ENGINEERING TOMORROW

Installation Guide

iC7-Automation Frequency Converters

FA02–FA08/FK06–FK08 (1.3–170 A)

drives.danfoss.com | iC7

1 Instructions

1.1 Safety and Installation Awareness

Both an installation and a safety guide are provided with the drive. Before starting installation, read all safety guidelines and precautions in the safety guide (136R0243). For details on cyber security, see Security Features in the application guide (136R0283). Additional resources - including the operating guide, design guide, and application guide - can be downloaded at www.danfoss.com/service-and-support.

1.2 Required Tools

- Lifting aid
- Tape measurer
- Wrench with extension and 10 mm socket
- Torx and slotted screwdrivers (T15, T20, T25, T30, T50, SL1, and SL2)
- Wire crimper
- Sheet metal punch and/or pliers for cable entry plate

1.3 Verifying the Shipment and the Contents

Make sure that the items supplied and the information on the product label correspond to the order confirmation. The product label is found on the top of the drive.

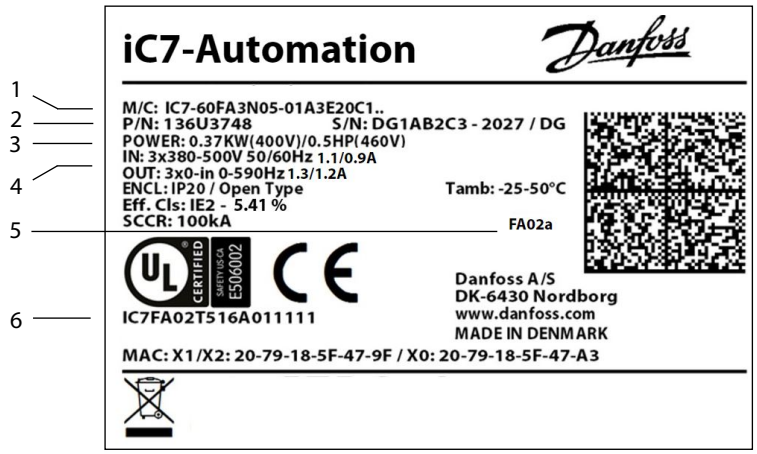

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Illustration 1: Example of a Product Label

1	Model code (2D code shows the full model code)	4	Input and output voltage, frequency, and current
2	Part number and serial number	5	Frame designation
3	Power rating	6	Compliance code

1.4 EMC-compliant Installation

For EMC-compliant installation, refer to the operating or design guide and follow the electrical installation instructions.

- Use shielded cables for motor output (unshielded cables within metal conduit are also acceptable), brake, DC, and control wiring.
- Connect the shield to the enclosures at both ends. If the shield connection points have a voltage potential difference, connect a low impedance equalizing wire parallel to the shielded cable. Otherwise, break the shield connection on one end to prevent ground current loops.
- Ensure that motor, brake, and DC cables are as short as possible to reduce the interference level from the entire system.
- Provide a minimum 200 mm (7.9 in) separation, if possible, between mains input, motor cables, and control cables.

- Convey the currents back to the unit using an EMC plate. Ensure good electrical contact from the EMC plate through the mounting screws to the drive chassis.
- Parts identified with (!) must be installed. See step 4 in the Illustrations section.

1.5 Installing the Drive

⚠ W A R N I N G ⚠

SHOCK HAZARD

Touching an uncovered motor, mains, or DC connection plug or terminal can result in death or serious injury.

– All plugs and terminal protection covers for the motor, mains, and DC connections must be installed within the IP20 enclosure to provide an IP20 protection rating. If the plug and terminal covers are not installed, the protection rating is considered IP00.

The installation location is important.

Full output current is available when the following installation conditions are met. For temperatures and altitudes outside this range, consult the Derating section in the design guide.

- Maximum surrounding air temperature: 45 °C (113 °F) average over 24 hours and 50 °C (122 °F) for 1 hour.
- Minimum surrounding air temperature: 0 °C (32 °F).
- Altitude < 1000 m (3280 ft) above sea level.

Procedure

1. Identify the frame designation. See Illustration 1.
2. Make sure that the operating environment and electrical installation meet the following standards.
   - **a.** Indoor unconditioned/pollution degree 2.
   - **b.** Overvoltage category 3.
3. Review the wiring diagram. See step 1 in the Illustrations section.

   All wiring must comply with local and national regulations regarding cross-section and ambient temperature requirements. Loose connections can cause equipment faults or reduced performance. Tighten the terminals according to the proper torque value shown in step 8.
4. Review the fuse specifications. See step 2 in the Illustrations section.

   The drive can be suitable for use on a circuit capable of delivering up to 100 kA short circuit current rating (SCCR) at 480/600 V. For circuit breaker and switch SCCR ratings, see the design guide.
5. Review the power cable specifications. See step 3 in the Illustrations section.

   Use copper wire with a minimum 70 °C (158 °F) rating for Fx02–Fx07 enclosures and 90 °C (194 °F) rating for Fx08 enclosures. For aluminum wire, see the design guide.
6. Install the drive following the numbered steps in the Illustrations section. Certain illustrations/steps pertain to specific frame designations and are marked as such.
   - **a.** Attach accessory bag components to the drive (step 4).
   - **b.** Mount the drive on or against a solid, non-combustible mounting surface such as concrete or metal (step 5). Ensure proper cooling by providing minimum clearance above and below the drive.
   - **c.** For frames FK06–FK08, drill cable openings in the cable entry plate and install the cable glands (step 6).
   - **d.** Install the control wiring (step 7).
   - **e.** Install the motor, mains, and ground wiring (step 8).
   - **f.** Route the control cables (step 9)
7. Securely fasten the cover to the drive.
8. Perform initial drive and motor setup. Consult the application guide.

1.6 Functional Safety (Safe Torque Off)

The drive is shipped with all safe inputs de-energized. Without extra wiring to the safe I/O terminal blocks (X31 and X32), the STO function is always active and the motor will not turn.

- To disable the STO function, install jumper wires to terminals X31 and X32. See step 7.
- To use the STO function, wire a safety device to 1 or both of the safe I/O terminal blocks. See step 1. To prevent erroneous faults or warnings from occurring, any unused safe I/O terminal blocks must be disabled using jumper wires or a jumper clip. One jumper clip is included in the accessory bag.

For more information, refer to the *iC7 Series Functional Safety Operating Guide* (136R0268).

⚠ W A R N I N G ⚠

RESIDUAL ROTATION

The STO function can be used for asynchronous, synchronous, and permanent magnet motors. Two faults can occur in the power semiconductor of the drive. When using synchronous or permanent magnet motors, a residual rotation can result from the faults. The rotation can be calculated to angle = 360/(number of poles). The application using synchronous or permanent magnet motors must consider this residual rotation and ensure that it does not pose a safety risk. The situation is not relevant for asynchronous motors.

N O T I C E

A successful commissioning test of the STO function is required after the initial installation and after each subsequent change to the installation or application involving the STO.

Commissioning test

There are 2 types of commissioning tests based on whether the STO parameter is set for manual restart or automatic restart. For more information on the STO parameter, see the application guide.

- (Test M) *Parameter 7.2.1 Safe Torque Off Response = Fault, reset required*.
- (Test A) *Parameter 7.2.1 Safe Torque Off Response = Warning, no reset required*.

