DRIVES FOR HVAC

ACH580-01 drives, frames R1 to R5

Quick installation and start-up guide

R1-R4

R5

EN

3AXD50000044861 Rev B MUL
EFFECTIVE: 2019-06-30

List of related manuals in English

Drive manuals and guides	Code (English)
ACH580 HVAC control program firmware manual	*3AXD50000027537*
ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual	*3AXD50000044839*
ACH580-01 quick installation and start-up guide for frames R1 to R5	*3AXD50000044861*
ACH580-01 quick installation and start-up guide for frames R6 to R9	*3AXD50000036602*
ACH580 Installation, Operation, and Maintenance Manual (I, O & M) (US only)	*3AXD50000049127*
ACx-AP-X assistant control panels user's manual	3AUA0000085685

Option manuals and guides	
CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971) user's manual	*3AXD50000030058*
CDPI-01 communication adapter module user's manual	*3AXD50000009929*
DPMP-01 mounting platform for control panels	*3AUA0000100140*
DPMP-02/03 mounting platform for control panels	*3AUA0000136205*
FBIP-21 BACnet/IP adapter module	*3AXD50000028468*
FCAN-01 CANopen adapter module user's manual	*3AFE68615500*
FCNA-01 ControlNet adapter module user's manual	*3AUA0000141650*
FDNA-01 DeviceNet™ adapter module user's manual	*3AFE68573360*
FECA-01 EtherCAT adapter module user's manual	*3AUA0000068940*
FEIP-21 Ethernet/IP adapter module user's manual	*3AXD50000158621*
FENA-01/-11/-21 Ethernet adapter module user's manual	*3AUA0000093568*
FEPL-02 Ethernet POWERLINK adapter module user's manual	*3AUA0000123527*
FLON-01 LONWORKS® adapter module user's manual	*3AUA0000041017*
FMBA-01 Modbus adapter module user's manual	*3AFE68586704*
FMBT-21 Modbus/TCP adapter module user's manual	*3AXD50000158607*
FPBA-01 PROFIBUS DP adapter module user's manual	*3AFE68573271*
FPNO-21 PROFINET adapter module user's manual	*3AXD50000158614*
FSCA-01 RS-485 adapter module user's manual	*3AUA0000109533*
Main switch and EMC C1 filter options (+F278, +F316, +E223) installation supplement for ACS580-01, ACH580-01 and ACH580-01 frames R1 to R5	*3AXD50000155132*
UL Type 12 hood quick installation guide for ACS580-01, ACH580-01 and ACQ580-01 frames R1 to R9	*3AXD50000196067*

Note: For UK gland plate and flange mounting kit manuals, see section Related documents in the drive *hardware manual*.

You can find manuals and other product documents in PDF format on the Internet.

See section Document library on the Internet on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.

The QR code below opens an online listing of the manuals applicable to this product.

ACH580-01 manuals

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DRIVES FOR HVAC

ACH580-01 drives

Quick installation guide
Frames R1 to R4

R1-R4

EN

3AXD50000044861 Rev B MUL
EFFECTIVE: 2019-06-30

Ratings and fuses

IEC ratings at U_N = 230 V, 400 V and 480 V

- U_N = 230 V

R1-R4

Type ACH580 -01-	Input rating	Output ratings			Heat dissipation	Air flow	Frame size
		Max. current	Nominal use				
	I_1	I_{max}	I_N	P_N			
	A	A	A	kW	W	m^3/h	
3-phase U_N = 230 V							
04A7-2	4.7	6.3	4.7	0.75	45	43	R1
06A7-2	6.7	8.9	6.7	1.1	55	43	R1
07A6-2	7.6	11.9	7.6	1.5	66	43	R1
012A-2	12.0	19.1	12.0	3.0	106	43	R1
018A-2	16.9	22.0	16.9	4.0	133	43	R1
025A-2	24.5	32.7	24.5	5.5	174	101	R2
032A-2	31.2	43.6	31.2	7.5	228	101	R2
047A-2	46.7	62.4	46.7	11	322	179	R3
060A-2	60	83.2	60.0	15	430	179	R3

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Type ACH580-01-	Input ratings	Output ratings		Frame size
	I_1	I_N	P_N	
	A	A[1)]	kW	
1-phase U_N = 230 V				
04A7-2	3.3	2.2	0.37	R1
06A7-2	4.6	3.2	0.5	R1
07A6-2	6.3	4.2	0.75	R1
12A0-2	8.9	6.0	1.1	R1
018A-2	11.8	6.8	1.5	R1
025A-2	17.3	9.6	2.2	R2
032A-2	30.4	15.2	4.0	R2
047A-2	42	22	5.5	R3
060A-2	55	28	7.5	R3

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[1)] Continuous current, no overloadability

U_N = 400 V

R1-R4

Type ACH580 -01-	Input rating	Output ratings			Heat dissipation	Air flow	Frame size
		Max. current	Nominal use				
	I_1	I_{max}	I_N	P_N			
	A	A	A	kW	W	m^3/h	
3-phase U_N = 400 V							
02A7-4	2.6	3.2	2.6	0.75	69	43	R1
03A4-4	3.3	4.7	3.3	1.1	78	43	R1
04A1-4	4.0	5.9	4.0	1.5	87	43	R1
05A7-4	5.6	7.2	5.6	2.2	113	43	R1
07A3-4	7.2	10.1	7.2	3.0	127	43	R1
09A5-4	9.4	13.0	9.4	4.0	165	43	R1
12A7-4	12.6	15.3	12.6	5.5	237	43	R1
018A-4	17.0	22.7	17.0	7.5	265	101	R2
026A-4	25.0	30.6	25.0	11.0	416	101	R2
033A-4	32.0	44.3	32.0	15.0	514	179	R3
039A-4	38.0	56.9	38.0	18.5	570	179	R3
046A-4	45.0	67.9	45.0	22.0	709	179	R3
062A-4	62	76	62	30	957	134	R4
073A-4	73	104	73	37	1230	134	R4

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U_N = 480 V

Type ACH580 -01-	Input rating	Output ratings			Heat dissipation	Air flow	Frame size
		Max. current	Nominal use				
	I_1	I_{max}	I_{Ld}	P_{Ld}			
	A	A	A	hp	W	m^3/h	
3-phase U_N = 480 V							
02A7-4	2.1	2.9	2.1	1.0	45	43	R1
03A4-4	3.0	3.8	3.0	1.5	55	43	R1
04A1-4	3.4	5.4	3.5	2.0	66	43	R1
05A7-4	4.8	6.1	4.8	3.0	84	43	R1
07A3-4	6.0	7.2	6.0	3.0	106	43	R1
09A5-4	7.6	8.6	7.6	5.0	133	43	R1
12A7-4	11.0	13.7	12.0	7.5	174	43	R1
018A-4	14.0	19.8	14.0	10.0	228	101	R2
026A-4	21.0	25.2	23.0	15.0	322	101	R2
033A-4	27.0	37.8	27.0	20.0	430	179	R3
039A-4	34.0	48.6	34.0	25.0	525	179	R3
046A-4	40.0	61.2	44.0	30.0	619	179	R3
062A-4	52	76	52	40	835	134	R4
073A-4	65	104	65	50	1024	134	R4

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gG fuses

Type ACH580-01-	Min. short-circuit current[1)]	Input current	gG (IEC 60269)					
			Nominal current	I^2t	Voltage rating	ABB type	IEC 60269 size	R1-R4
	A	A	A	A^2s	V			
3-phase U_N = 230 V								
04A7-2	200	4.7	25.0	2500.0	500	OFAF000H25	000	
06A7-2	200	6.7	25.0	2500.0	500	OFAF000H25	000	
07A6-2	200	7.6	25.0	2500.0	500	OFAF000H25	000	
012A-2	200	12.0	25.0	2500.0	500	OFAF000H25	000	
018A-2	200	16.9	25.0	2500.0	500	OFAF000H25	000	
025A-2	320	24.5	40.0	7700.0	500	OFAF000H40	000	
032A-2	320	31.2	40.0	7700.0	500	OFAF000H40	000	
047A-2	500	46.7	63.0	20100.0	500	OFAF000H63	000	
060A-2	500	60.0	63.0	20100.0	500	OFAF000H63	000	
3-phase U_N = 400 or 480 V								
02A7-4	32	2.6	4	55	500	OFAF000H4	000	
03A4-4	48	3.3	6	110	500	OFAF000H6	000	
04A1-4	48	4.0	6	110	500	OFAF000H6	000	
05A7-4	80	5.6	10	360	500	OFAF000H10	000	
07A3-4	80	7.2	10	360	500	OFAF000H10	000	
09A5-4	128	9.4	16	740	500	OFAF000H16	000	
12A7-4	128	12.6	16	740	500	OFAF000H16	000	
018A-4	200	17.0	25	2500	500	OFAF000H25	000	
026A-4	256	25.0	32	4000	500	OFAF000H32	000	
033A-4	320	32.0	40	7700	500	OFAF000H40	000	
039A-4	400	38.0	50	16000	500	OFAF000H50	000	
046A-4	500	45.0	63	20100	500	OFAF000H63	000	
062A-4	800	62	80	37500	500	OFAF000H80	000	
073A-4	1000	73	100	65000	500	OFAF000H100	000	

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[1)] Minimum short-circuit current of the installation

uR or aR fuses

R1-R4

Type ACH580 -01-	Min. short-circuit current[1)]	Input current	uR or aR (DIN 43620 blade style)				
			Nominal current	I^2t	Voltage rating	Bussmann type	IEC 60269 size
	A	A	A	A^2s	V		
3-phase U_N = 230 V							
04A7-2	120.0	4.7	40.0	460.0	690	170M1563	000
06A7-2	120.0	6.7	40.0	460.0	690	170M1563	000
07A6-2	120.0	7.6	40.0	460.0	690	170M1563	000
012A-2	120.0	12.0	40.0	460.0	690	170M1563	000
018A-2	120.0	16.9	40.0	460.0	690	170M1563	000
025A-2	170.0	24.5	63.0	1450.0	690	170M1565	000
032A-2	170.0	31.2	63.0	1450.0	690	170M1565	000
047A-2	280.0	46.7	80.0	2550.0	690	170M1566	000
060A-2	280.0	60.0	80.0	2550.0	690	170M1566	000
089A-2	700.0	89.0	200.0	15000.0	690	170M3815	1
115A-2	700.0	115.0	200.0	15000.0	690	170M3815	1
144A-2	1000	144.0	315	46500	690	170M3817	1
171A-2	1280	171.0	450	105000	690	170M5809	2
213A-2	1450	213.0	500	155000	690	170M5810	2
276A-2	2050	276.0	630	220000	690	170M6810	3
3-phase U_N = 400 or 480 V							
02A7-4	65	2.6	25	130	690	170M1561	000
03A4-4	65	3.3	25	130	690	170M1561	000
04A1-4	65	4.0	25	130	690	170M1561	000
05A7-4	65	5.6	25	130	690	170M1561	000
07A3-4	65	7.2	25	130	690	170M1561	000
09A5-4	65	9.4	25	130	690	170M1561	000
12A7-4	65	12.6	25	130	690	170M1561	000
018A-4	120	17.0	40	460	690	170M1563	000
026A-4	120	25.0	40	460	690	170M1563	000
033A-4	170	32.0	63	1450	690	170M1565	000
039A-4	170	38.0	63	1450	690	170M1565	000
046A-4	280	45.0	80	2550	690	170M1566	000
062A-4	380	62	100	4650	690	170M1567	000
073A-4	480	73	125	8500	690	170M1568	000
088A-4	700	88	160	16000	690	170M1569	000
106A-4	1280	106	315	46500	690	170M3817	1
145A-4	1280	145	315	46500	690	170M3817	1
169A-4	1800	169	450	105000	690	170M5809	1
206A-4	2210	206	500	145000	690	170M5810	1
246A-4	3010	246	630	275000	690	170M5812	2
293A-4	4000	293	800	490000	690	170M6812D	2
363A-4	5550	363	1000	985000	690	170M6814D	2
430A-4	7800	430	1250	2150000	690	170M8554D	2

