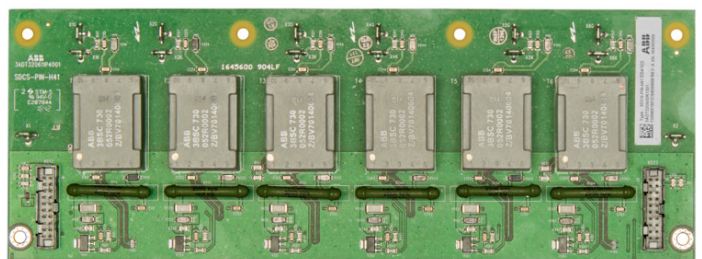
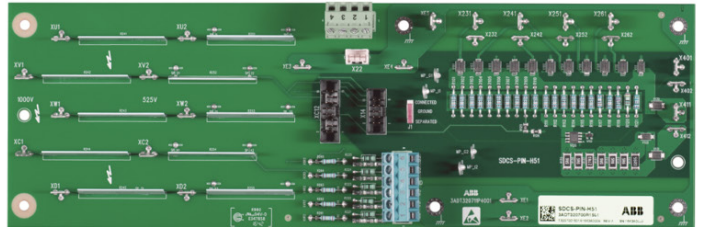
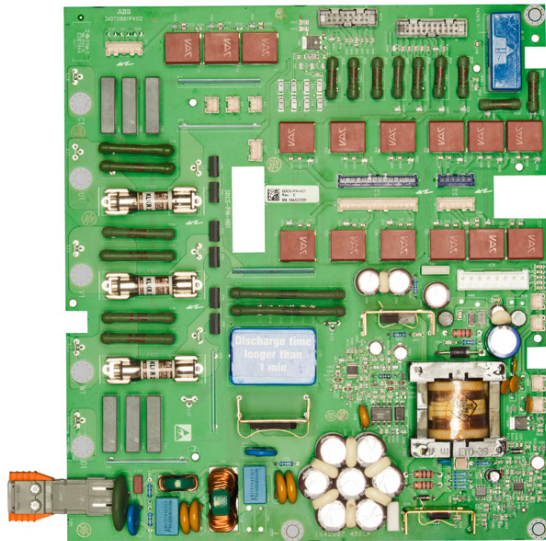


DCS880


DCS880 Service manual



DCS880 Drive Manuals

All the documents available for the drive system DCS880 are listed below:

List of manuals

		Language							
		E	D	I	ES	F	CN	RU	
General									
DCS880 Quick Guide	3ADW000480	x							
DCS880 Documentation pack	 DCS880 CD download	x							
DCS880 Units									
DCS880 Flyer	3ADW000475	x	x			x			
DCS880 Technical Catalog	3ADW000465	x							
DCS880 Hardware Manual	3ADW000462	x							
DCS880 Firmware Manual	3ADW000474	x							
DCS880 Service Manual	3ADW000488	x							
ACS-AP-x assistant control panels user's manual	3AUA0000085685	x							
Adaptive programming, Application guide	3AXD50000028574	x							
Functional safety									
Safety instructions all languages	3ADW000481	x	x	x	x	x	x	x	
Supplement for functional safety	3ADW000452	x							
Option manuals and guides									
SDCS-DPI-H01 panel bus adapter module	HW DCT880 0001E	x							
Door mounting kits									
DPMP-01 mounting platform for ACS-AP control panel	3AUA0000100140	x							
DPMP-02 mounting platform for ACS-AP control panel	3AUA0000136205	x							
Serial communication									
FCAN-01 CANopen adapter module	3AFE68615500 3AUA0000121752	x	x						
FDNA-01 DeviceNet™ adapter module	3AFE68573360	x							
FECA-01 EtherCAT adapter module	3AUA0000068940 3AUA0000083936	x	x						
FENA-01/-11/-21 Ethernet adapter module	3AUA0000093568	x							
FEPL-02 Ethernet POWERLINK adapter module	3AUA0000123527 3AUA0000133138	x	x						
FPBA-01 PROFIBUS DP adapter module	3AFE68573271 3AFE68989078	x	x						
FSCA-01 RS-485 adapter module	3AUA0000109533	x							
FDCO-01/02 DDCS communication modules	3AUA0000114058								
Drive (IEC61131-3) application programming manual	3AUA0000127808	x							
Tool and maintenance manuals and guides									
Drive composer PC tool	3AUA0000094606	x							
NETA-21 remote monitoring tool	3AUA0000096939	x							
NETA-21 remote monitoring tool installation and startup guide	3AUA0000096881	x							
Extension modules									
FIO-11 Analog extension module	3AFE68784930	x							
FIO-01 Digital extension module	3AFE68784921	x							
FAIO-01 Analog extension module	3AUA0000124968	x							
FEN-01 TTL encoder interface	3AFE68784603	x							
FEN-31 HTL encoder interface	3AUA0000031044	x							
FEA-01 F-series extension adapter	3AUA0000071412	x							
FEA-03 F series extension adapter	3AUA0000115811	x							
x → existing p → planned									
Status 11.2017									