Table 1: Commissioning Test for STO Functionality

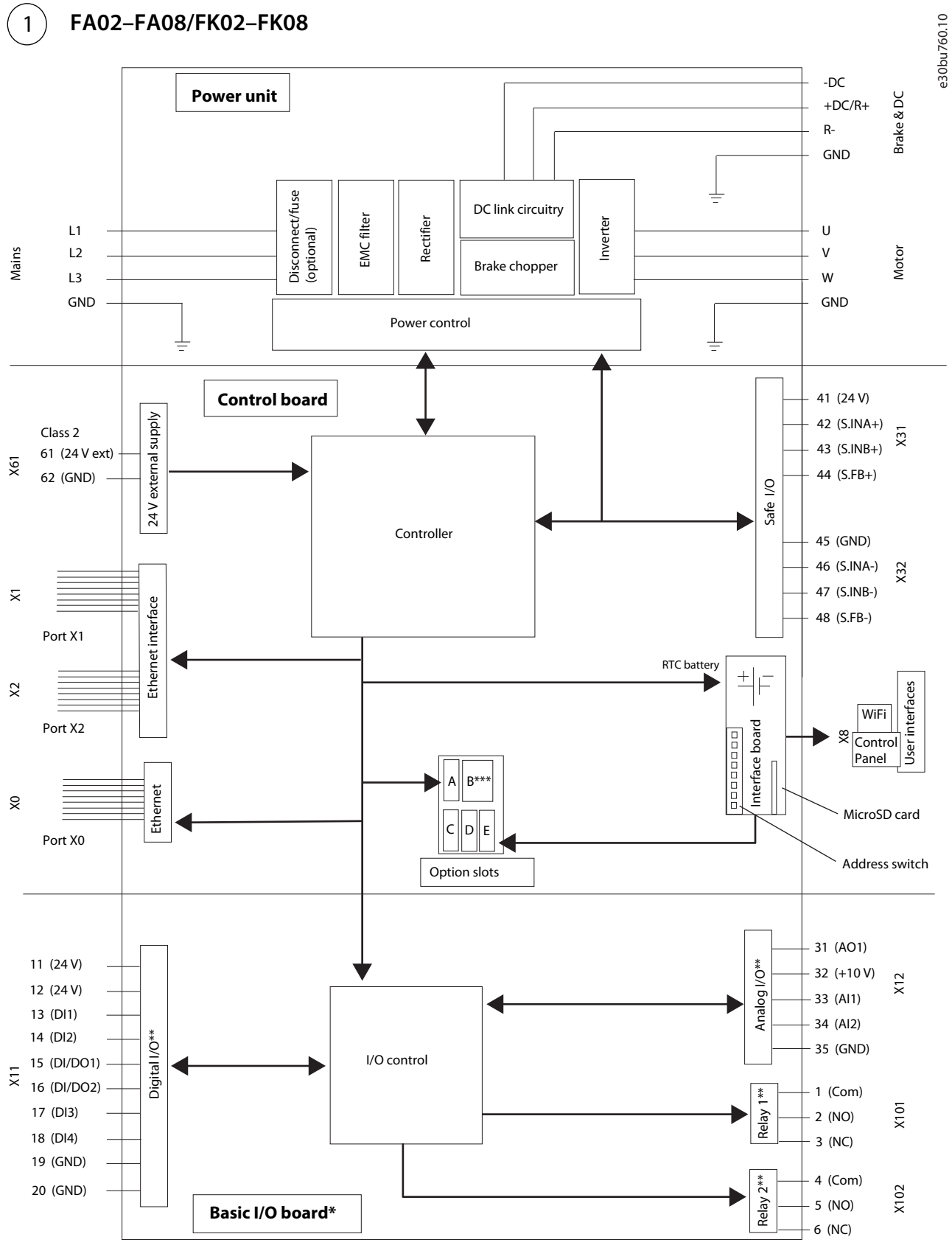
Type of test	Commissioning steps	X
M/A	Power on the frequency converter.	☐
M/A	Verify that no safety faults are present.	☐
M/A	Start the motor.	☐
M/A	Without interrupting the mains supply, remove the 24 V DC voltage supply to both STO input terminals using the safety device.	☐
M/A	Verify that the motor coasts. This process can take some time.	☐
M/A	Verify that STO activated is shown on the control panel or in the event log.	☐
M/A	If the STO feedback is utilized, verify that STO is activated by checking the state of the STO Feedback.	☐
M/A	Reapply 24 V DC supply to both the STO input terminals.	☐
M/–	Verify that the motor remains in the coasted state and any connected relays remain activated.	☐
M/–	Send a reset signal via fieldbus, digital I/O, or the control panel.	☐
M/A	Verify that the motor starts up and runs within the original speed range.	☐

1.7 Power Losses and Efficiency

For power loss data including part load losses, see https://ecosmart.mydrive.danfoss.com.

1.8 Illustrations

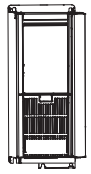
1 FA02–FA08/FK02–FK08

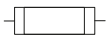


* Optional. ** Functionality set by parameters. *** Option B is available only in FA02–FA05/FK02–FK05.

Illustration 2:

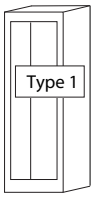
2 FA02–FA08/FK02–FK08





IEC

UL



L (cu. ft)

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	IEC	UL	L (cu. ft)
05-01A3 FA02	10 A, gG	4 A, RK5	52 (1.8)
05-01A8 FA02	10 A, gG	6 A, RK5	52 (1.8)
05-02A4 FA02	10 A, gG	8 A, RK5	52 (1.8)
05-03A0 FA02	10 A, gG	10 A, RK5	52 (1.8)
05-04A0 FA02	10 A, gG	10 A, RK5	52 (1.8)
05-05A6 FA02	10 A, gG	10 A, RK5	52 (1.8)
05-07A2 FA02	10 A, gG	10 A, RK5	52 (1.8)
05-09A2 FA02	16 A, gG	15 A, RK5	52 (1.8)
05-12A5 FA02	20 A, gG	20 A, RK5	52 (1.8)
05-16A0 FA03	25 A, gG	25 A, RK5	52 (1.8)
05-24A0 FA04	40 A, gG	35 A, RK5	96 (3.4)
05-31A0 FA04	50 A, gG	50 A, RK5	96 (3.4)
05-38A0 FA05	50 A, gG	50 A, RK5	96 (3.4)
05-43A0 FA05	63 A, gG	60 A, RK5	96 (3.4)
05-61A0 FA06	80 A, gG	80 A, RK5	192 (6.8)
05-61A0 FK06	80 A, gG	100 A, T/J/CF	–
05-73A0 FA06	100 A, gG	100 A, RK5	192 (6.8)
05-73A0 FK06	100 A, gG	125 A, T/J/CF	–
05-90A0 FA07	125 A, gG	125 A, RK5	240 (8.5)
05-90A0 FK07	125 A, gG	150 A, T/J/CF	–
05-106A FA07	125 A, gG	150 A, RK5	240 (8.5)
05-106A FK07	125 A, gG	175 A, T/J/CF	–
05-147A FA08	200 A, gG	200 A, RK5	288 (10.2)
05-147A FK08	200 A, gG	225 A, T/J/CF	–
05-170A FA08	200 A, gG	250 A, RK5	288 (10.2)
05-170A FK08	200 A, gG	250 A, T/J/CF	–

Illustration 3:

3 FA02–FA08/FK02–FK08

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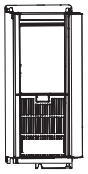
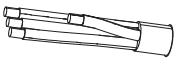
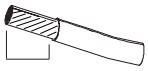
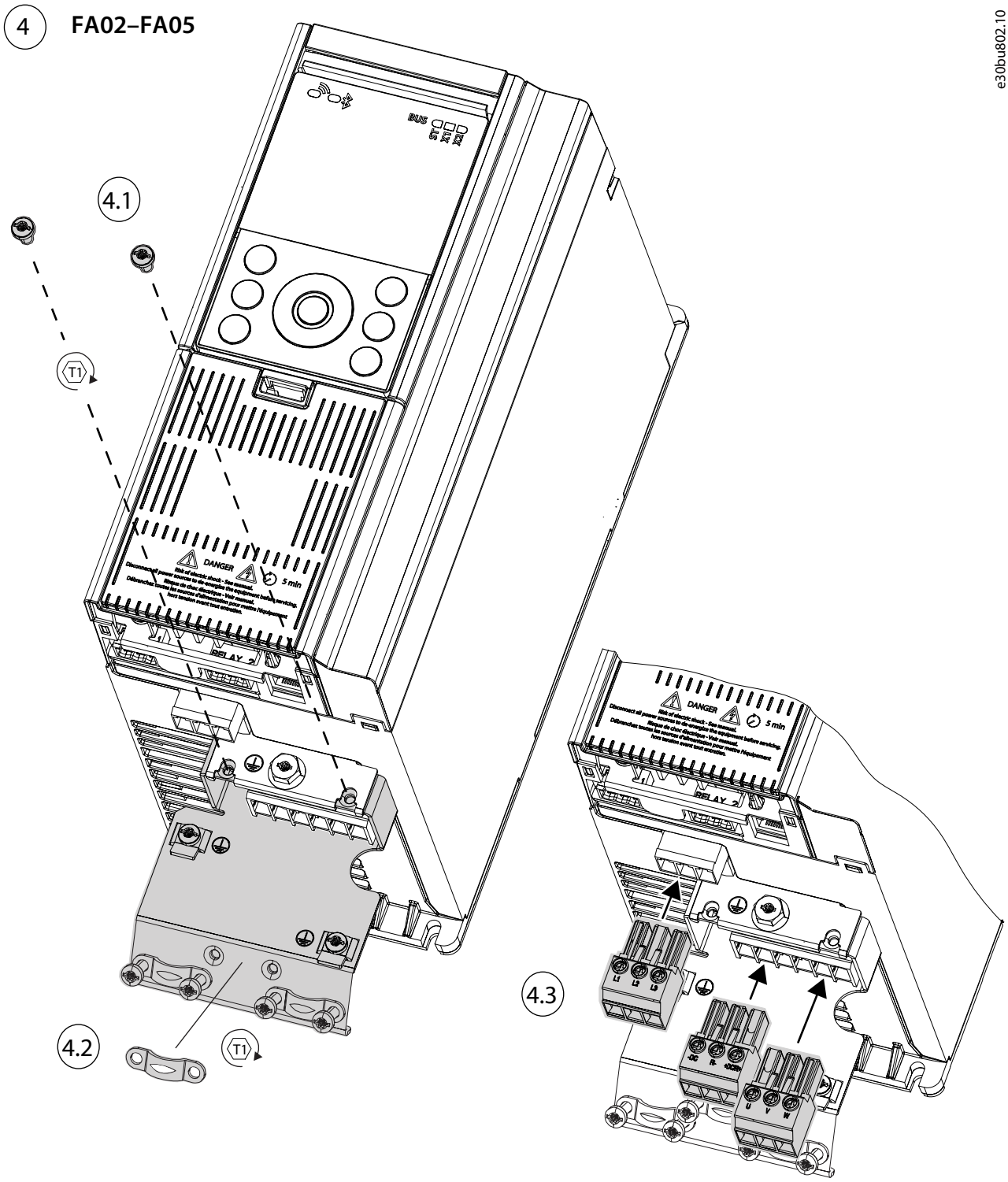
	L1/L2/L3 U/V/W  [mm^2 (AWG)]	-DC, R-, +DC/R+  [mm^2 (AWG)]	 [mm (in)]
05-01A3 FA02	1.5–4 (16–12)	1.5–4 (16–12)	10 (0.4)
05-01A8 FA02	1.5–4 (16–12)	1.5–4 (16–12)	10 (0.4)
05-02A4 FA02	1.5–4 (16–12)	1.5–4 (16–12)	10 (0.4)
05-03A0 FA02	1.5–4 (16–12)	1.5–4 (16–12)	10 (0.4)
05-04A0 FA02	1.5–4 (16–12)	1.5–4 (16–12)	10 (0.4)
05-05A6 FA02	1.5–4 (16–12)	1.5–4 (16–12)	10 (0.4)
05-07A2 FA02	1.5–4 (16–12)	1.5–4 (16–12)	10 (0.4)
05-09A2 FA02	4–6 (12–10)	4–6 (12–10)	10 (0.4)
05-12A5 FA02	4–6 (12–10)	4–6 (12–10)	10 (0.4)
05-16A0 FA03	4–6 (12–10)	4–6 (12–10)	10 (0.4)
05-24A0 FA04	6–16 (10–6)	6–16 (10–6)	15 (0.6)
05-31A0 FA04	6–16 (10–6)	6–16 (10–6)	15 (0.6)
05-38A0 FA05	10–25 (8–4)	10–25 (8–4)	22 (0.9)
05-43A0 FA05	10–25 (8–4)	10–25 (8–4)	22 (0.9)
05-61A0 FA06	16–50 (6–1)	16–50 (6–1)	22 (0.9)
05-61A0 FK06	16–50 (6–1)	16–50 (6–1)	22 (0.9)
05-73A0 FA06	16–50 (6–1)	16–50 (6–1)	22 (0.9)
05-73A0 FK06	16–50 (6–1)	16–50 (6–1)	22 (0.9)
05-90A0 FA07	35–95 (2–3/0)	16–50 (6–1)	22 (0.9)
05-90A0 FK07	35–95 (2–3/0)	16–50 (6–1)	22 (0.9)
05-106A FA07	35–95 (2–3/0)	16–50 (6–1)	22 (0.9)
05-106A FK07	35–95 (2–3/0)	16–50 (6–1)	22 (0.9)
05-147A FA08	50–150 (1–300 mcm)	35–95 (2–3/0)	29 (1.1)
05-147A FK08	50–120 (1–4/0)	35–95 (2–3/0)	29 (1.1)
05-170A FA08	50–150 (1–300 mcm)	35–95 (2–3/0)	29 (1.1)
05-170A FK08	50–120 (1–4/0)	35–95 (2–3/0)	29 (1.1)

Illustration 4:



T1 – [2 Nm (18 in-lb)]

Illustration 5:

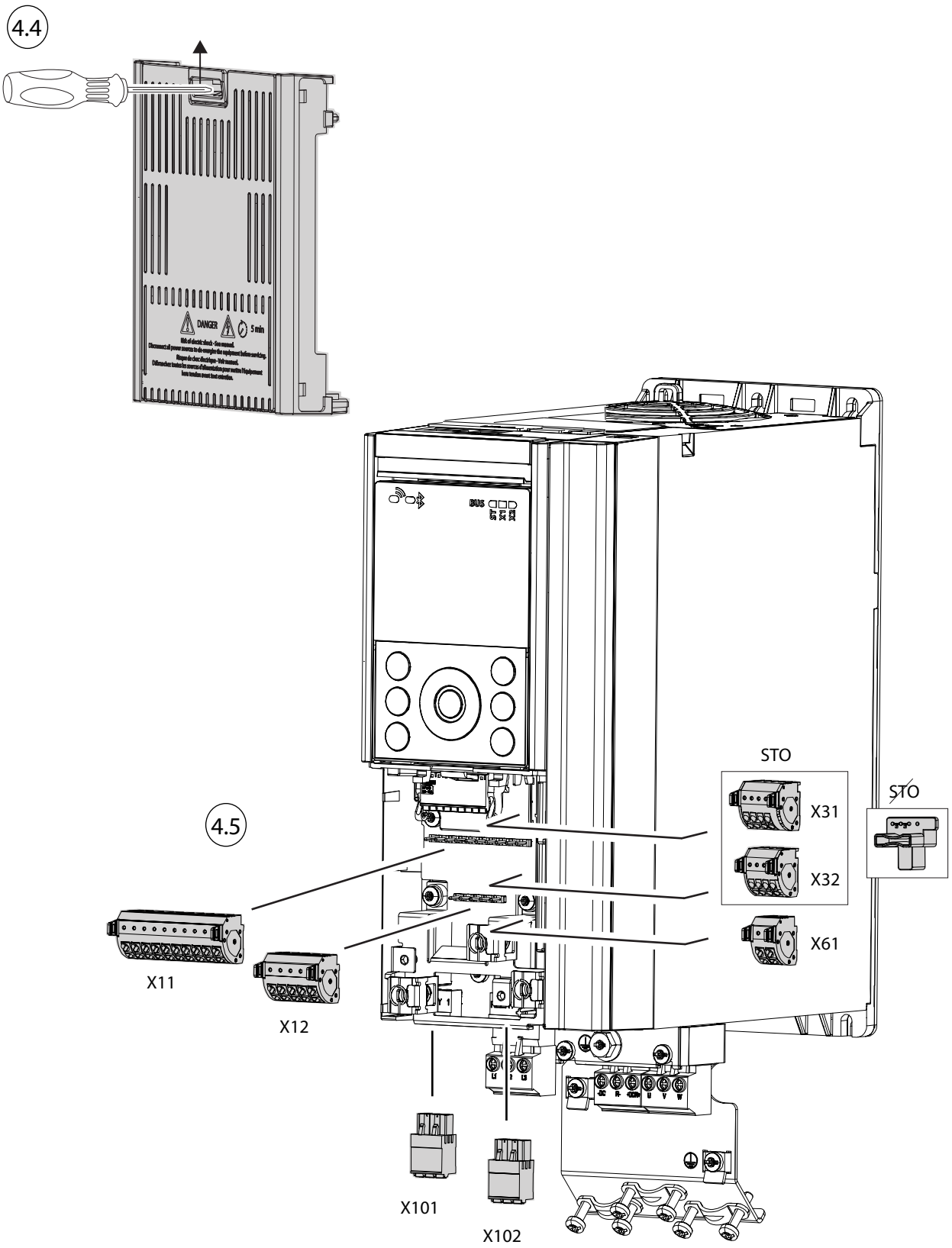


Illustration 6:

FA06–FA08

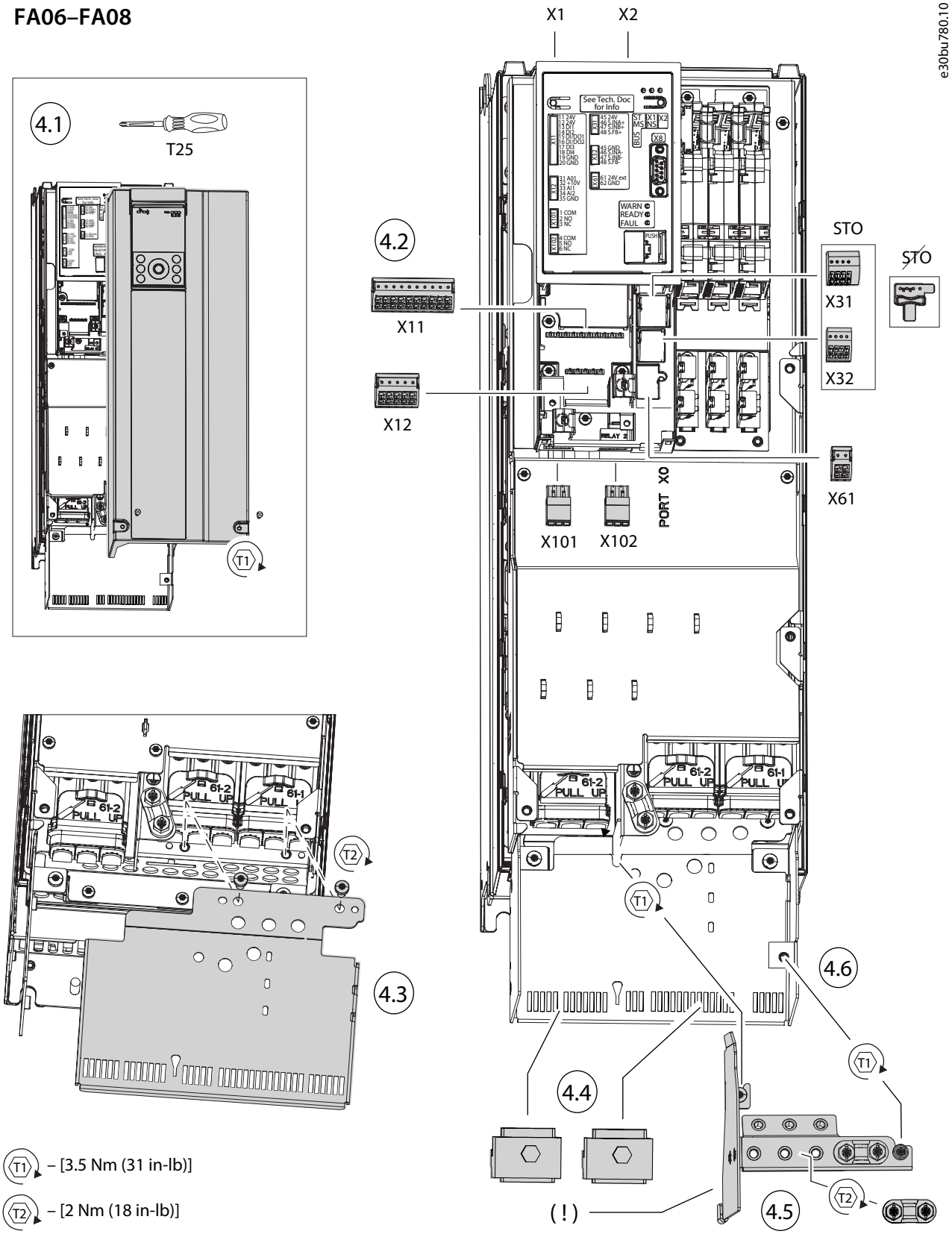
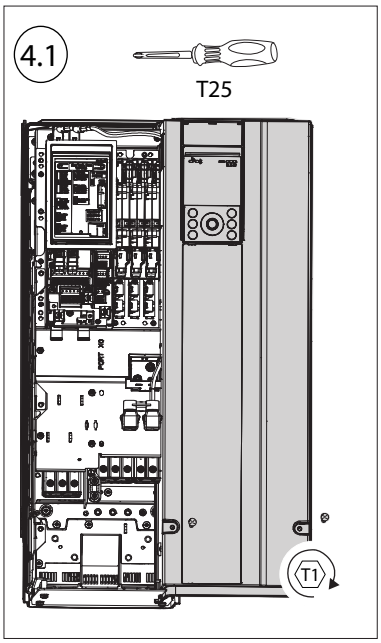
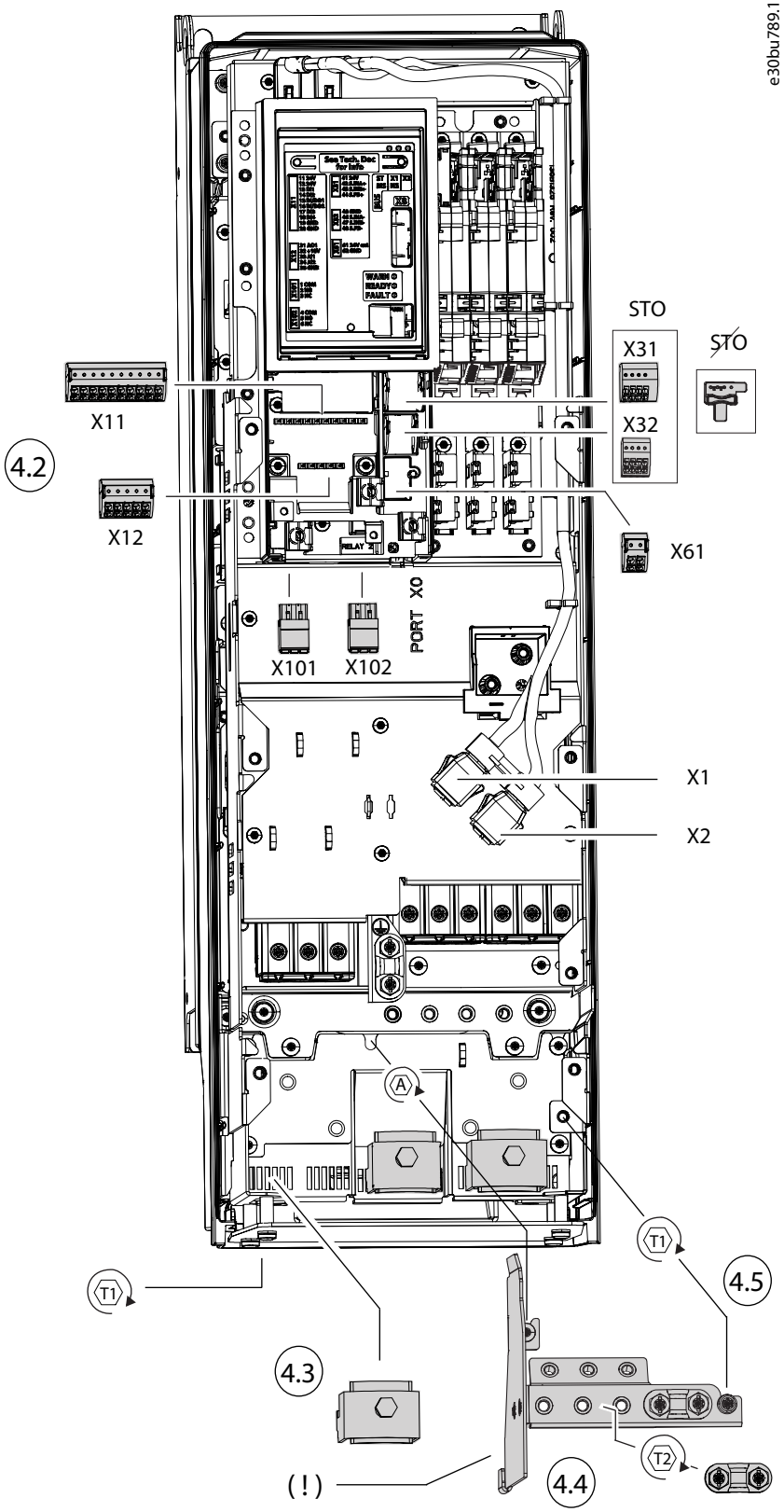


Illustration 7:

FK06–FK08





T1 – [3.5 Nm (31 in-lb)]

T2 – [2 Nm (18 in-lb)]

Illustration 8:

5 FA02–FA08/FK02–FK08

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[mm (in)]	FA02	FA03	FA04	FA05	FA06/FK06	FA07/FK07	FA08/FK08
A	257 (10.1)	257 (10.1)	380 (15.0)	380 (15.0)	535 (21.1)	580 (22.1)	721 (28.4)
B	70 (2.8)	94 (3.7)	105 (4.1)	140 (5.5)	170 (6.7)	200 (7.9)	200 (7.9)
C	100 (3.9)	100 (3.9)	100 (3.9)	100 (3.9)	200 (7.9)	200 (7.9)	200 (7.9)
	4 x M5		4 x M6		4 x M8		