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[1)] Minimum short-circuit current of the installation

Type ACH580 -01-	Min. short-circuit current[1)]	Input current	uR or aR (DIN 43653 bolted tags)				
			Nominal current	I^2t	Voltage rating	Bussmann type	IEC 60269 size
	A	A	A	A^2s	V		
3-phase U_N = 400 or 480 V							
02A7-4	65	2.6	25	130	690	170M1311	000
03A4-4	65	3.3	25	130	690	170M1311	000
04A1-4	65	4.0	25	130	690	170M1311	000
05A7-4	65	5.6	25	130	690	170M1311	000
07A3-4	65	7.2	25	130	690	170M1311	000
09A5-4	65	9.4	25	130	690	170M1311	000
12A7-4	65	12.6	25	130	690	170M1311	000
018A-4	120	17.0	40	460	690	170M1313	000
026A-4	120	25.0	40	460	690	170M1313	000
033A-4	170	32.0	63	1450	690	170M1315	000
039A-4	170	38.0	63	1450	690	170M1315	000
046A-4	280	45.0	80	2550	690	170M1316	000
062A-4	380	62	100	4650	690	170M1417	000
073A-4	480	73	125	8500	690	170M1318	000
088A-4	700	88	160	16000	690	170M1319	000
106A-4	700	106	200	15000	690	170M3015	1
145A-4	1000	145	250	28500	690	170M3016	1
169A-4	1280	169	315	46500	690	170M3017	1
206A-4	1520	206	350	68500	690	170M3018	1
246A-4	2050	246	450	105000	690	170M5009	2
293A-4	2200	293	500	145000	690	170M5010	2
363A-4	3100	363	630	275000	690	170M5012	2
430A-4	3600	430	700	405000	690	170M5013	2

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[1)] Minimum short-circuit current of the installation

R1-
R4

EN – R1…R4 Quick installation guide

This guide briefly describes how to install the drive for IEC use. For complete information on installation, see *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]). For start-up instructions, see chapter *EN – Quick start-up guide* on page *43*.

To read a manual, go to www.abb.com/drives/documents and search for the document number.

Obey the safety instructions

WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur:

- If you are not a qualified electrical professional, do not do electrical installation work.
- Do not work on the drive, motor cable or motor when main power is applied. If the drive is already connected to the input power, wait for 5 minutes after disconnecting the input power.
- Do not work on the control cables when power is applied to the drive or to the external control circuits.
- Make sure that debris from drilling, cutting and grinding does not enter the drive when installing.
- Make sure that the floor below the drive and the wall where the drive is installed are non-flammable.

Check if capacitors need to be reformed

The capacitors must be reformed if the drive has not been powered (either in storage or unused) for a year or more.

You can determine the manufacturing time from the serial number, which you find on the type designation label attached to the drive. The serial number is of format MYYWWRXXXX. YY and WW tell the manufacturing year and week as follows:

YY: 17, 18, 19, … for 2017, 2018, 2019, …
WW: 01, 02, 03, … for week 1, week 2, week 3, …

For information on reforming the capacitors, see *Converter module capacitor reforming instructions* (3BFE64059629 [English]), available on the Internet at www.abb.com/drives/documents.

Select the power cables

Size the power cables according to local regulations to carry the nominal current given on the type designation label of your drive.

R1-R4

Ensure the cooling

See table *IEC ratings at UN = 230 V, 400 V and 480 V* on page *9* for the heat dissipation. The allowed operating temperature range of the drive is -15 to +50 °C (+5 to +122 °F). No condensation or frost is allowed. For more information on the ambient temperature and derating, see chapter *Technical data* in *ACH580-01 (0.75 to 250 kW) hardware manual* (3AXD50000044839 [English]).

EN

Protect the drive and input power cable

See tables *gG fuses* (on page *11*) and *uR or aR fuses* (on page *12*).

If you use gG fuses, make sure that the operating time of the fuse is below 0.5 seconds. Follow the local regulations.

Install the drive on the wall

See figure *R1…R4 Figures A* on page *51*.

Check the insulation of the power cables and the motor

Check the insulation of the input cable according to local regulations before connecting it to the drive.

See figure *B1* on page *51*.

1. Check the insulation of the motor cable and motor when the cable is disconnected from the drive. Measure the insulation resistance between each phase conductor and then between each phase conductor and the Protective Earth conductor using a measuring voltage of 1000 V DC. The insulation resistance of a typical motor must exceed 100 Mohm (reference value at 25 °C or 77 °F). For the insulation resistance of motors, see the manufacturer's instructions.

Note: Moisture inside the motor casing will reduce the insulation resistance. If moisture is suspected, dry the motor and repeat the measurement.

Switch off the power and open the cover

See figure *B1* on page *51*.

2. Switch off the power from the drive.
3. Remove the front cover: Loosen the retaining screw, if any, with a screwdriver (3a) and lift the cover from the bottom outwards (3b) and then up (3c).

Install the cable box

Only for frames IP21, R1….R2.

See figures *B1* on page *51*.

4. IP21, R1….R2: Remove the screw (4a) and lift the cover off (4b) from the separate cable box.
5. IP21, R1….R2: Attach the cable box cover to the front cover.
6. IP21, R1….R2: Install the cable box to the frame. Position the cable box (6a) and tighten the screws (6b).

Attach the warning sticker

See figure *B2* on page *51*.

7. Attach the residual voltage warning sticker in the local language.

Check the compatibility with IT (ungrounded), corner-grounded delta, midpoint-grounded delta, and TT systems

EMC filter

A drive with the internal EMC filter connected can be installed to a symmetrically grounded TN-S system. If you install the drive to another system, you may need to disconnect the EMC filter. See section *Checking the compatibility with IT (ungrounded), corner-grounded delta, midpoint-grounded delta, and TT systems* (for IEC) in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]).

WARNING! Do not install a drive with the EMC filter connected to a system that the filter is not suitable for. This can cause danger, or damage the drive.

Note: When the internal EMC filter is disconnected, the EMC compatibility of the drive is considerably reduced. See section *EMC compatibility and motor cable length* in chapter *Technical data* in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]).

Ground-to-phase varistor

A drive with the ground-to-phase varistor connected can be installed to a symmetrically grounded TN-S system. If you install the drive to another system, you may need to disconnect the varistor. See section See section *Checking the compatibility with IT (ungrounded), corner-grounded delta, midpoint-grounded delta, and TT systems* (for IEC) in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]).

R1-R4

WARNING! Do not install a drive with the ground-to-phase varistor connected to a system that the varistor is not suitable for. If you do, the varistor circuit can be damaged.

EN

Connect the power cables

See figures C1 (page 51), C2, D, E1, E2, F, G1, G2 and R1…R4 Figures H (page 53).

1. Remove the rubber grommets from the cable entry.

R1-R4

Use symmetrical shielded cable for motor cabling. If the cable shield is the sole PE conductor for drive or motor, make sure that is has sufficient conductivity for the PE.

2. Cut an adequate hole into the rubber grommet. Slide the grommet onto the cable.
3. Prepare the ends of the motor cable as illustrated in figures 3a and 3b (two different motor cable types are shown). In frames R1 and R2 there are markings on the drive frame near the power cable terminals helping you to strip the wires to the correct length of 8 mm. **Note:** The bare shield will be grounded 360 degrees. Mark the pigtail made from the shield as a PE conductor with yellow-and-green color.

EN

4. Slide the cable through the hole in the cable entry. and attach the grommet to the hole.
5. Connect the motor cable:
   - Ground the shield 360 degrees by tightening the clamp of the power cable grounding shelf onto the stripped part of the cable (5a).
   - Connect the twisted shield of the cable to the grounding terminal (5b).
   - Connect the phase conductors of the cable to the T1/U, T2/V and T3/W terminals (5c). Tighten the screws to the torque given in the figure.
6. Repeat steps 2…4 for the input power cable.
7. Connect the input power cable. Connect the additional PE conductor of the cable (7c). Tighten the screws to the torque given in the figure.
8. R1…R2, R4: Install the grounding shelf.
9. Repeat steps 2…4 for the brake resistor cable (if used). Cut off extra phase conductors (if any).
10. Connect the resistor cable (if used). Tighten the screws to the torque given in the figure.
11. Put the unused rubber grommets to the holes in the cable entry.
12. Secure the cables outside the unit mechanically.
13. Ground the motor cable shield at the motor end. For minimum radio frequency interference, ground the motor cable shield 360 degrees at the cable entry of the motor terminal box.

Connect the control cables

See figures *I* and *I2* on page *53*. It shows an example with one analog signal cable and one digital signal cable. Make the connections according to the default configuration in use. The default connections of the HVAC default configuration are shown in section *Default I/O connections* on page *21*.

R1-R4

1. Remove the front cover, if not already removed. See section *Switch off the power and open the cover* on page *17*.

Example of connecting an analog signal cable:

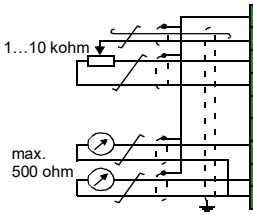
2. Cut an adequate hole into the rubber grommet and slide the grommet onto the cable. Slide the cable through a hole in the cable entry and attach the grommet to the hole.

EN

3. Ground the outer shield of the cable 360 degrees under the grounding clamp. Keep the cable unstripped as close to the terminals of the control board as possible. Ground also the pair-cable shields and grounding wire at the SCR1 terminal.
4. Route the cable as shown in the figure.
5. Connect the conductors to the appropriate terminals of the control board and tighten to 0.5…0.6 N·m (0.4 lbf·ft).
6. Tie all control cables to the provided cable tie mounts.

Default I/O connections

Default I/O connections of the HVAC default configuration are shown below.



X1		Reference voltage and analog inputs and outputs	
	1	SCR	Signal cable shield (screen)
	2	AI1	**Output frequency/speed reference**: 0…10 V
	3	AGND	Analog input circuit common
	4	+10V	Reference voltage 10 V DC
	5	AI2	**Actual feedback:** 0…10 V
	6	AGND	Analog input circuit common
	7	AO1	**Output frequency:** 0…10 V
	8	AO2	**Output current:** 0…20 mA
	9	AGND	Analog output circuit common
X2 & X3		Aux. voltage output and programmable digital inputs	
	10	+24V	Aux. voltage output +24 V DC, max. 250 mA
	11	DGND	Aux. voltage output common
	12	DCOM	Digital input common for all
	13	DI1	**Stop (0) / Start (1)**
	14	DI2	Not configured
	15	DI3	**Constant frequency/speed selection**
	16	DI4	**Start interlock 1 (1 = allow start)**
	17	DI5	Not configured
	18	DI6	Not configured
X6, X7, X8		Relay outputs	
Damper actuator	19	RO1C	**Damper control** 250 V AC / 30 V DC 2 A — Energize damper 19 connected to 21
	20	RO1A	
	21	RO1B	
Run status	22	RO2C	**Running** 250 V AC / 30 V DC 2 A — Running 22 connected to 24
	23	RO2A	
	24	RO2B	
Fault status	25	RO3C	**Fault (-1)** 250 V AC / 30 V DC 2 A — Fault condition 25 connected to 26
	26	RO3A	
	27	RO3B	
X5		Embedded fieldbus	
	29	B+	Embedded fieldbus, EFB (EIA-485)
	30	A-	
	31	DGND	
	S4	TERM	Termination switch
	S5	BIAS	Bias resistors switch
X4		Safe torque off	
	34	OUT1	Safe torque off. Factory connection. Both circuits must be closed for the drive to start. See chapter *The Safe torque off function* in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]).
	35	OUT2	
	36	SGND	
	37	IN1	
	38	IN2	

Total load capacity of the Auxiliary voltage output +24V (X2:10) is 6.0 W (250 mA / 24 V DC).

Wire sizes:

0.2…2.5 mm^2 (24…14 AWG): Terminals +24V, DGND, DCOM, B+, A-, DGND, Ext. 24V

0.14…1.5 mm^2 (26…16 AWG): Terminals DI, AI, AO, AGND, RO, STO

Tightening torques: 0.5…0.6 N·m (0.4 lbf·ft)

Install optional modules, if any

See chapter *Electrical installation* in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]).