DCS880 Manuals list e.e.docx

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Safety instructions

What this chapter contains

This chapter contains the safety instructions you must follow when installing, operating and servicing the drive. If ignored, physical injury or death may follow, or damage may occur to the drive, the motor or driven equipment. Read the safety instructions before you work on the unit.

To which products this chapter applies

The information is valid for the whole range of the product DCS880, the converter modules DCS880-S0x size H1 ... H8, field exciter units DCF80x, etc. like the Rebuild Kit DCS880-R00.

Usage of warnings and notes

There are two types of safety instructions throughout this manual: warnings and notes. Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment, and advice on how to avoid the danger. Notes draw attention to a particular condition or fact, or give information on a subject. The warning symbols are used as follows:



Dangerous voltage warning warns of high voltage which can cause physical injury or death and/or damage to the equipment.



General danger warning warns about conditions, other than those caused by electricity, which can result in physical injury or death and/or damage to the equipment.



Electrostatic sensitive devices warning warns of electrostatic discharge which can damage the equipment.

Installation and maintenance work

These warnings are intended for all who work on the drive, motor cable or motor. Ignoring the instructions can cause physical injury or death and/or damage to the equipment.



WARNING

- **Only qualified electricians are allowed to install and maintain the drive!**
- Never work on the drive, motor cable or motor when main power is applied.
- Always ensure by measuring with a multimeter (impedance at least 1 MΩ) that:
 1. Voltage between drive input phases U1, V1 and W1 and the frame is close to 0 V.
 2. Voltage between terminals C+ and D- and the frame is close to 0 V.
- Do not work on the control cables when power is applied to the drive or to the external control circuits. Externally supplied control circuits may cause dangerous voltages inside the drive even when the main power on the drive is switched off.
- Do not make any insulation resistance or voltage withstand tests on the drive or drive modules.
- Isolate the motor cables from the drive when testing the insulation resistance or voltage withstand of the cables or the motor.
- When reconnecting the motor cable, always check that the C+ and D- cables are connected with the proper terminal.

Note:

- The motor cable terminals on the drive are at a dangerously high voltage when the main power is on, regardless of whether the motor is running or not.
- Depending on the external wiring, dangerous voltages (115 V, 220 V or 230 V) may be present on the relay outputs of the drive system (e.g. XRO1 ... XRO3).
- DCS880 with enclosure extension: Before working on the drive, isolate the whole drive system from the supply.

Grounding

These instructions are intended for all who are responsible for the grounding of the drive. Incorrect grounding can cause physical injury, death and/or equipment malfunction and increase electromagnetic interference.



WARNING

- Ground the drive, motor and adjoining equipment to ensure personnel safety in all circumstances, and to reduce electromagnetic emission and pick-up.
- Make sure that grounding conductors are adequately sized and marked as required by safety regulations.
- In a multiple-drive installation, connect each drive separately to protective earth (PE \oplus).
- Minimize EMC emission and make a 360° high frequency grounding (e.g. conductive sleeves) of screened cable entries at the cabinet lead-through plate.
- Do not install a drive equipped with an EMC filter to an ungrounded power system or a high resistance-grounded ($> 30 \Omega$) power system.