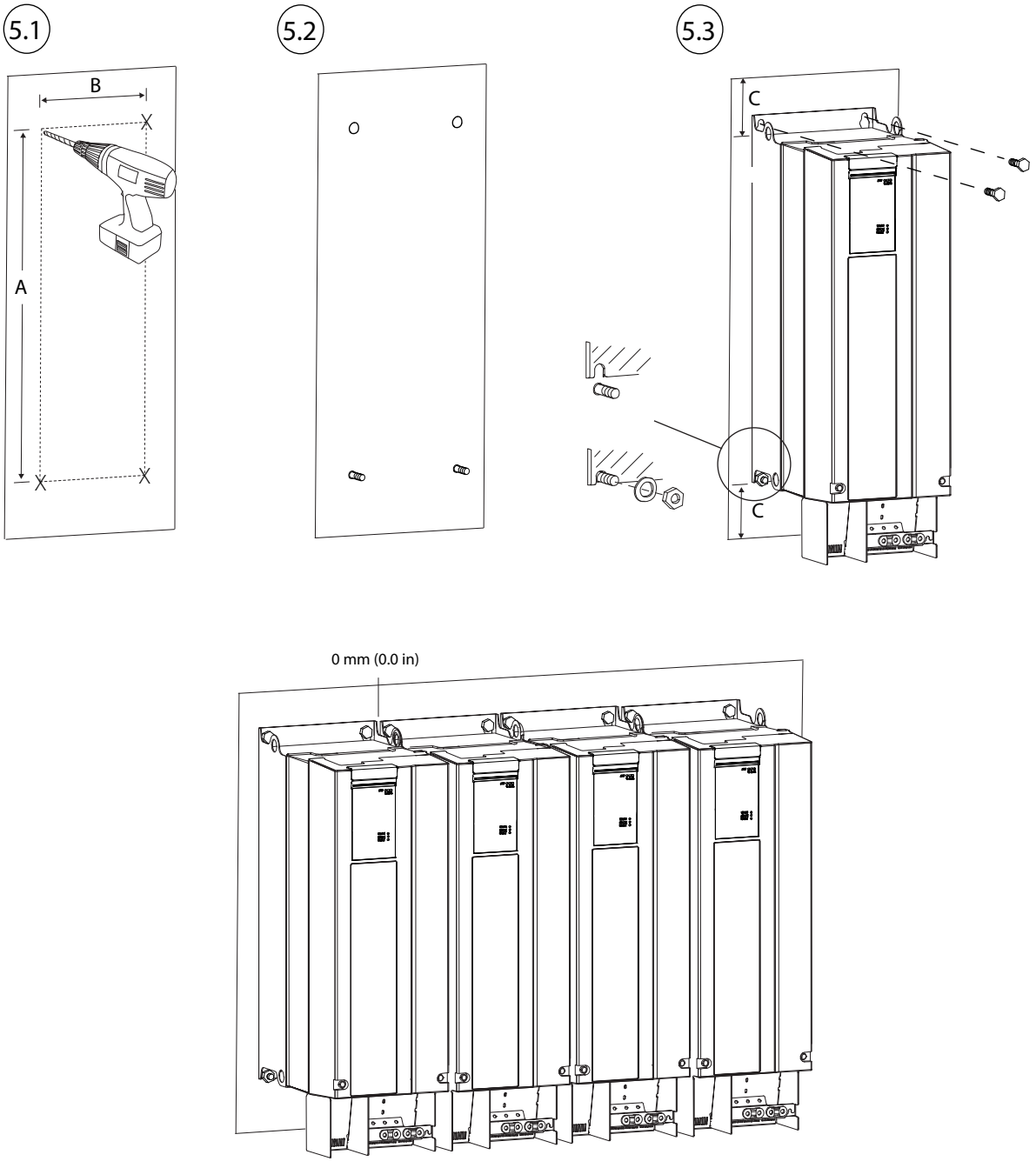


Illustration 9:

6 FK06–FK08

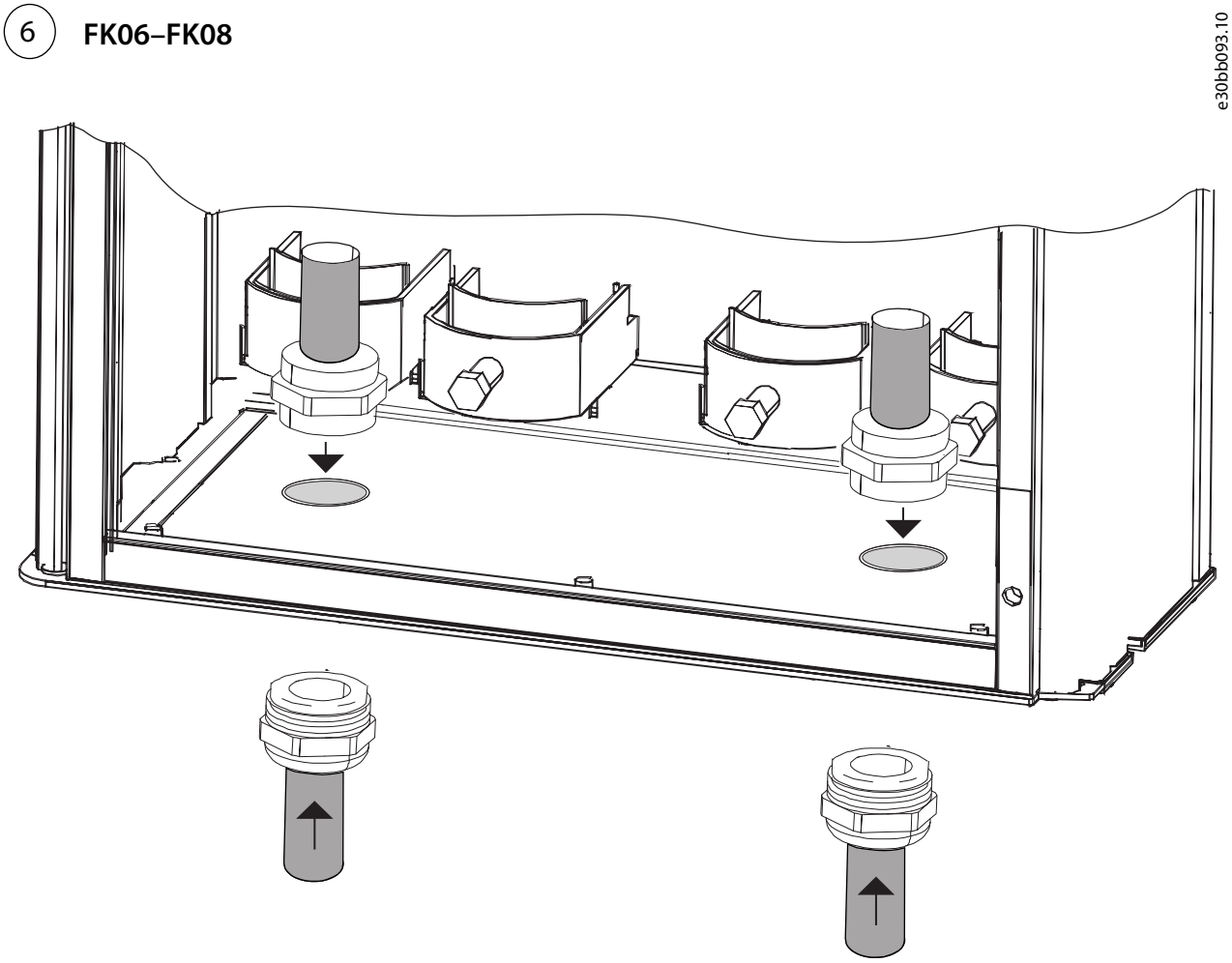


Illustration 10:

7 FA02–FA08/FK02–FK08

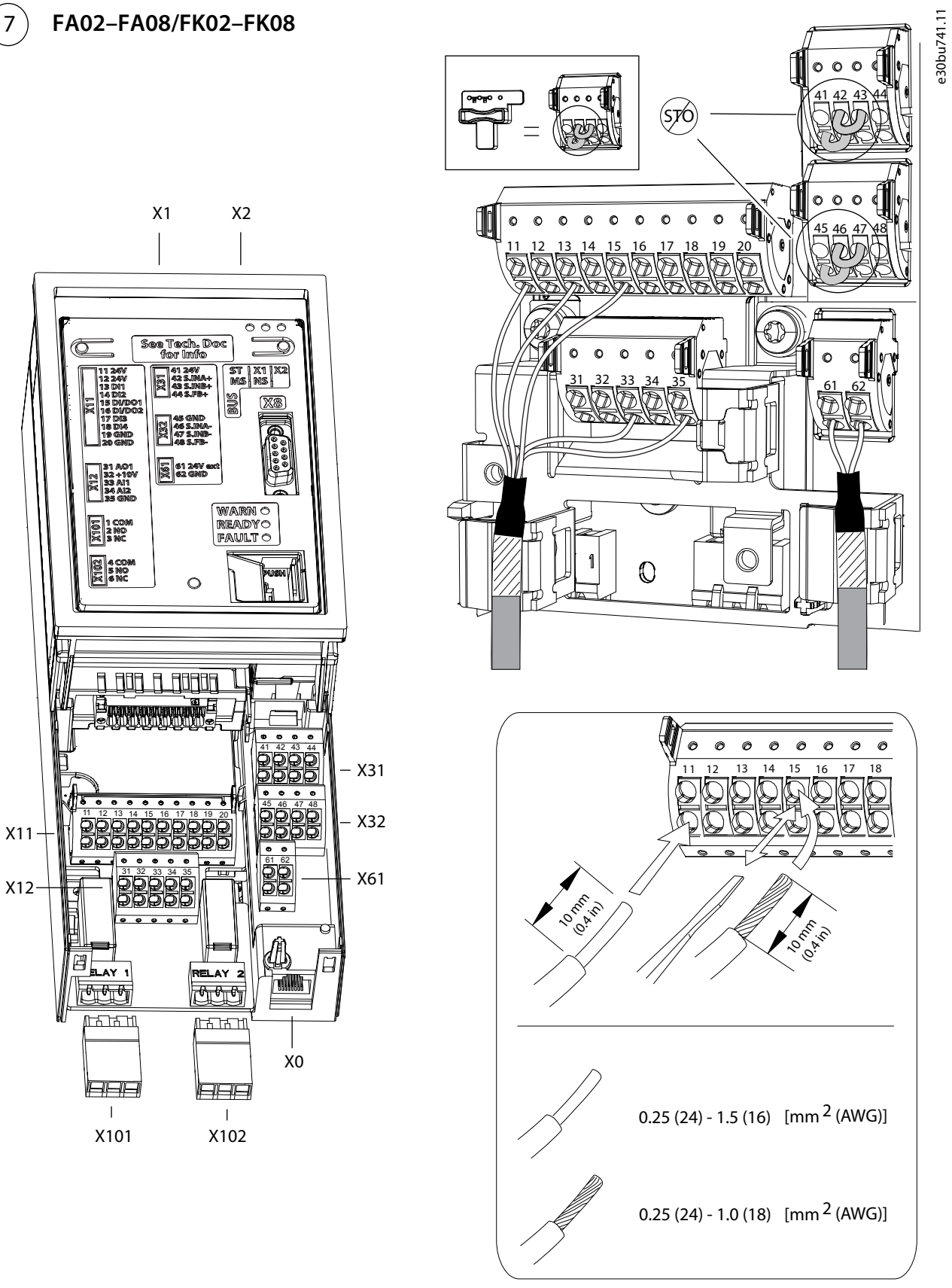
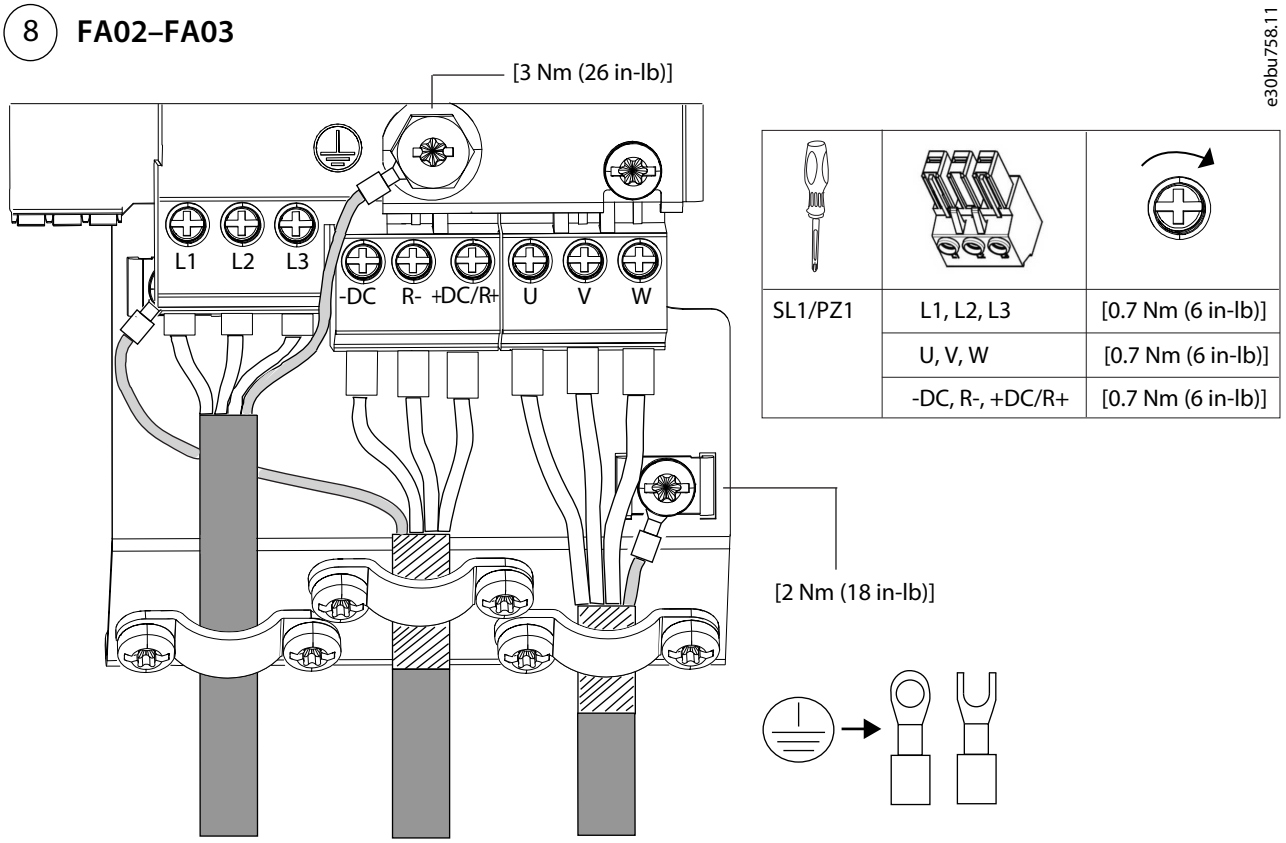


Illustration 11:

8 FA02–FA03



SL1/PZ1	L1, L2, L3	[0.7 Nm (6 in-lb)]
	U, V, W	[0.7 Nm (6 in-lb)]
	-DC, R-, +DC/R+	[0.7 Nm (6 in-lb)]

Illustration 12:

FA04–FA05

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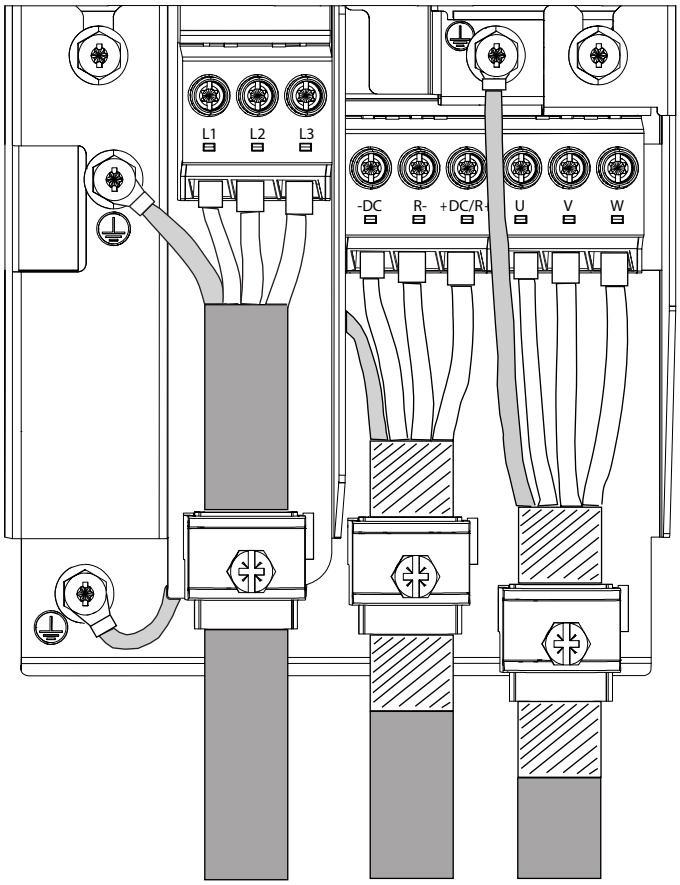


FA04	L1, L2, L3	1.2–1.5 Nm (11–13 in-lb)
	U, V, W	1.2–1.5 Nm (11–13 in-lb)
	-DC, R-, +DC, R+	1.2–1.5 Nm (11–13 in-lb)
FA05	L1, L2, L3	2.0–2.5 Nm (18–22 in-lb)
	U, V, W	2.0–2.5 Nm (18–22 in-lb)
	-DC, R-, +DC, R+	2.0–2.5 Nm (18–22 in-lb)
	⏚	3 Nm (26 in-lb)