R1-R4

Reinstall cover

See figure *J* on page *54*.

1. Put the tabs on the inside of the cover top in their counterparts on the housing (1a) and then press the cover at the bottom (1b).
2. Tighten the retaining screw with a screwdriver.

EN

For start-up instructions, see chapter *EN – Quick start-up guide* on page *43*.

Compliance with the European Machinery Directive 2006/42/EC

Declaration of conformity

Power and productivity for a better world™

R1-R4

EU Declaration of Conformity

Machinery Directive 2006/42/EC

We

Manufacturer: ABB Oy
Address: Hiomotie 13, 00380 Helsinki, Finland.
Phone: +358 10 22 11

declare under our sole responsibility that the following product:

Frequency converter

ACH580-01/-31

with regard to the safety function

Safe torque off

is in conformity with all the relevant safety component requirements of EU Machinery Directive 2006/42/EC, when the listed safety function is used for safety component functionality.

The following harmonized standards have been applied:

EN 61800-5-2:2007	*Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional*
EN 62061:2005 + AC:2010 + A1:2013 + A2:2015	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN ISO 13849-1:2015	*Safety of machinery – Safety-related parts of control systems. Part 1: General requirements*
EN ISO 13849-2:2012	*Safety of machinery – Safety-related parts of the control systems. Part 2: Validation*
EN 60204-1: 2006 + A1:2009 + AC:2010	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

The following other standards have been applied:

IEC 61508:2010	Functional safety of electrical / electronic / programmable electronic safety-related systems
IEC 61800-5-2:2016	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional

The product referred in this Declaration of conformity fulfils the relevant provisions of other European Union Directives which are notified in Single EU Declaration of conformity 3AXD10000497691.

Person authorized to compile the technical file:

Name and address: Risto Mynttinen, Hiomotie 13, 00380 Helsinki, Finland.

Helsinki, 15 Sep 2017

Manufacturer representative:

Vesa Kandell
Vice President, ABB Oy

R1-
R4

DRIVES FOR HVAC

ACH580-01 drives

Quick installation guide
Frames R5

R5

EN

3AXD50000044861 Rev B MUL
EFFECTIVE: 2019-06-30

Ratings and fuses

IEC ratings at U_N = 230 V, 400 V and 480 V

U_N = 230 V

Type ACH580 -01-	Input rating	Output ratings			Heat dissipation	Air flow	Frame size
		Max. current	Nominal use				
	I_1	I_{max}	I_N	P_N			
	A	A	A	kW	W	m^3/h	
3-phase U_N = 230 V							
089A-2	89	135	89	22	619	139	R5
115A-2	115	158	115	30	835	139	R5

3AXD00000586715.xls L

Type ACH580-01-	Input ratings	Output ratings		Frame size
	I_1	I_N	P_N	
	A	A[1)]	kW	
1-phase U_N = 230 V				
089A-2	81	42	11	R5
115A-2	111	54	15	R5

3AXD00000586715.xls L

[1)] Continuous current, no overloadability

U_N = 400 V

Type ACH580 -01-	Input rating	Output ratings			Heat dissipation	Air flow	Frame size
		Max. current	Nominal use				
	I_1	I_{max}	I_N	P_N			
	A	A	A	kW	W	m^3/h	
3-phase U_N = 400 V							
088A-4	88	122	88	45	1316	139	R5
106A-4	106	148	106	55	1589	139	R5

3AXD00000586715.xls L

U_N = 480 V

Type ACH580 -01-	Input rating	Output ratings			Heat dissipation	Air flow	Frame size
		Max. current	Nominal use				
	I_1	I_{max}	I_{Ld}	P_{Ld}			
	A	A	A	hp	W	m^3/h	
3-phase U_N = 480 V							
088A-4	77	122	77	60	1240	139	R5
106A-4	96	148	96	75	1510	139	R5

R5

3AXD00000586715.xls L

gG fuses

Type ACH580-01-	Min. short-circuit current[1)]	Input current	gG (IEC 60269)				
			Nominal current	I^2t	Voltage rating	ABB type	IEC 60269 size
	A	A	A	A^2s	V		
3-phase U_N = 230 V							
089A-2	1300	89.0	125.0	103000	500	OFAF00H125	00
115A-2	1300	115.0	125.0	103000	500	OFAF00H125	00
3-phase U_N = 400 or 480 V							
088A-4	1000	88	100	65000	500	OFAF000H100	000
106A-4	1300	106	125	103000	500	OFAF00H125	00

R5

3AXD00000586715.xls L

[1)] Minimum short-circuit current of the installation

uR or aR fuses

Type ACH580 -01-	Min. short-circuit current[1)]	Input current	uR or aR (DIN 43620 blade style)				
			Nominal current	I^2t	Voltage rating	Bussmann type	IEC 60269 size
	A	A	A	A^2s	V		
3-phase U_N = 230 V							
089A-2	700.0	89.0	200.0	15000.0	690	170M3815	1
115A-2	700.0	115.0	200.0	15000.0	690	170M3815	1
3-phase U_N = 400 or 480 V							
088A-4	700	88	160	16000	690	170M1569	000
106A-4	1280	106	315	46500	690	170M3817	1

3AXD00000586715.xls L

[1)] Minimum short-circuit current of the installation

Type ACH580 -01-	Min. short-circuit current[1)]	Input current	uR or aR (DIN 43653 bolted tags)				
			Nominal current	I^2t	Voltage rating	Bussmann type	IEC 60269 size
	A	A	A	A^2s	V		
3-phase U_N = 400 or 480 V							
088A-4	700	88	160	16000	690	170M1319	000
106A-4	700	106	200	15000	690	170M3015	1

3AXD00000586715.xls L

[1)] Minimum short-circuit current of the installation

R5

EN – R5 Quick installation guide

This guide briefly describes how to install the drive for IEC use. For complete information on installation, see *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044861 [English]). For start-up instructions, see chapter *EN – Quick start-up guide* on page *43*.

To read a manual, go to www.abb.com/drives/documents and search for the document number.

Obey the safety instructions

WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur:

- If you are not a qualified electrical professional, do not do electrical installation work.
- Do not work on the drive, motor cable or motor when main power is applied. If the drive is already connected to the input power, wait for 5 minutes after disconnecting the input power.
- Do not work on the control cables when power is applied to the drive or to the external control circuits.
- Make sure that debris from drilling, cutting and grinding does not enter the drive when installing.
- Make sure that the floor below the drive and the wall where the drive is installed are non-flammable.

Check if capacitors need to be reformed

The capacitors must be reformed if the drive has not been powered (either in storage or unused) for a year or more.

You can determine the manufacturing time from the serial number, which you find on the type designation label attached to the drive. The serial number is of format MYYWWRXXXX. YY and WW tell the manufacturing year and week as follows:

YY: 16, 17, 18, … for 2016, 2017, 2018, …
WW: 01, 02, 03, … for week 1, week 2, week 3, …

For information on reforming the capacitors, see *Converter module capacitor reforming instructions* (3BFE64059629 [English]), available on the Internet at www.abb.com/drives/documents.

Select the power cables

Size the power cables according to local regulations to carry the nominal current given on the type designation label of your drive.

Ensure the cooling

R5

See table *IEC ratings at UN = 230 V, 400 V and 480 V* on page *27* for the heat dissipation. The allowed operating temperature range of the drive is -15 to +50 °C (+5 to +122 °F). No condensation or frost is allowed. For more information on the ambient temperature and derating, see chapter *Technical data* in *ACH580-01 (0.75 to 250 kW) hardware manual* (3AXD50000044861 [English]).

Protect the drive and input power cable

EN

See tables *gG fuses* (on page *29*) and *uR or aR fuses* (on page *29*).

If you use gG fuses, make sure that the operating time of the fuse is below 0.5 seconds. Follow the local regulations.

Install the drive on the wall

See figure *R5 Figures A* on page *55*.

Check the insulation of the power cables and the motor

Check the insulation of the input cable according to local regulations before connecting it to the drive.

See figure *B* on page *55*.

1. Check the insulation of the motor cable and motor when the cable is disconnected from the drive. Measure the insulation resistance between each phase conductor and then between each phase conductor and the Protective Earth conductor using a measuring voltage of 1000 V DC. The insulation resistance of a typical motor must exceed 100 Mohm (reference value at 25 °C or 77 °F). For the insulation resistance of motors, see the manufacturer's instructions.

Note: Moisture inside the motor casing will reduce the insulation resistance. If moisture is suspected, dry the motor and repeat the measurement.

Switch off the power and open the cover

See figure *B* on page *55*.

2. Switch off the power from the drive.
3. IP21, Remove the module cover: Loosen the retaining screws with a screwdriver (3a) and lift the cover from the bottom outwards (3b) and then up (3c).
4. IP21, Remove the box cover: Loosen the retaining screws with a screwdriver (4a) and slide the cover downwards (4b).
5. IP55, Remove the front cover: Loosen the retaining screws with a screwdriver (4a) and lift the cover from the bottom outwards (4b) and then up (4c).

Check the compatibility with IT (ungrounded), corner-grounded delta, midpoint-grounded delta, and TT systems

See figure *C* on page *56*.

EMC filter

A drive with the internal EMC filter connected can be installed to a symmetrically grounded TN-S system. If you install the drive to another system, you may need to disconnect the EMC filter. See section *Checking the compatibility with IT (ungrounded), corner-grounded delta, midpoint-grounded delta, and TT systems* (for IEC) in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]).

WARNING! Do not install a drive with the EMC filter connected to a system that the filter is not suitable for. This can cause danger, or damage the drive.

Note: When the internal EMC filter is disconnected, the EMC compatibility of the drive is considerably reduced. See section *EMC compatibility and motor cable length* in chapter *Technical data* in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]).

Ground-to-phase varistor

A drive with the ground-to-phase varistor connected can be installed to a symmetrically grounded TN-S system. If you install the drive to another system, you may need to disconnect the varistor. See section See section *Checking the compatibility with IT (ungrounded), corner-grounded delta, midpoint-grounded delta, and TT systems* (for IEC) in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]).

WARNING! Do not install a drive with the ground-to-phase varistor connected to a system that the varistor is not suitable for. If you do, the varistor circuit can be damaged.

Connect the power cables

See figures *D* (page *56*), *E* and *R5 Figures F* (page *57*).

1. Attach the residual voltage warning sticker in the local language next to the control board.
2. Remove the shroud on the power cable terminals by releasing the clips with a screwdriver and pulling the shroud out.

Use symmetrical shielded cable for motor cabling. If the cable shield is the sole PE conductor for drive or motor, make sure that is has sufficient conductivity for the PE.

3. Cut an adequate hole into the rubber grommet. Slide the grommet onto the cable.
4. Prepare the ends of the motor cable as illustrated in figures 4a and 4b (two different motor cable types are shown). **Note:** The bare shield will be grounded 360 degrees. Mark the pigtail made from the shield as a PE conductor with yellow-and-green color.

5. Slide the cable through the hole in the cable entry and attach the grommet to the hole.
6. Connect the motor cable:
   - Ground the shield 360 degrees by tightening the clamp of the power cable grounding shelf onto the stripped part of the cable (6a).
   - Connect the twisted shield of the cable to the grounding terminal (6b).
   - Connect the phase conductors of the cable to the T1/U, T2/V and T3/W terminals (6c). Tighten the screws to the torque given in the figure.
7. Repeat steps *3*…*5* for the input power cable.
8. Connect the input power cable. Tighten the screws to the torque given in the figure.
9. Install the cable box plate. Position the plate and tighten the screw.
10. Reinstall the shroud on the power terminals by putting the tabs at the top of the shroud in their counterparts on the drive frame and then pressing the shroud in place.
11. Secure the cables outside the unit mechanically.
12. See figure *G* (page *57*). Ground the motor cable shield at the motor end. For minimum radio frequency interference, ground the motor cable shield 360 degrees at the cable entry of the motor terminal box.