Note:

- Power cable shields are suitable as equipment grounding conductors only when adequately sized to meet safety regulations.
- As the normal leakage current of the drive is higher than 3.5 mA_{AC} or 10 mA_{DC} (stated by EN 50178, 5.2.11.1), a fixed protective earth connection is required.

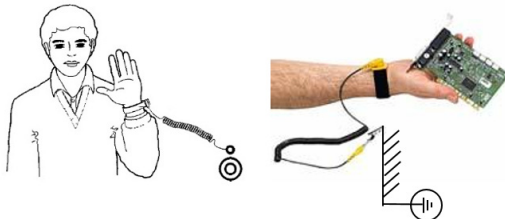
Printed circuit boards and fiber optic cables

These instructions are intended for all who handle the circuit boards and fiber optic cables. Ignoring the following instructions can cause damage to the equipment.



WARNING

- The printed circuit boards contain components sensitive to electrostatic discharge. Wear a grounding wrist band when handling the boards. Do not touch the boards unnecessarily.
- Use grounding strip:



- ABB order no.: 3ADV050035P0001



WARNING

- Handle the fiber optic cables with care.
- When unplugging optic cables, always grab the connector, not the cable itself.
- Do not touch the ends of the fibers with bare hands as the fiber is extremely sensitive to dirt.
- The minimum allowed bend radius is 35 mm (1.38 in.).

Mechanical installation

These notes are intended for all who install the drive. Handle the unit carefully to avoid damage and injury.



WARNING



- DCS880 sizes H4 ... H8: The drive is heavy. Do not lift it alone. Do not lift the unit by the front cover. Place units H4 ... H6 only on its back.
- DCS880 sizes H6 ... H8: The drive is heavy. Lift the drive by the lifting lugs only. Do not tilt the unit. The unit will overturn from a tilt of about 6 degrees.
- Make sure that dust from drilling does not enter the drive when installing. Electrically conductive dust inside the unit may cause damage or lead to malfunction.
- Ensure sufficient cooling.
 - Do not fasten the drive by riveting or welding.

Operation


These warnings are intended for all who plan the operation of the drive or operate the drive. Ignoring the instructions can cause physical injury or death and/or damage to the equipment.



WARNING

- Before adjusting the drive and putting it into service, make sure that the motor and all driven equipment are suitable for operation throughout the speed range provided by the drive. The drive can be adjusted to operate the motor at speeds above and below the base speed.
- Do not control the motor with the disconnecting device (disconnecting mains); instead, use the control panel keys  and , or commands via the I/O board of the drive.
- Mains connection:
You can use a disconnect switch (with fuses) to disconnect the electrical components of the drive from the mains for installation and maintenance work. The type of disconnect switch used must be as per EN 60947-3, Class B, so as to comply with EU regulations, or a circuit-breaker type which switches off the load circuit by means of an auxiliary contact causing the breaker's main contacts to open. The mains disconnect must be locked in its "OPEN" position during any installation and maintenance work.
- EMERGENCY STOP buttons must be installed at each control desk and at all other control panels requiring an emergency stop function. Pressing the STOP button on the control panel of the drive will neither cause an emergency stop of the motor, nor will the drive be disconnected from any dangerous potential.
- To avoid unintentional operating states, or to shut the unit down in case of any imminent danger according to the standards in the safety instructions it is not sufficient to merely shut down the drive via signals "RUN", "drive OFF" or "Emergency Stop" respectively "control panel" or "PC tool".
- Intended use:
- The operating instructions cannot take into consideration every possible case of configuration, operation or maintenance. Thus, they mainly give such advice only, which is required by qualified personnel for normal operation of the machines and devices in industrial installations.
- If in special cases the electrical machines and devices are intended for use in non-industrial installations - which may require stricter safety regulations (e.g. protection against contact by children or similar) - these additional safety measures for the installation must be provided by the customer during assembly.

