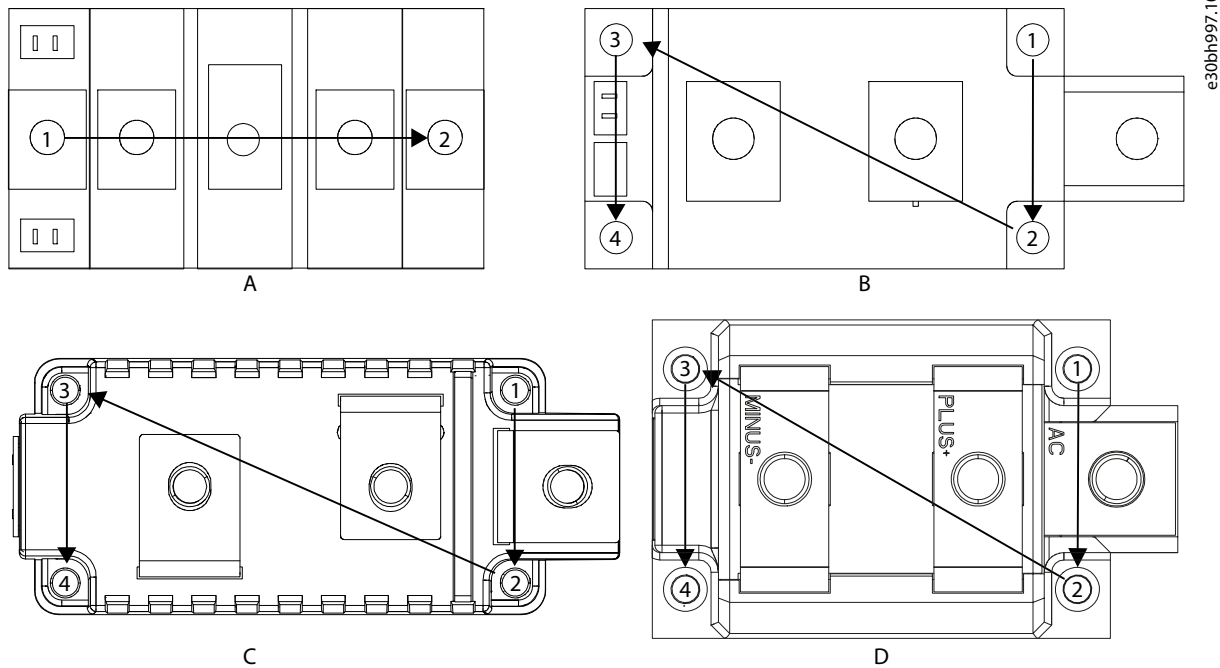


Illustration 2: SCR/Diode Module Fastener Tightening Sequences

Table 7: Torque Tightening Values and Sequence

| Kit number | Mounting torque [Nm (in-lb)] | Busbar connection torque [Nm (in-lb)] | Tightening order | Diagram |
|------------|------------------------------|---------------------------------------|------------------|---------|
| 176F3426 | 6.0 (53) | 12.0 (106) | 1-2-3-4 | B |
| 176F3859 | 5.0 (44) | 9.0 (80) | 1-2-3-4 | C |
| 176F3860 | 6.0 (53) | 12.0 (106) | 1-2-3-4 | C |
| 176F3890 | 6.0 (53) | 12.0 (106) | 1-2-3-4 | C |
| 176F3934 | 5.5 (49) | 11.0 (97) | 1-2-3-4 | D |
| 176F4099 | 5.5 (49) | 11.0 (97) | 1-2-3-4 | D |
| 176F6647 | 5.5 (49) | 11.0 (97) | 1-2-3-4 | D |
| 176F6648 | 5.5 (49) | 11.0 (97) | 1-2-3-4 | D |
| 176F8318 | 2.5 (22) | 5.0 (44) | 1-2 | A |
| 176F8320 | 5.8 (51) | 12.0 (106) | 1-2-3-4 | B |
| 176F8529 | 2.5 (22) | 5.0 (44) | 1-2 | A |
| 176F8530 | 5.8 (51) | 12.0 (106) | 1-2-3-4 | B |