Connect the control cables

See figure *H* on page *57*. It shows an example with one analog signal cable and one digital signal cable. Make the connections according to the default configuration in use. The default connections of the HVAC default configuration are shown in section *Default I/O connections* on page *37*.

R5

1. Remove the front cover, if not already removed. See section *Switch off the power and open the cover* on page *33*.

Example of connecting an analog signal cable:

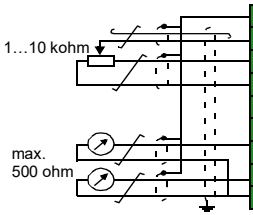
2. Cut an adequate hole into the rubber grommet and slide the grommet onto the cable. Slide the cable through a hole in the cable entry and attach the grommet to the hole.

EN

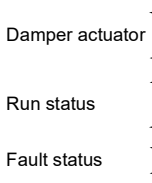
3. Ground the outer shield of the cable 360 degrees under the grounding clamp. Keep the cable unstripped as close to the terminals of the control board as possible. Ground also the pair-cable shields and grounding wire at the SCR1 terminal.
4. Route the cable as shown in the figure.
5. Connect the conductors to the appropriate terminals of the control board and tighten to 0.5…0.6 N·m (0.4 lbf·ft).
6. Tie all control cables to the provided cable tie mounts.

Default I/O connections

Default I/O connections of the HVAC default configuration are shown below

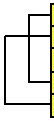


X1	Reference voltage and analog inputs and outputs	
1	SCR	Signal cable shield (screen)
2	AI1	**Output frequency/speed reference**: 0…10 V
3	AGND	Analog input circuit common
4	+10V	Reference voltage 10 V DC
5	AI2	**Actual feedback:** 0…10 V
6	AGND	Analog input circuit common
7	AO1	**Output frequency:** 0…10 V
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
X2 & X3	Aux. voltage output and programmable digital inputs	
10	+24V	Aux. voltage output +24 V DC, max. 250 mA
11	DGND	Aux. voltage output common
12	DCOM	Digital input common for all
13	DI1	**Stop (0) / Start (1)**
14	DI2	Not configured
15	DI3	**Constant frequency/speed selection**
16	DI4	**Start interlock 1 (1 = allow start)**
17	DI5	Not configured
18	DI6	Not configured



X6, X7, X8	Relay outputs		
19	RO1C	**Damper control** 250 V AC / 30 V DC 2 A	Energize damper 19 connected to 21
20	RO1A		
21	RO1B		
22	RO2C	**Running** 250 V AC / 30 V DC 2 A	Running 22 connected to 24
23	RO2A		
24	RO2B		
25	RO3C	**Fault (-1)** 250 V AC / 30 V DC 2 A	Fault condition 25 connected to 26
26	RO3A		
27	RO3B		

X5	Embedded fieldbus	
29	B+	Embedded fieldbus, EFB (EIA-485)
30	A-	
31	DGND	
S4	TERM	Termination switch
S5	BIAS	Bias resistors switch



X4	Safe torque off	
34	OUT1	Safe torque off. Factory connection. Both circuits must be closed for the drive to start. See chapter *The Safe torque off function* in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044839 [English]).
35	OUT2	
36	SGND	
37	IN1	
38	IN2	

Total load capacity of the Auxiliary voltage output +24V (X2:10) is 6.0 W (250 mA / 24 V DC).

Wire sizes:

0.2…2.5 mm^2 (24…14 AWG): Terminals +24V, DGND, DCOM, B+, A-, DGND, Ext. 24V

0.14…1.5 mm^2 (26…16 AWG): Terminals DI, AI, AO, AGND, RO, STO

Tightening torques: 0.5…0.6 N·m (0.4 lbf·ft)

Install optional modules, if any

See chapter *Electrical installation* in *ACH580-01 (0.75 to 250 kW, 1 to 350 hp) hardware manual* (3AXD50000044861 [English]).

Reinstall cover

R5

See figure *I* on page *58*.

1. IP21, Reinstall the box cover: Slide the cover upwards (1a) and tighten the retaining screws (1b).
2. IP21, Reinstall the module cover: Put the tabs on the inside of the cover top in their counterparts on the housing (2a), press the cover at the bottom (2b) and tighten the retaining screws (2c).

EN

3. IP55, Reinstall the front cover: Put the tabs on the inside of the cover top in their counterparts on the housing (3a), press the cover at the bottom (3a) and tighten the retaining screws (3b).

For start-up instructions, see chapter *EN – Quick start-up guide* on page *43*.

Compliance with the European Machinery Directive 2006/42/EC

R5

Declaration of conformity

Power and productivity for a better world™

EU Declaration of Conformity

Machinery Directive 2006/42/EC

R5

We

Manufacturer: ABB Oy
Address: Hiomotie 13, 00380 Helsinki, Finland.
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declare under our sole responsibility that the following product:

Frequency converter

ACH580-01/-31

with regard to the safety function

Safe torque off

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Person authorized to compile the technical file:

Name and address: Risto Mynttinen, Hiomotie 13, 00380 Helsinki, Finland.

Helsinki, 15 Sep 2017

Manufacturer representative:

Vesa Kandell
Vice President, ABB Oy

DRIVES FOR HVAC

ACH580-01 drives

Quick start-up guide
Frames R1 to R9

R1-R9

EN

3AXD50000044861 Rev B MUL
EFFECTIVE: 2019-06-30

EN – Quick start-up guide

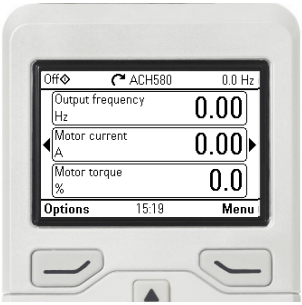
This guide describes how to start-up the drive using the First start assistant on the HVAC control panel. For complete information on start-up, see *ACH580 HVAC control program firmware manual* (3AXD50000027537 [English]).

Before you start

Ensure that the drive has been installed as described in chapter *EN – R1…R4 Quick installation guide* on page *15* (frames R1…R4) or *EN – R5 Quick installation guide* on page *31* (frame R5).

Start-up with the First start assistant on an HVAC control panel

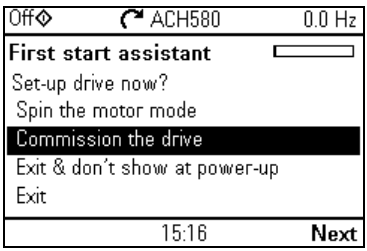
Safety	
☐	Make sure that the installation work is complete. Make sure that cover of the drive and the cable box, if included, are on place.
☐	⚠ Check that the starting of the motor does not cause any danger. **De-couple the driven machine** if there is a risk of damage in case of an incorrect direction of rotation.
Hints on using the assistant control panel	
	The two commands at the bottom of the display (**Options** and **Menu** in the figure on the right), show the functions of the two softkeys and located below the display. The commands assigned to the softkeys vary depending on the context. Use keys ◄, ►, ▲ and ▼ to move the cursor and/or change values depending on the active view. Key ? shows a context-sensitive help page.
1 – First start assistant guided settings: Language, motor nominal values, and date and time	
☐	Have the motor name plate data at hand. Power up the drive.

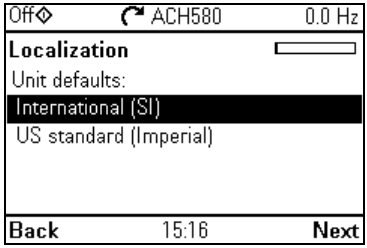


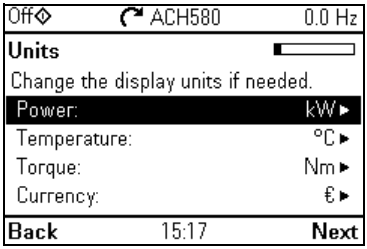
R1-R9

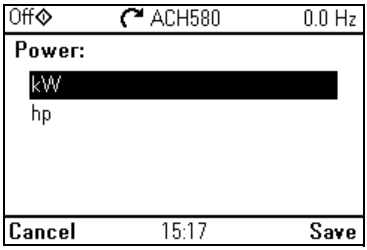
EN

☐	The First start assistant guides you through the first start-up. The assistant begins automatically. Wait until the control panel enters the view shown on the right. Select the language you want to use by highlighting it (if not already highlighted) and pressing (**OK**). **Note:** After you have selected the language, it takes a few minutes for the control panel to wake up.
☐	Select **Commission the drive** and press (**Next**).
☐	Select the localization you want to use and press (**Next**).
☐	Change the units shown on the panel if needed. • Go to the edit view of a selected row by pressing . • Scroll the view with and . Go to the next view by pressing (**Next**).
☐	To select a value in an edit view: • Use and to select the value. Press (**Save**) to accept the new setting, or press (**Cancel**) to go back to the previous view without making changes.





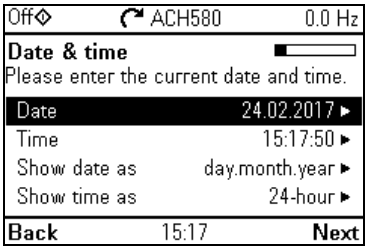




☐ Set the date and time as well as date and time display formats.

- Go to the edit view of a selected row by pressing ▶.
- Scroll the view with ▲ and ▼.

Go to the next view by pressing (**Next**).



Refer to the motor nameplate for the following nominal value settings of the motor. Enter the values exactly as shown on the motor nameplate.

Example of a nameplate of an induction (asynchronous) motor:

ABB Motors CE

3 ~ motor	M2AA 200 MLA 4						
	IEC 200 M/L 55						
		No					
		Ins.cl. F				IP 55	
V	Hz	kW	r/min	A	cos φ	IA/IN	tE/s
690 Y	50	30	1475	32.5	0.83		
400 D	50	30	1475	56	0.83		
660 Y	50	30	1470	34	0.83		
380 D	50	30	1470	59	0.83		
415 D	50	30	1475	54	0.83		
440 D	60	35	1770	59	0.83		
Cat. no	3GAA 202 001 - ADA						
6312/C3		6210/C3			180 kg		
			IEC 34-1				

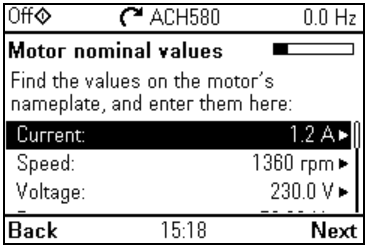
☐ Check that the motor data is correct. Values are predefined on the basis of the drive size but you should verify that they correspond to the motor.

Start with the motor type.

- Go to the edit view of a selected row by pressing ▶.
- Scroll the view with ▲ and ▼.

Motor nominal cos Φ and nominal torque are optional.

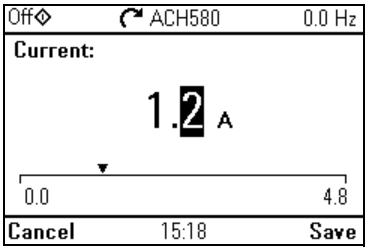
Press (**Next**) to continue.



☐ To change a value in an edit view:

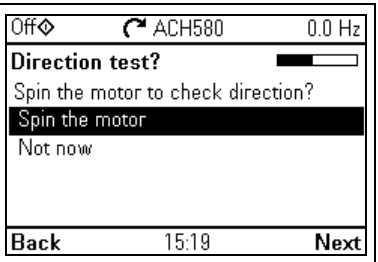
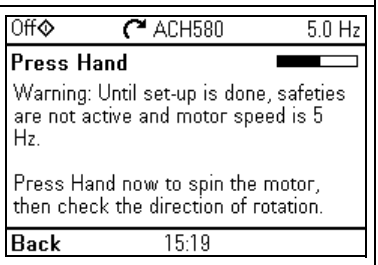
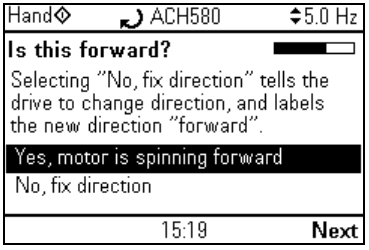
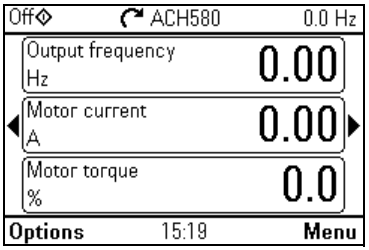
- Use ◀ and ▶ to move the cursor left and right.
- Use ▲ and ▼ to change the value.