Note:

- When the control location is not set to Local (Local not shown in the status row of the display), the stop key on the control panel will not stop the drive. To stop the drive using the control panel, press the Loc/Rem key and then the stop key .

Introduction to this manual

Chapter overview

This chapter describes the purpose, contents and the intended use of this manual.

Before You Start

The purpose of this service manual is to provide detailed information on how to service DCS880 power converters. The [Safety instructions](#) at the beginning of this manual needs to be studied before attempting any work on or with the drive. Read this manual before servicing the drive.

What this manual contains

The [Safety instructions](#) can be found at the beginning of this manual.

[Introduction to this manual](#), the chapter you are currently reading, introduces you to this manual.

[Fault Tracing Thyristors](#), this chapter describes how to detect a faulty thyristor or SDCS-BAB-F0x.

[Handling the Semiconductors](#), this chapter describes the handling of thyristors and thyristor modules.

[Exchange thyristors sizes H1 ... H4](#), this chapter describes the exchange of thyristors and SDCS-BAB-F0x in converters sizes H1 ... H4.

[Exchange thyristors size H5](#), this chapter describes the exchange of thyristors in converters size H5.

[Exchange thyristors size H6](#), this chapter describes the exchange of thyristors in converters size H6.

[Exchange thyristors size H7](#), this chapter describes the exchange of thyristors in converters size H7.

[Exchange thyristors size H8](#), this chapter describes the exchange of thyristors in converters size H8.

[Exchange SDCS-CON-H01](#), this chapter describes the exchange of a SDCS-CON-H01.

[Service](#), this chapter contains hardware change information, firmware download and technical hints.

[Preventive Maintenance](#), this chapter describes preventive maintenance of thyristor converters.

[Appendix: Spare Parts list](#), the Appendix contains the spare parts list.

Target group

This manual is designed to help those responsible for planning, installing, starting up and servicing thyristor power converters.

These people should possess:

- Basic knowledge of physics, electrical engineering, electrical wiring principles, components as well as symbols used in electrical engineering.
- Basic experience with DC drives and DC products.

Related documents

A list of related manuals is shown on the inside of the front cover under [DCS880 Drive Manuals](#).

The above listed documentation can be found as DCS880 - Documentation pack following this link:

[DCS880 - Documentation pack](#).