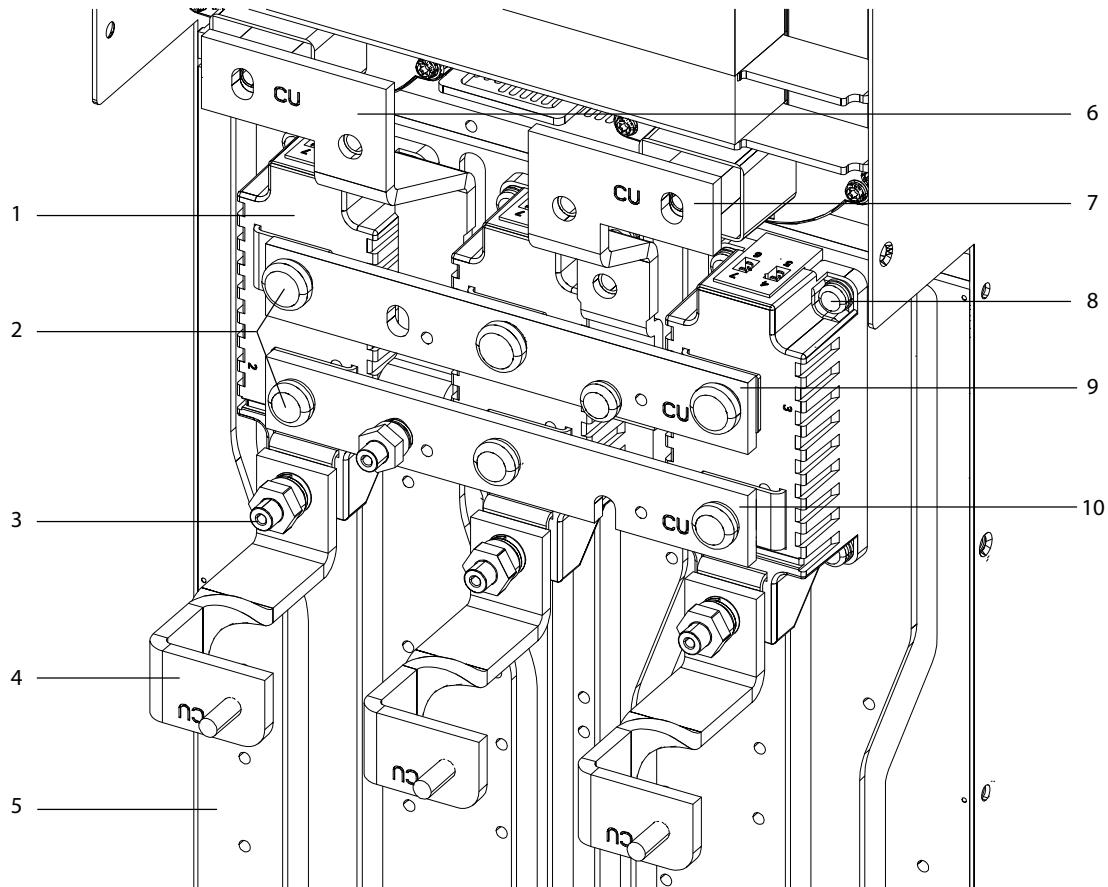
2.3 Installing the SCR/Diode Module Busbars

SCR/diode module conversion kits contain 3 SCRs plus new busbars. Use the following steps to install the busbars. See [Illustration 3](#).

Procedure

1. Position the 3 SCR input busbars in the frequency converter, 1 on each SCR/diode module.
2. Fasten 3 standoffs (19 mm), 1 in each SCR/diode module connecting it to the busbar.
3. Fasten 3 M10 screws (T50) in the SCR-to-DC(-) busbar, connecting it to the 3 SCR/diode modules.
4. Fasten 3 M10 screws (T50) in the SCR-to-DC(+) busbar, connecting it to the 3 SCR/diode modules.
5. Position the DC(-) busbar behind the SCR-to-DC(-) busbar and fasten 1 screw connecting the busbars.

6. Position the DC(+) busbar behind the SCR-to-DC(+) busbar and fasten 1 standoff connecting the busbars.



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Illustration 3: SCR/Diode Module Busbar Installation

| | | | |
|---|-------------------|----|---------------------|
| 1 | SCR/diode module | 6 | DC(+) busbar |
| 2 | M10 screws | 7 | DC(-) busbar |
| 3 | Standoff | 8 | M6 screw |
| 4 | SCR input busbars | 9 | SCR-to-DC(-) busbar |
| 5 | Heat sink | 10 | SCR-to-DC(+) busbar |

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