Press (**Save**) to accept the new setting, or press (**Cancel**) to go back to the previous view without making changes.



R1-R9

EN

☐	This step is optional, and requires rotating the motor. Do not do this if it could cause any risk, or if the mechanical set-up does not allow it. To do the direction test, select **Spin the motor** and press ⌐ (**Next**).	
☐	Press the Hand key Hand on the panel to start the drive.	
☐	Check the direction of the motor. If it is forward, select **Yes, motor is spinning forward** and press ⌐ (**Next**) to continue. If the direction is not forward, select **No, fix direction** and press ⌐ (**Next**) to continue.	
☐	The first start is now complete and the drive is ready for use. Press ⌐ (**Done**) to enter the Home view.	
☐	The Home view 1 monitoring the values of the selected signals is shown on the panel. There are eight different Home view displays. Home view 1 is the default Home view. You can browse them with keys ◄ and ►.	

2 – Hand/Off/Auto operation

☐ The drive can be in remote control or local control, and in local control there are additionally two different modes.

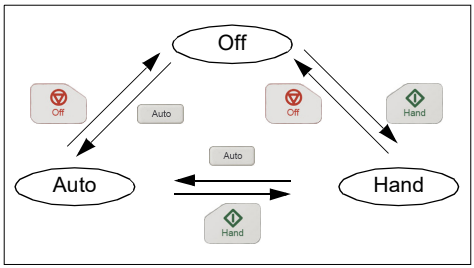
Remote control: Drive is controlled from the I/O or the fieldbus.

- Top row of the view shows Auto.

Local control: Drive is controlled from the control panel.

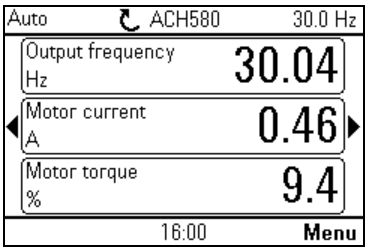
- Top row of the view shows Off, that is, the drive is in the Off mode. Drive is stopped.
- Top row of the view shows Hand, that is, the drive is in the Hand mode. Drive is running. The initial reference in the Hand mode is copied from the drive reference.
  Symbol ▲▼ on the top row indicates that you can change the reference with ▲ and ▼.

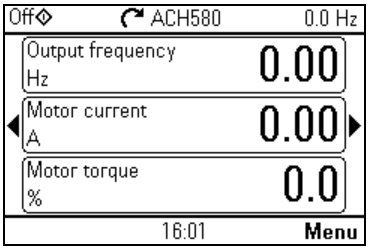
The following diagram shows the state transitions when you press the Hand, Off or Auto button:

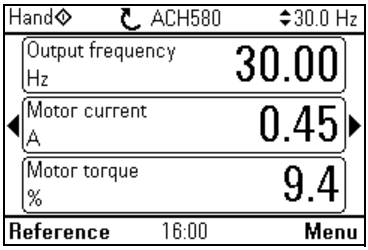


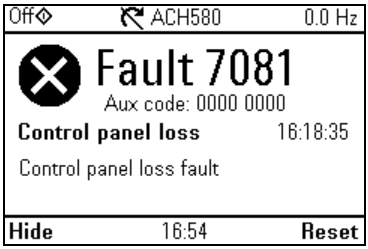
Note: When you restart the drive while fault 7081 Control panel loss is active, the mode changes from Hand or Off to Auto.

Note: Override operation overrides the actual running mode. See *ACH580 HVAC control program firmware manual* (3AXD50000027537 [English]).









R1-R9

EN

R1-
R9

EN

DRIVES FOR HVAC

ACH580-01 drives

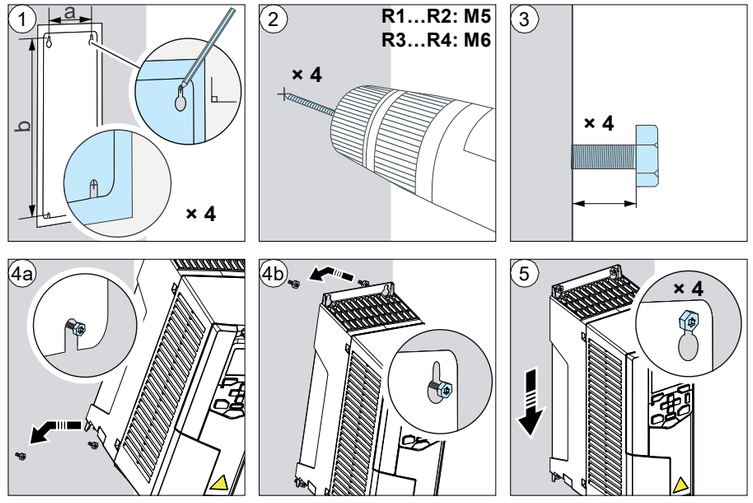
R1-R4

R5

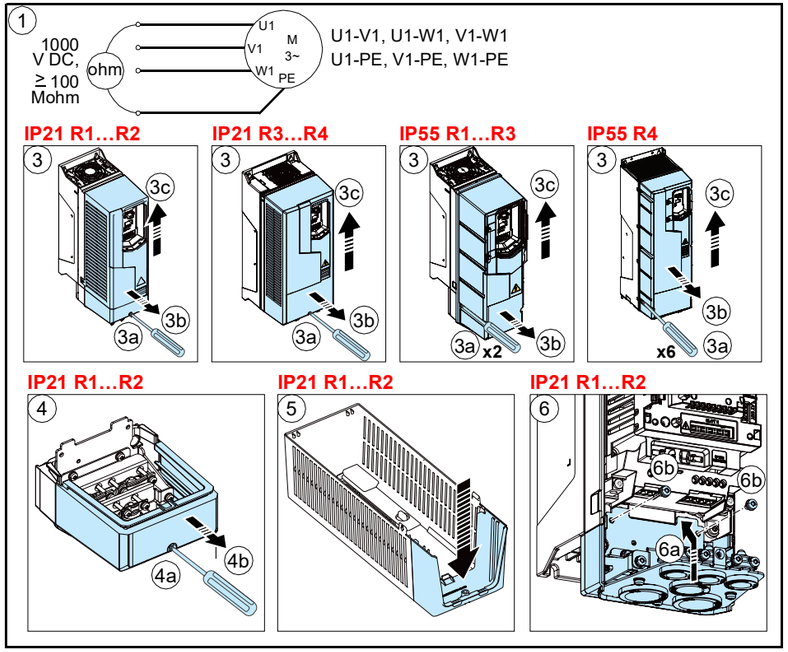
Quick installation guide
Frames R1 to R4 and R5 installation figures

3AXD50000044861 Rev B MUL
EFFECTIVE: 2019-06-30

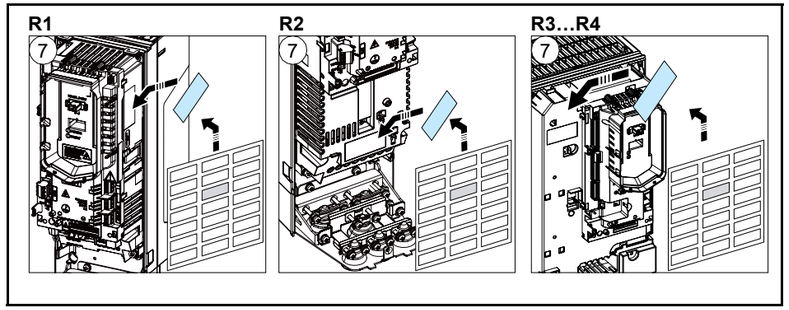
R1…R4 Figures A



B1

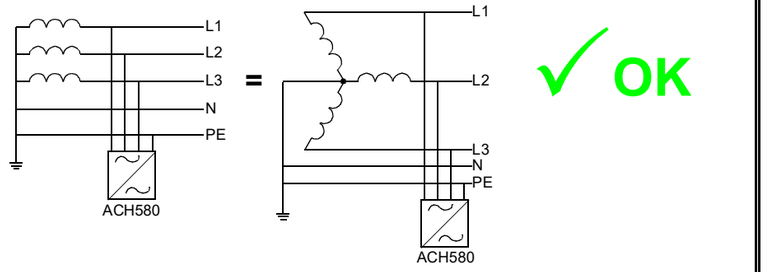


B2

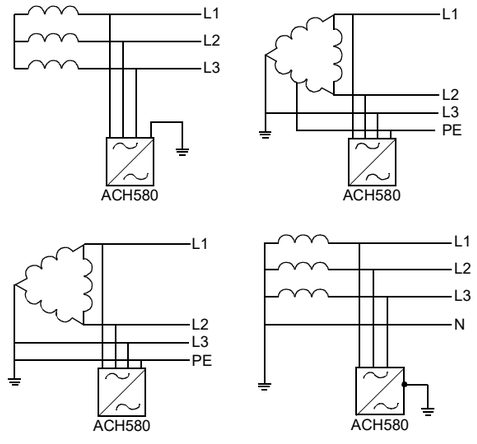


B3

SYMMETRICALLY GROUNDED TN SYSTEMS (TN-S) = CENTER-GROUNDED WYE

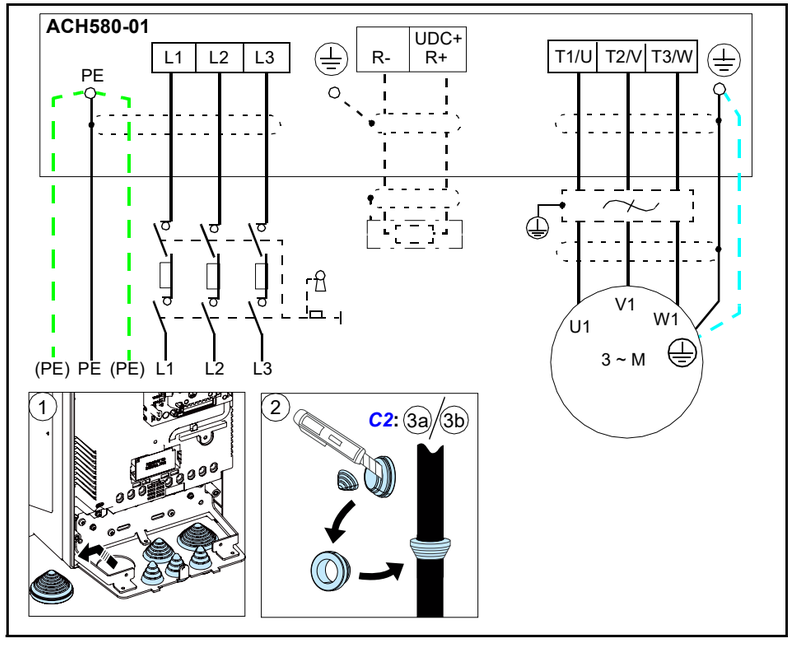


IT (UNGROUNDED), CORNER-GROUNDED DELTA, MIDPOINT-ROUNDED DELTA AND TT SYSTEMS

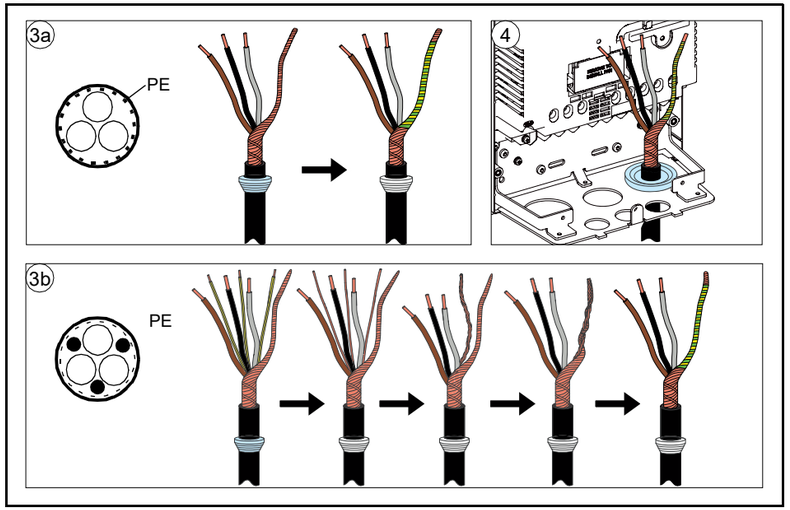


EN: See page *17*.
DA: Se side *39*.
DE: Siehe Seite *29*.
ES: Véase la página *41*.
FI: Katso sivu *51*.
FR: Cf. page *61*.
IT: Vedere pag. *91*.
NL: Zie pagina *101*.
PL: Patrz str. *111*.
PT: Veja a página *123*.
RU: См. стр. *71*.
SV: Se sidan *83*.
TR: Bkz. sayfa *153*.
ZH: 请参阅第*163*.