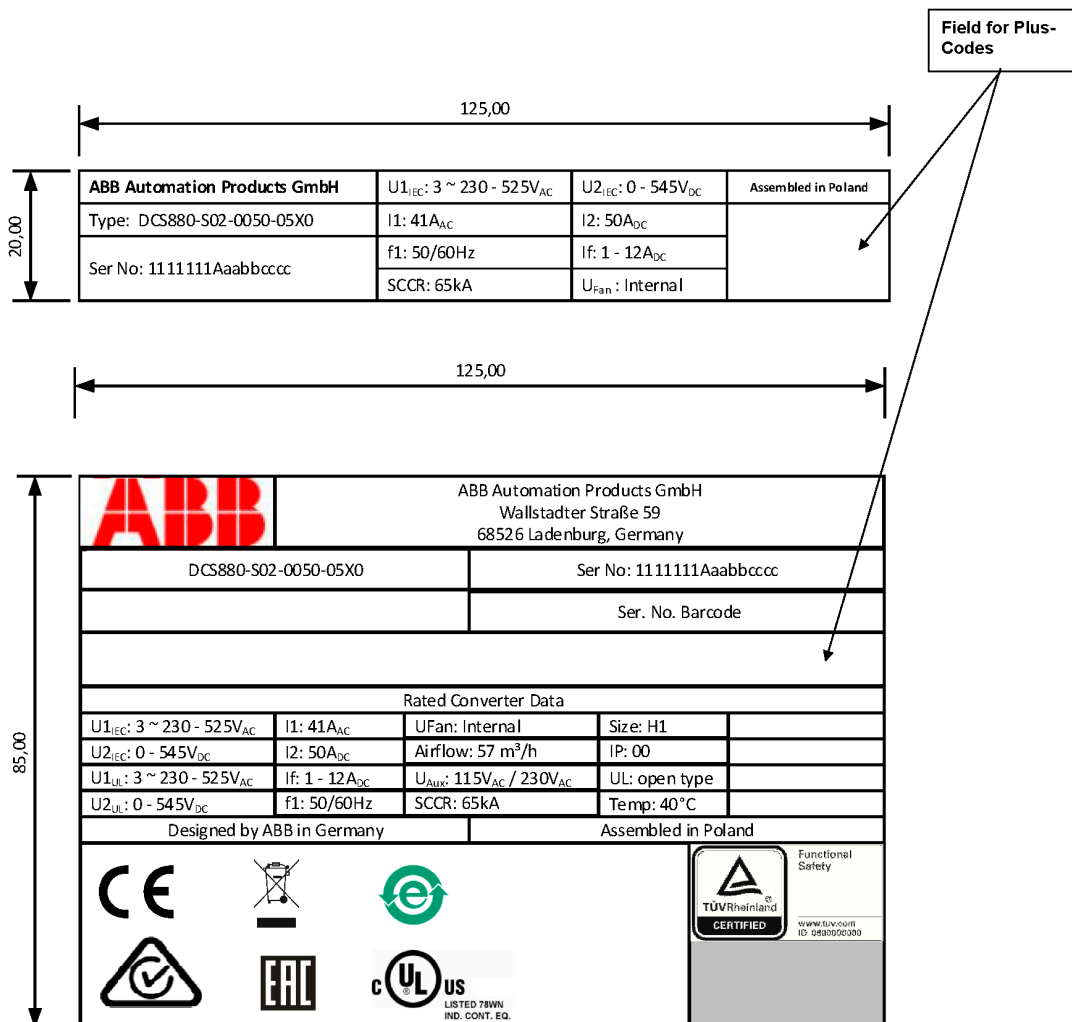
Storage and transport

If the unit has been in storage prior to installation or is transported to another location, care must be taken to ensure that the environmental conditions are complied with (see [DCS880 Hardware Manual](#)).

Name plate

For purposes of identification, each thyristor power converter is fitted with name plates, stating the type code and the serial number, which serve for each unit's individual identification.

The type code contains information about the characteristics and the configuration of the unit.



Ser No	0025421A 1729 4264 1729 = Production year 2017 and week 29.
U _{1IEC}	Rated input voltage according to IEC.
U _{2IEC}	Rated output voltage according to IEC.
U _{1UL}	Rated input voltage according to UL.
U _{2UL}	Rated output voltage according to UL.
I ₁	Rated input current.
I ₂	Rated output current.
I _f	Rated internal field exciter current.
f ₁	Rated frequency of mains voltage.
U _{Fan}	Rated fan voltage.
Airflow	Rated cooling air flow.
U _{Aux}	Rated auxiliary voltage.
Size	Unit size.
SCCR	Short circuit current ratio.
IP: 00	Protection class according to ISO20653.
UL: open type	Protection class according to UL.
Temp	Max. permissible cooling air temperature.

Type code

The type code contains information on the specification and configuration of the drive. The first digits from left show the basic configuration (e.g. DCS880-S01-2000). The optional selections are given thereafter on the name plate by plus code. The main selections are described below. Not all selections are available for all types.