SL1/T15
SL2/T20

10 mm

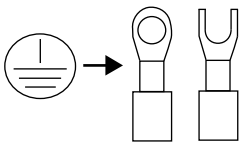
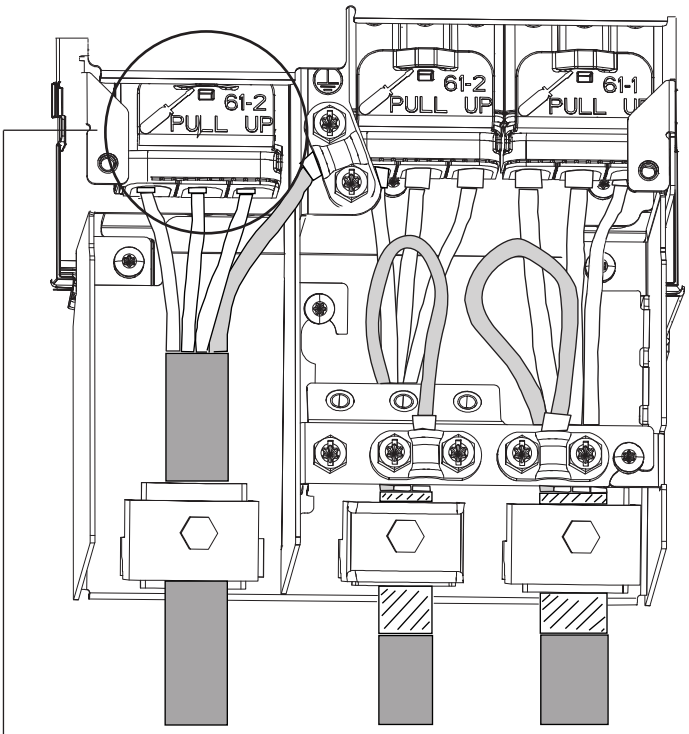
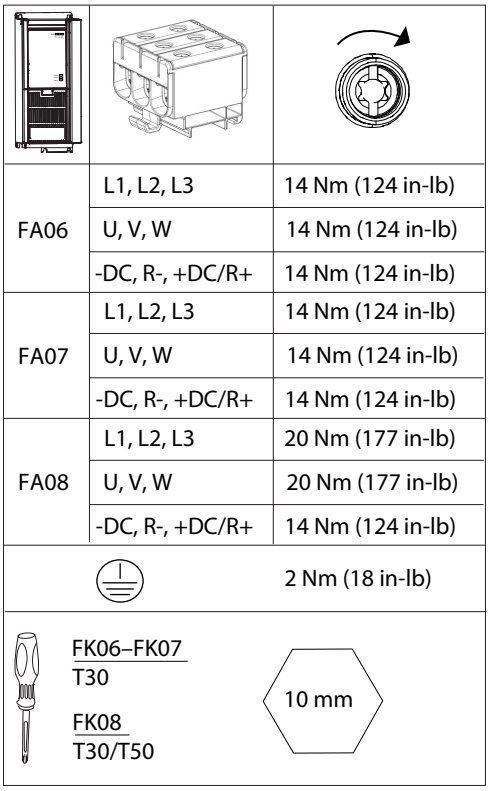


Illustration 13:

FA06–FA08





FA06	L1, L2, L3	14 Nm (124 in-lb)
	U, V, W	14 Nm (124 in-lb)
	-DC, R-, +DC/R+	14 Nm (124 in-lb)
FA07	L1, L2, L3	14 Nm (124 in-lb)
	U, V, W	14 Nm (124 in-lb)
	-DC, R-, +DC/R+	14 Nm (124 in-lb)
FA08	L1, L2, L3	20 Nm (177 in-lb)
	U, V, W	20 Nm (177 in-lb)
	-DC, R-, +DC/R+	14 Nm (124 in-lb)
		2 Nm (18 in-lb)

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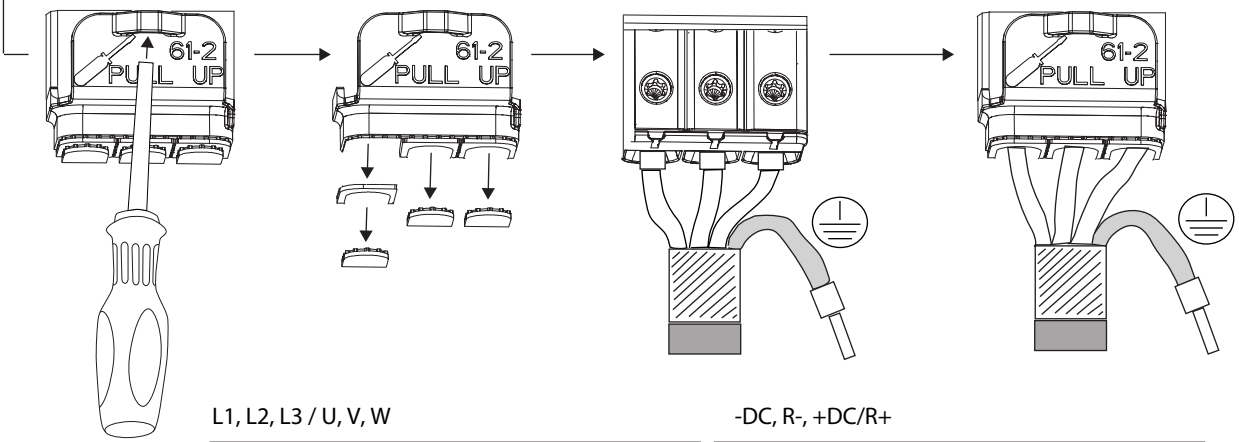

L1, L2, L3 / U, V, W

FA06	50 mm² (1 AWG)	16 mm² (6 AWG)
FA07	95 mm² (3/0 AWG)	35 mm² (2 AWG)
FA08	150 mm² (300 mcm)	50 mm² (1 AWG)

-DC, R-, +DC/R+

FA06	50 mm² (1 AWG)	16 mm² (6 AWG)
FA07	50 mm² (1 AWG)	16 mm² (6 AWG)
FA08	95 mm² (3/0 mcm)	35 mm² (2 AWG)

Illustration 14:

FK06–FK08

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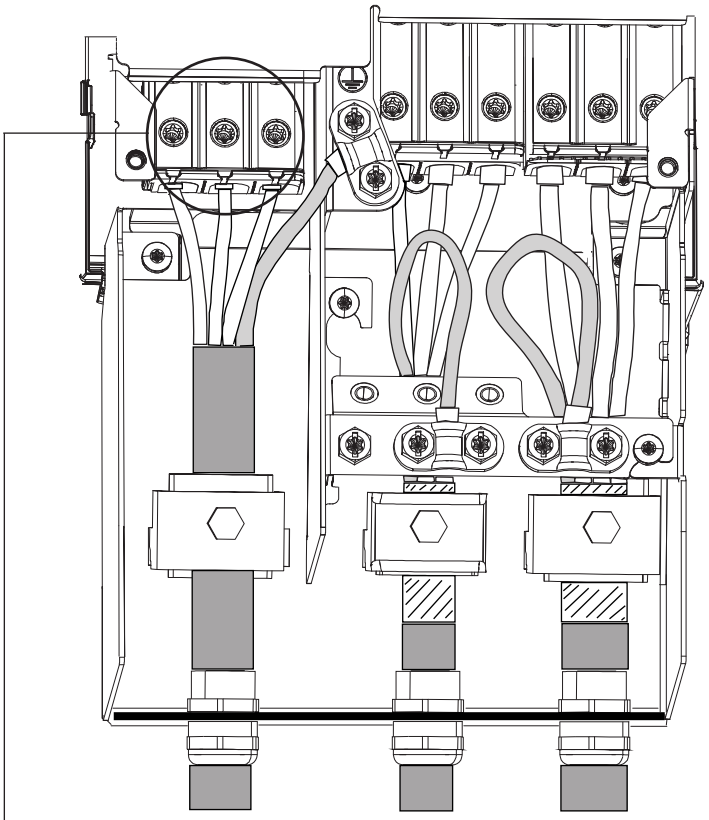
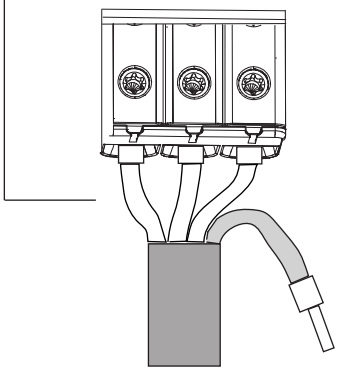


	L1, L2, L3	14 Nm (124 in-lb)
FK06	U, V, W	14 Nm (124 in-lb)
	-DC, R-, +DC/R+	14 Nm (124 in-lb)
	L1, L2, L3	14 Nm (124 in-lb)
FK07	U, V, W	14 Nm (124 in-lb)
	-DC, R-, +DC/R+	14 Nm (124 in-lb)
	L1, L2, L3	20 Nm (177 in-lb)
FK08	U, V, W	20 Nm (177 in-lb)
	-DC, R-, +DC/R+	14 Nm (124 in-lb)
	⏚	2 Nm (18 in-lb)

FK06–FK07
T30

FK08
T30/T50

10 mm



L1, L2, L3 / U, V, W

FK06	50 mm^2 (1 AWG)	16 mm^2 (6 AWG)
FK07	95 mm^2 (3/0 AWG)	35 mm^2 (2 AWG)
FK08	120 mm^2 (4/0 mcm)	50 mm^2 (1 AWG)

-DC, R-, +DC/R+

FK06	50 mm^2 (1 AWG)	16 mm^2 (6 AWG)
FK07	50 mm^2 (1 AWG)	16 mm^2 (6 AWG)
FK08	95 mm^2 (3/0 AWG)	35 mm^2 (2 AWG)