C1

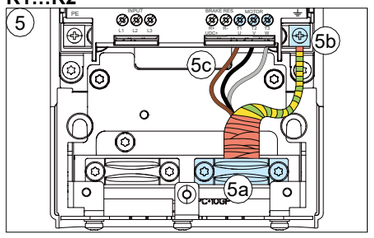


C2

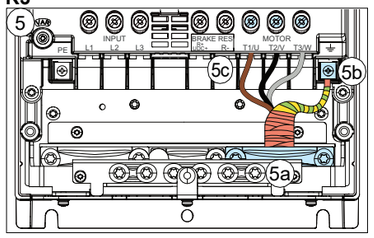


D

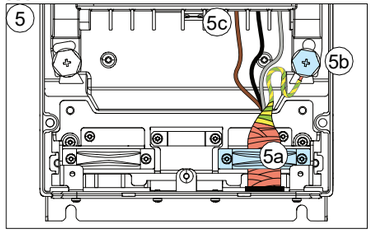
R1…R2



R3



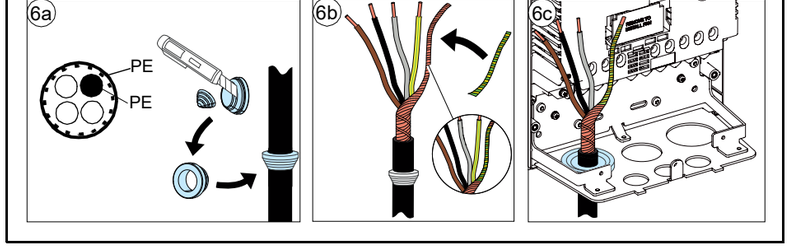
R4



Frame size	R1		R2	
	N·m	lbf·ft	N·m	lbf·ft
T1/U, T2/V, T3/W	1.0	0.7	1.5	1.1
PE, ⏚	1.5	1.1	1.5	1.1
	1.2	0.9	1.2	0.9

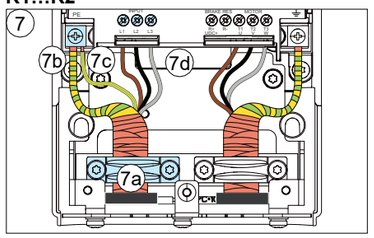
Frame size	R3		R4	
	N·m	lbf·ft	N·m	lbf·ft
T1/U, T2/V, T3/W	3.5	2.6	4.0	3.0
PE, ⏚	1.5	1.1	2.9	2.1
	1.2	0.9	1.2	0.9

E1

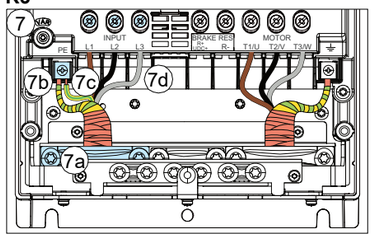


E2

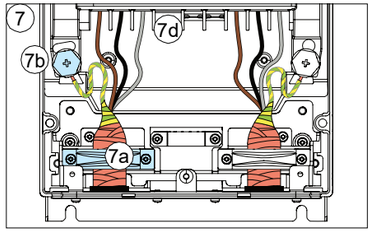
R1…R2



R3



R4

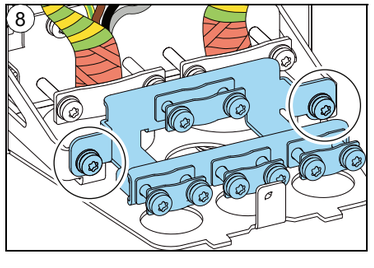


Frame size	R1		R2	
	N·m	lbf·ft	N·m	lbf·ft
L1, L2, L3	1.0	0.7	1.5	1.1
PE, ⏚	1.5	1.1	1.5	1.1
	1.2	0.9	1.2	0.9

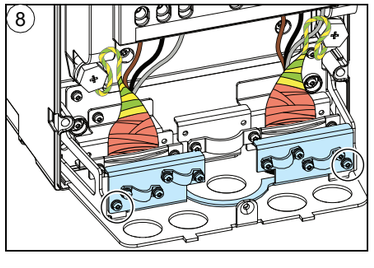
Frame size	R3		R4	
	N·m	lbf·ft	N·m	lbf·ft
L1, L2, L3	3.5	2.6	4.0	3.0
PE, ⏚	1.5	1.1	2.9	2.1
	1.2	0.9	1.2	0.9

F

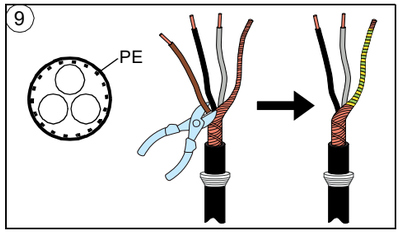
R1…R2



R4

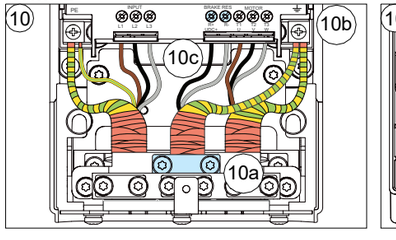


G1

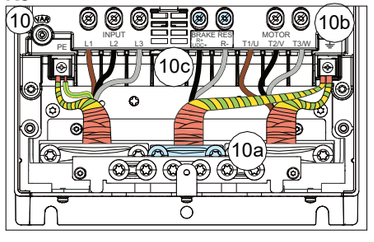


G2

R1…R2



R3



Frame size	R1		R2		R3	
	N·m	lbf·ft	N·m	lbf·ft	N·m	lbf·ft
R-, R+	1.0	0.7	1.5	1.1	3.5	2.6
PE, ⏚	1.5	1.1	1.5	1.1	1.5	1.1
	1.2	0.9	1.2	0.9	1.2	0.9

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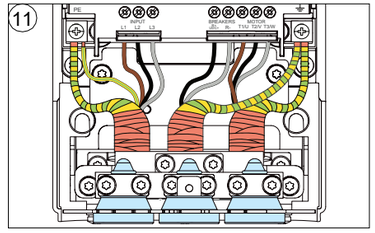
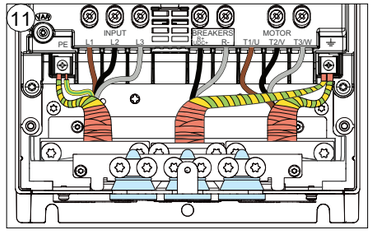
R1…R4 Figures H

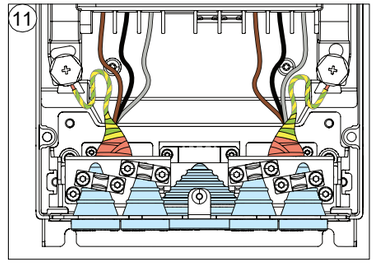
R1…R2

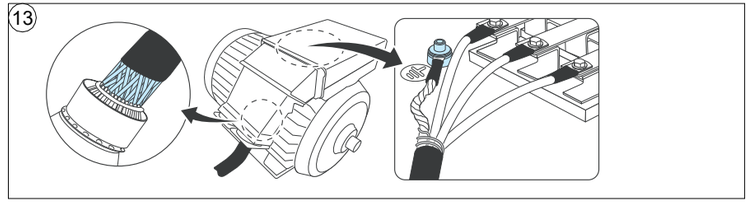


R3



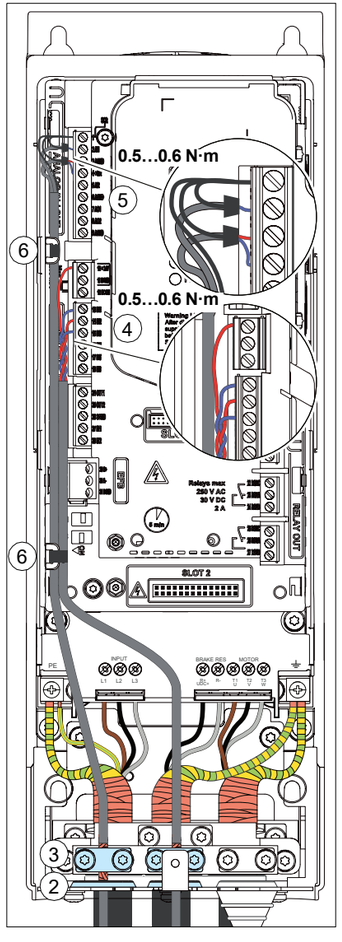
R4



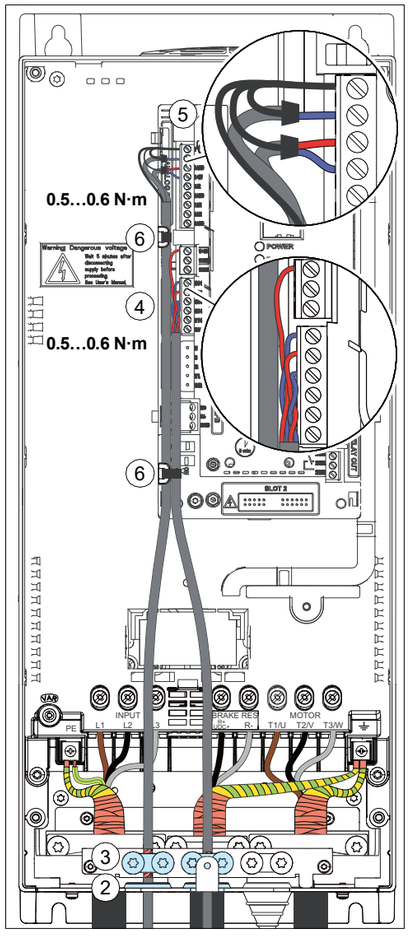


I

R1…R2

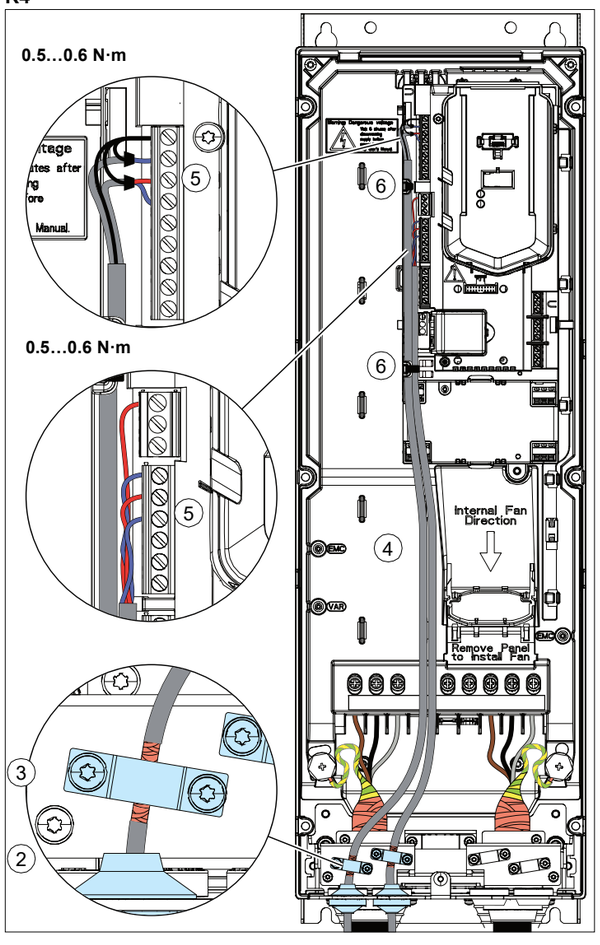


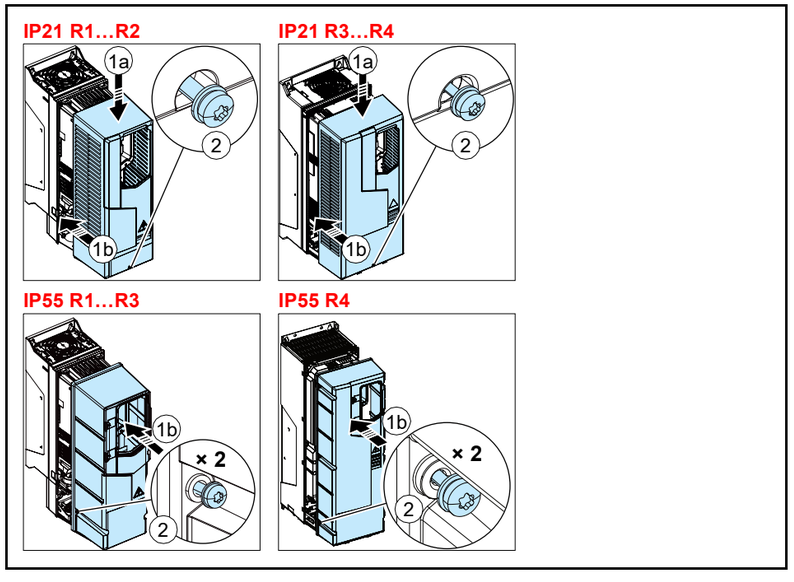
R3



I2

R4





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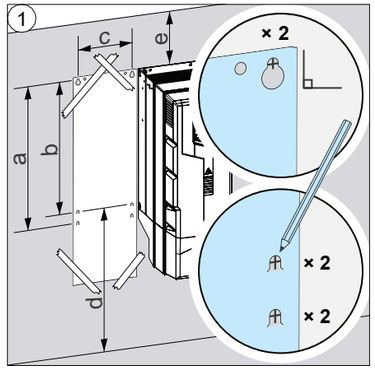
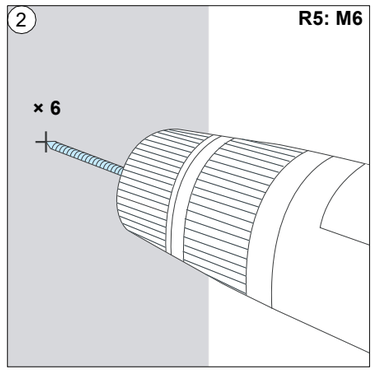
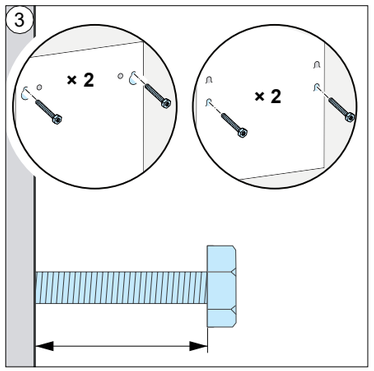
R5 Figures A

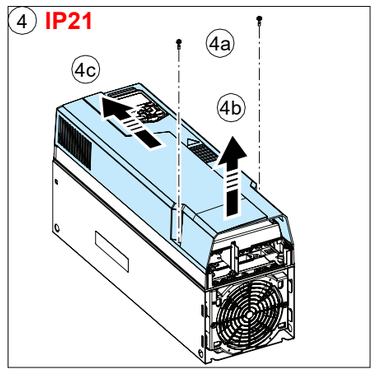


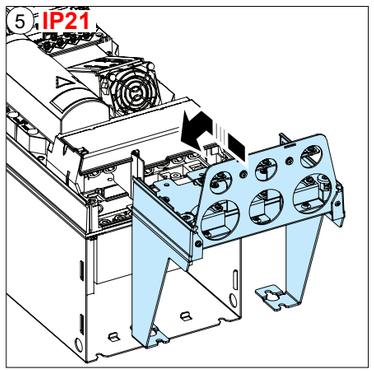
	R5 IP21		R5 IP55	
	mm	in	mm	in
a	612	24.09	612	24.09
b	581	22.87	581	22.87
c	160	6.30	160	6.30
d >	200	7.87	200	7.87
e >	100	3.94	100	3.94

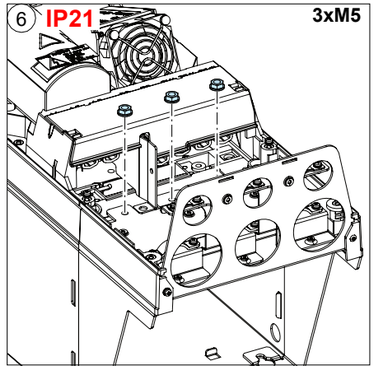
⚠	R5 IP21		R5 IP55	
	kg	lb	kg	lb
	28.3	62.4	29.0	64.0

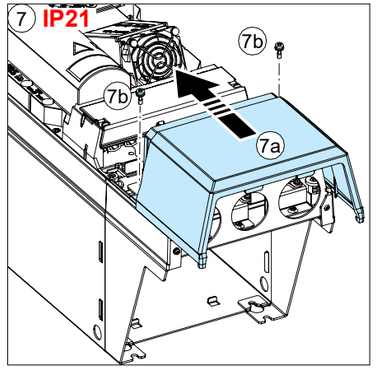


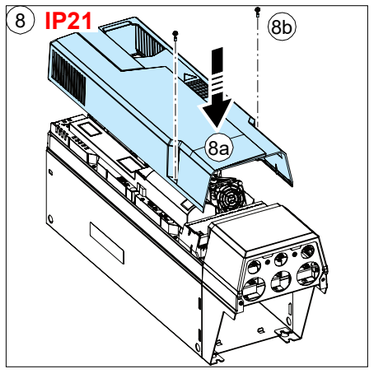


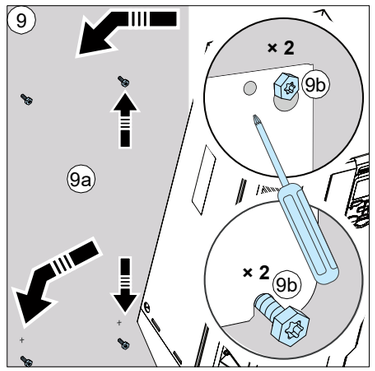


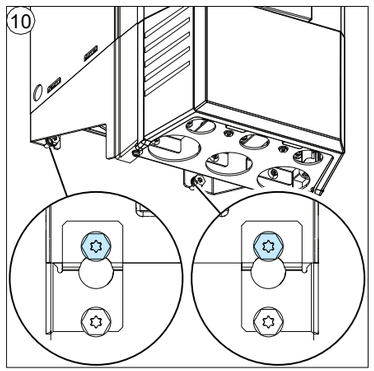












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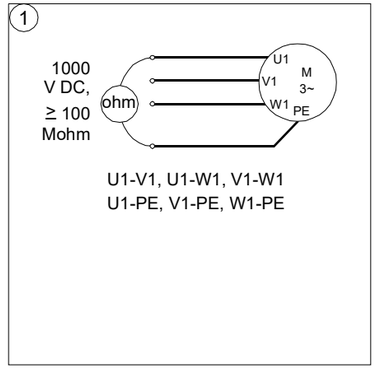
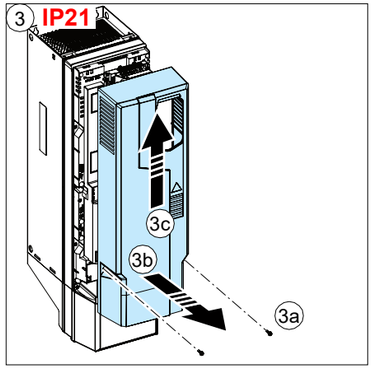
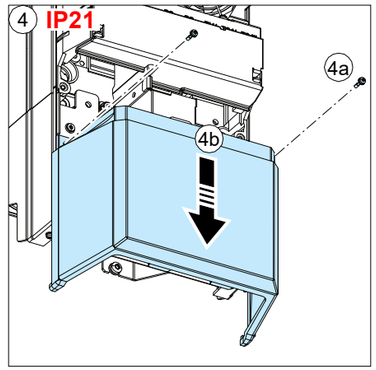
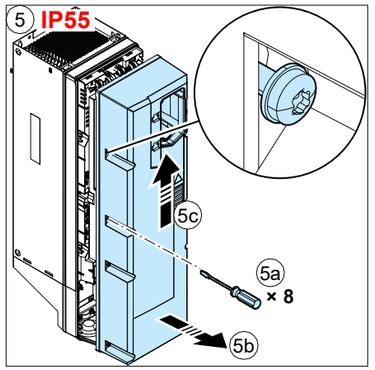


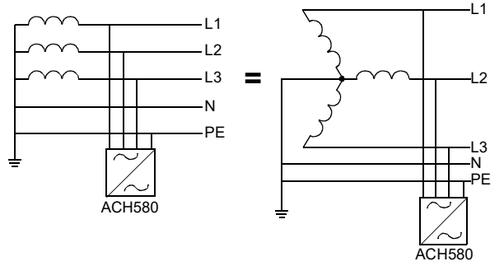






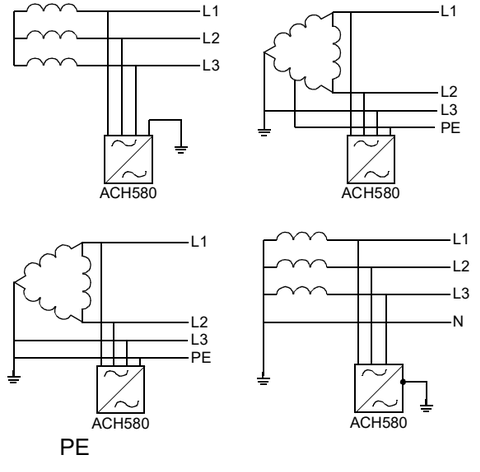
C

SYMMETRICALLY GROUNDED TN SYSTEMS (TN-S) = CENTER-GROUNDED WYE



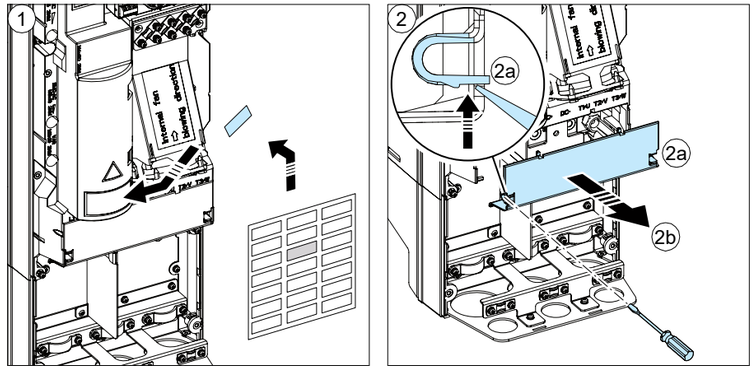
✓ OK

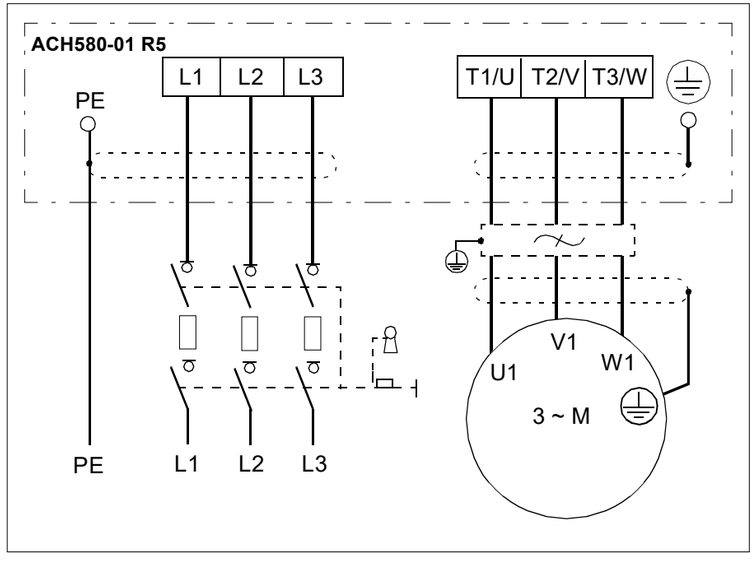
IT (UNGROUNDED), CORNER-GROUNDED DELTA, MIDPOINT-ROUNDED DELTA AND TT SYSTEMS



EN: See page *33*.
DA: Se side *243*.
DE: Siehe Seite *109*.
ES: Véase la página *119*.
FI: Katso sivu *129*.
FR: Cf. page *139*.
IT: Vedere pag. *303*.
NL: Zie pagina *315*.
PL: Patrz str. *327*.
PT: Veja a página *339*.
RU: См. стр. *149*.
SV: Se sidan *159*.
TR: Bkz. sayfa *375*.
ZH: 请参阅第 *387*.