Illustration 15:

9 FA02–FA08/FK02–FK08

e30bu781.10

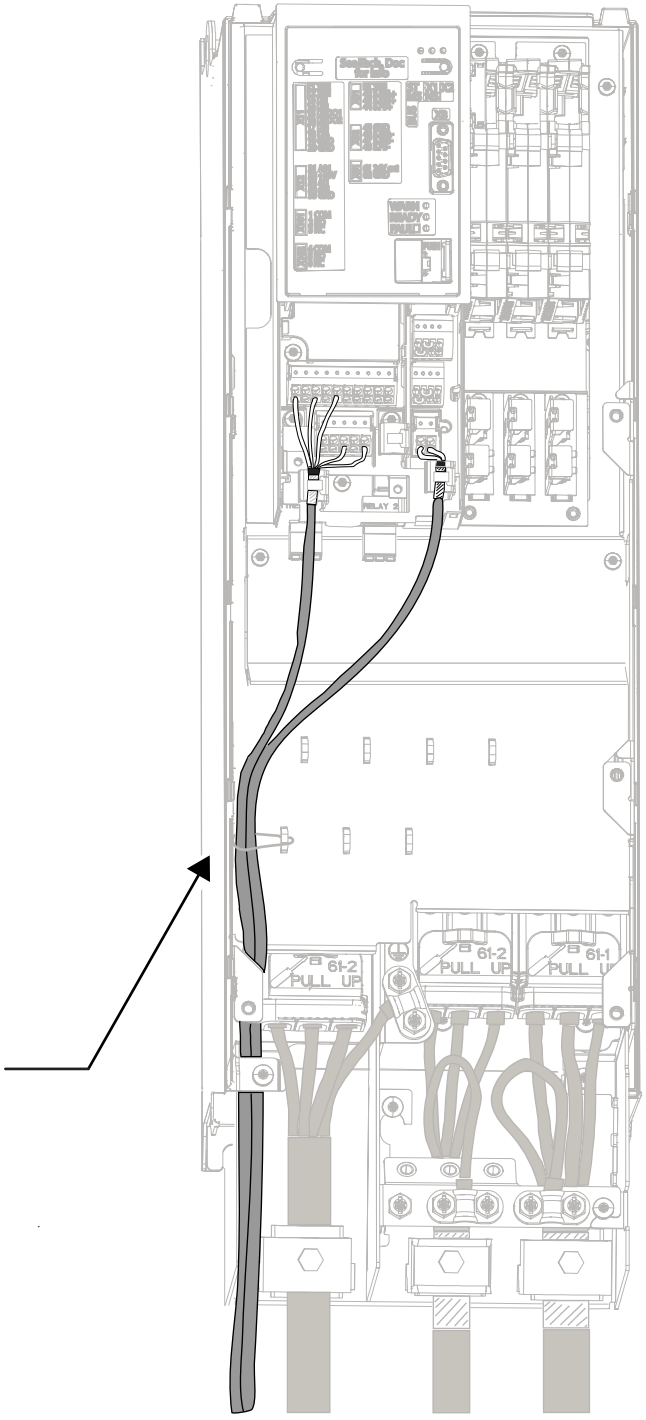


Illustration 16:

ENGINEERING TOMORROW

Danfoss A/S
6430 Nordborg
Denmark
CVR nr.: 20 16 57 15

Telephone: +45 7488 2222
Fax: +45 7449 0949

EU DECLARATION OF CONFORMITY

Danfoss A/S

Danfoss Drives

declares under our sole responsibility that the

Product category: Frequency Converter
Type designation(s): iC7yyyyAyyyyyyyyyyyy***y

"y" are varying numbers or letters indicating drive options which impact this DoC, and "*" may be any number or letter indicating drive options which do not impact this DoC.

Character 4-5: FA, FK, FB.
Character 6-7: 02, 03, 04, 05, 09, 10, 11, 12.
Character 9-10: T5.
Character 11-14: 01A3, 02A4, 03A0, 04A0, 05A6, 07A2, 09A2, 12A5, 16A0, 24A0, 31A0, 38A0, 43A0, 206A, 245A, 302A, 385A, 395A, 480A, 588A, 658A, 736A, 799A, 893A, 1000, 1120, 1260.
Character 15: 1, 2, 4.
Character 16: A, B, C, D, E.
Character 17: X, 1.
Character 18: X, 1, 3.
Character 19: X, 1.
Character 23: X, A.

Covered by this declaration is in conformity with the following directive(s), regulations(s), standard(s) or other normative document(s), provided that the product is used in accordance with our instructions.

Low Voltage Directive 2014/35/EU

EN61800-5-1:2007 + A1:2017	Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy.

EMC Directive 2014/30/EU

EN61800-3:2004 + A1:2012	Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods.

Date: 2022.03.09 Place of issue:	Issued by	Date: 2022.03.09 Place of issue:	Approved by
Graasten, DK	Signature: Name: Martin Skov Holm Title: Chief Product Architect	Graasten, DK	Signature: Name: Michael Quitzau Title: Head of PM&D, Denmark

RoHS Directive 2011/65/EU including amendment 2015/863.

EN IEC63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

Commission Regulation (EU) 2019/1781 under the Ecodesign Directive 2009/125/EC including amendment in Commission Regulation (EU) 2021/341

EN61800-9-2:2017	Adjustable speed electrical power drive systems - Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Energy efficiency indicators for power drive systems and motor starters.

Machinery Directive 2006/42/EC

EN/IEC 61800-5-2:2007	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design.

Other standards considered

EN ISO 13849-1:2015	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design.
EN/IEC 62061:2005 + A2:2015	Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems.
EN/IEC 61508-1 to -3:2010	Functional safety of electrical/electronic/ programmable electronic safety-related systems Part 1: General requirements Part 2: Requirements for electrical/ electronic / programmable electronic safety-related systems Part 3: Software Requirements
EN/IEC 60204-1:2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Illustration 17:

ENGINEERING TOMORROW

Danfoss A/S
6430 Nordborg
Denmark
CVR nr.: 20 16 57 15

Telephone: +45 7488 2222
Fax: +45 7449 0949

UK DECLARATION OF CONFORMITY

Danfoss A/S

Danfoss Drives

declares under our sole responsibility that the

Product category: Frequency Converter
Type designation(s): iC7yyyyAyyyyyyyyyyy***y

"y" are varying numbers or letters indicating drive options which impact this DoC, and "*" may be any number or letter indicating drive options which do not impact this DoC.

Character 4-5: FA, FK, FB.
Character 6-7: 02, 03, 04, 05, 09, 10, 11, 12.
Character 9-10: T5.
Character 11-14: 01A3, 02A4, 03A0, 04A0, 05A6, 07A2, 09A2, 12A5, 16A0, 24A0, 31A0, 38A0, 43A0, 206A, 245A, 302A, 385A, 395A, 480A, 588A, 658A, 736A, 799A, 893A, 1000, 1120, 1260.
Character 15: 1, 2, 4.
Character 16: A, B, C, D, E.
Character 17: X, 1.
Character 18: X, 1, 3.
Character 19: X, 1.
Character 23: X, A.

Covered by this declaration is in conformity with the following directive(s), regulation(s), standard(s) or other normative document(s), provided that the product is used in accordance with our instructions.

Electrical Equipment (Safety) Regulations 2016

BS EN61800-5-1:2007 + A1:2017	Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy.

Electromagnetic Compatibility Regulations 2016

BS EN61800-3:2004 + A1:2012	Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods.

Date: 2022.03.09 Place of issue:	Issued by	Date: 2022.03.09 Place of issue:	Approved by
Graasten, DK	**Signature:** **Name: Martin Skov Holm** **Title: Chief Product Architect**	Graasten, DK	**Signature:** **Name: Michael Quitzau** **Title: Head of PM&D, Denmark**

Danfoss only vouches for the correctness of the English version of this declaration. In the event of the declaration being translated into any other language, the translator concerned shall be liable for the correctness of the translation

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 as amended

BS EN IEC63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

Commission Regulation (EU) 2019/1781 under the Ecodesign Directive 2009/125/EC including amendment in Commission Regulation (EU) 2021/341

BS EN61800-9-2:2017	Adjustable speed electrical power drive systems - Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Energy efficiency indicators for power drive systems and motor starters.

Supply of Machinery (Safety) Regulations 2008

EN/IEC 61800-5-2:2007	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design.

Other standards considered

EN ISO 13849-1:2015	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design.
EN/IEC 62061:2005 + A2:2015	Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems.
EN/IEC 61508-1 to -3:2010	Functional safety of electrical/electronic/ programmable electronic safety-related systems Part 1: General requirements Part 2: Requirements for electrical/ electronic / programmable electronic safety-related systems Part 3: Software Requirements
EN/IEC 60204-1:2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Illustration 18:

ENGINEERING
TOMORROW

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136R0242