D





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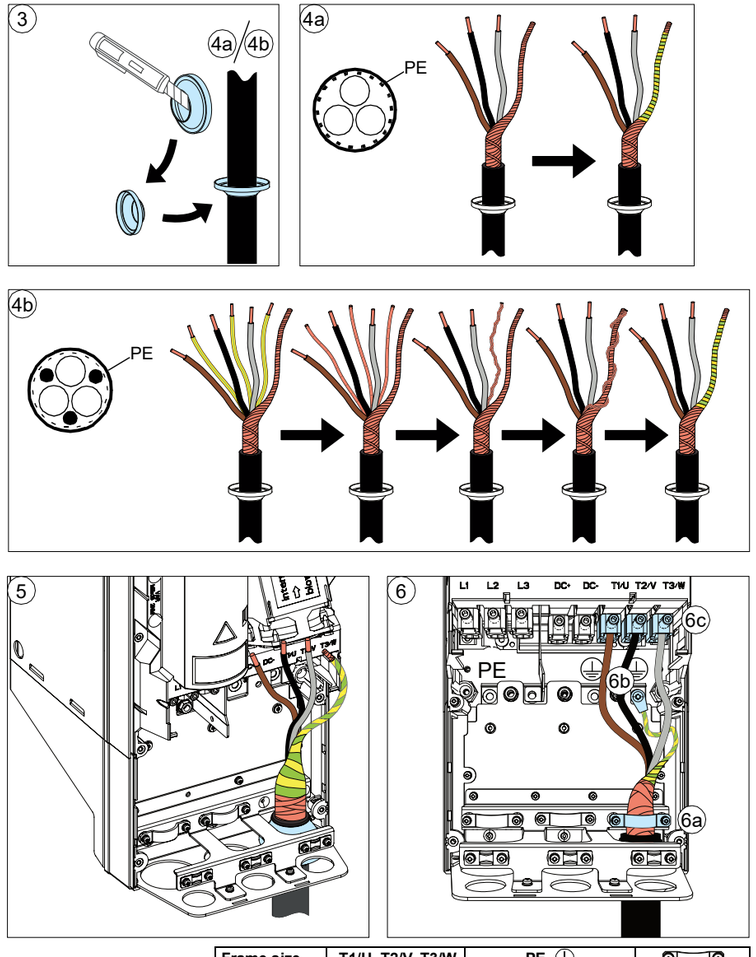

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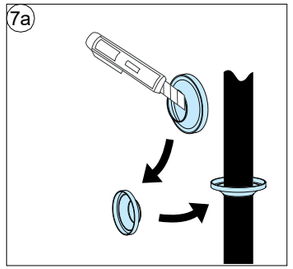
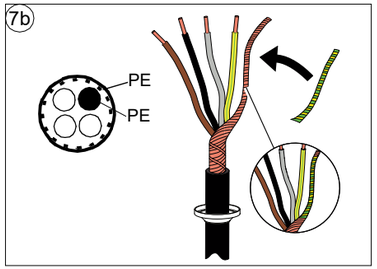
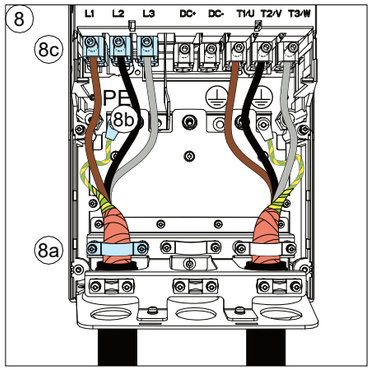
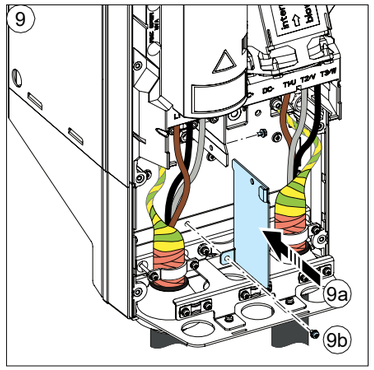
R5 Figures F









Frame size	L1, L2, L3,		PE, ⏚			⊙⊙	
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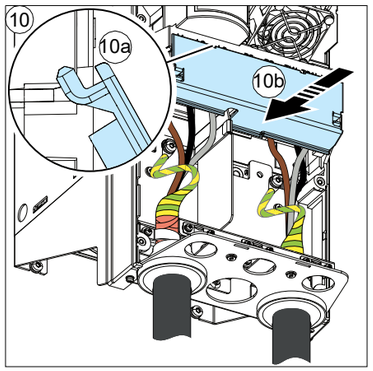
R5	5.6	4.1	M5	2.2	1,6	1.2	0.9



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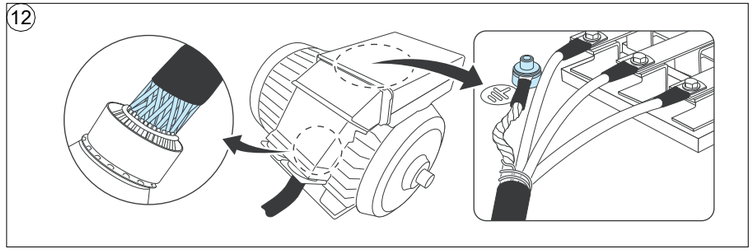

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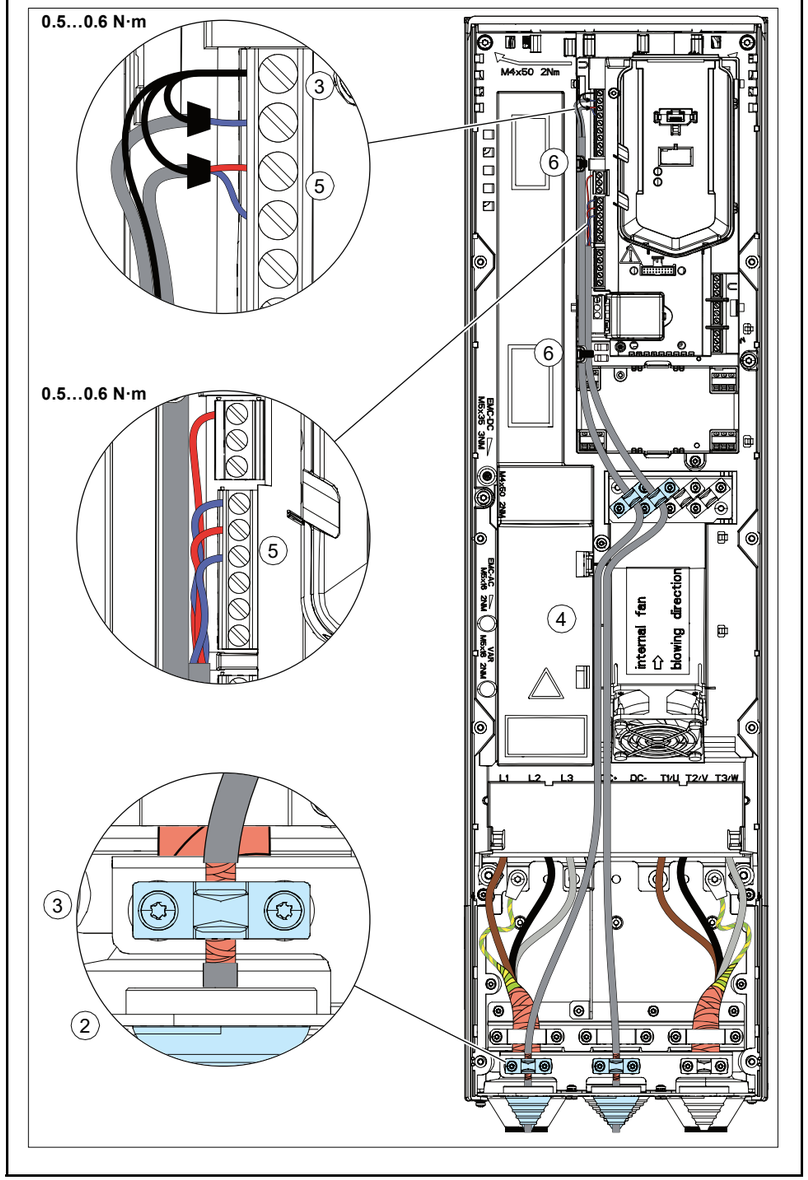

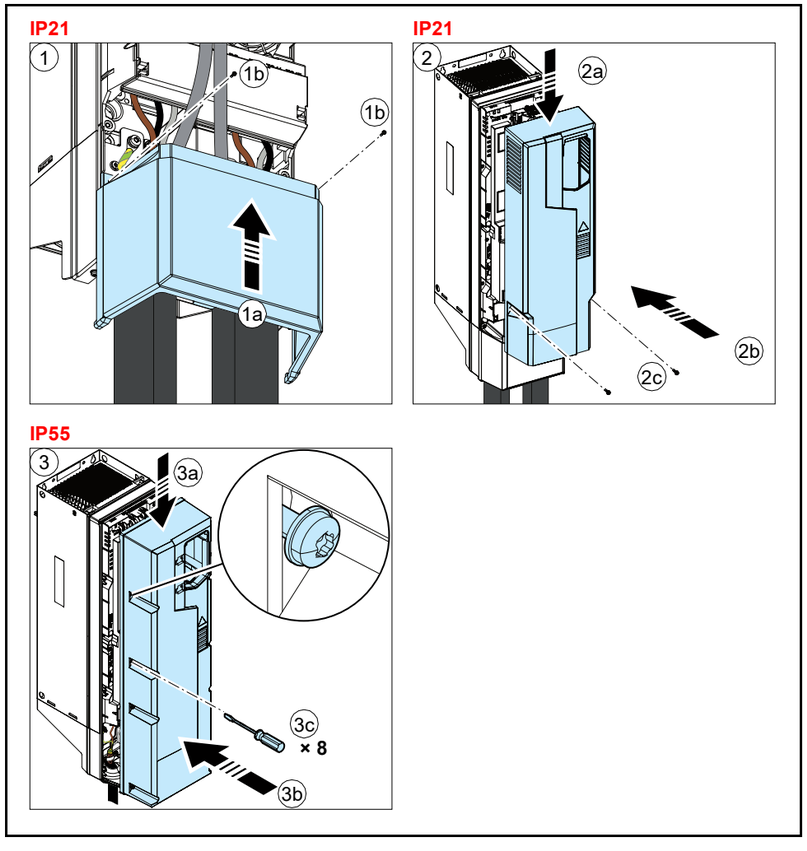
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Further information

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