The drive's basic type code: DCS880-aab-cccc-ddef			
Product family:	DCS880		
Product type:	aa	= S0	Standard converter module
		= R0	Rebuild kit
		= E0	Panel solution
		= A0	Enclosed converter
Bridge type:	b	= 1	Single bridge (2-Q)
		= 2	2 anti-parallel bridges (4-Q)
Module type:	cccc	=	Rated DC current (IP00)
Rated AC voltage:	dd	= 04	100 V _{AC} ... 415 V _{AC}
		= 05	100 V _{AC} ... 525 V _{AC}
		= 06	270 V _{AC} ... 600 V _{AC}
		= 07	315 V _{AC} ... 690 V _{AC}
		= 08	360 V _{AC} ... 800 V _{AC}
		= 10	450 V _{AC} ... 990 V _{AC}
		= 12	540 V _{AC} ... 1200 V _{AC}
Power connection:	e	= X	Standard H1 ... H7
		= L	Left side H8
		= R	Right side H8
Revision code:	f	= 0	1 st generation
Field exciter configuration:	+0S163 +S164	H1 ... H4 without OnBoard field exciter H5 and H6 with internal field exciter, supply external (H5 and H6: 25 A, Rebuild kit: 16 A/25 A)	
Fan voltage:	Standard +S171	Size H4 Fan voltage: 230 V/1-ph Fan voltage: 115 V/1-ph	
Application programming	+S551	Memory unit including drive application programming license	
SDCS-DSL-H1x:	+S521	1 DCSLink channel, 0 channels optical power link SDCS-DSL-H10	
	+S522	1 DCSLink channel, 2 channels optical power link SDCS-DSL-H12	
	+S523	1 DCSLink channel, 4 channels optical power link SDCS-DSL-H14	
Voltage measurement:	+S185	SDCS-PIN-H51 configured for 20 V _{AC} ... 100 V _{AC} (H6 ... H8)	
Control panel:	+0J404 +J428 +J429	Without control panel daisy-chain option DPI-H01 kit Bluetooth control panel ACS-AP-W	

The technical data and specifications are valid as of going to press. ABB reserves the right to make subsequent alterations.

Voltage ratings

The maximum available armature voltages have been calculated using the following assumptions:

- U_{VN} = rated mains voltage, 3-phase.
- Voltage tolerance $\pm 10\%$.
- Internal voltage drop approximately 1% .

If a deviation or a voltage drop has to be taken into account in compliance with IEC and VDE standards, the output voltage and/or the output current must be reduced.

Mains voltage	Maximum DC voltage		Ideal DC voltage	DC voltage class
U_{VN} [V _{AC}]	$U_{d \max 2-Q}$ [V _{DC}]	$U_{d \max 4-Q}$ [V _{DC}]	U_{d0} [V _{DC}]	
230	265	240	310	04
380	440	395	510	04
400	465	415	540	04
415	480	430	560	04
440	510	455	590	05
460	530	480	620	05
480	555	500	640	05
500	580	520	670	05
525	610	545	700	05
575	670	600	770	06
600	700	625	810	06
660	765	685	890	07
690	800	720	930	07
800	915	820	1060	08
990	1160	1040	1350	10
1200	1380	1235	1590	12

The maximum available field voltage can be calculated using following formula:

$$U_F \leq 1.35 * U_{VN} * \left(\frac{100\% * TOL}{100\%} \right), \text{ with:}$$

U_F = field voltage.

U_{VN} = mains voltage.

TOL = tolerance of the mains voltage in %.

Current ratings

Unit size	2-Q rated current DCS880-S01 [A _{DC}]	4-Q rated current DCS880-S02 [A _{DC}]	Supply voltage [V _{AC}]						
			400	525	600	690	800	990	1200
H1	20	25	X	X					
	45	50	X	X					
	65	75	X	X					
	90	100	X	X					
H2	135	150	X	X					
	180	200	X	X					
	225	250	X	X					
	270	300	X	X					
H3	290	320			X				
	315	350	X	X					
	405	450	X	X					
	470	520	X	X					
H4	590	650			X				
	610	680	X	X					
	740	820	X	X					
	900	1000	X	X					
H5	1190 ①	1190 ①	X	X					
H6	900	900			X	X			
	1200	1200	X	X					
	1500	1500	X	X	X	X			
	2000		X	X	X	X			
		2000	X	X					
H7	1900	1900					X		
	2050	2050		X	X	X			
	2500	2500	X	X	X	X	X		
	3000	3000	X	X	X	X	X		
H8	2050	2050						X	
	2600	2600						X	X
	3300	3300	X	X	X	X	X	X	X
	4000	4000	X	X	X	X	X	X	X
	4800	4800			X	X	X		
	5200	5200	X	X					

① 1190 A_{DC} for 35°C and 1140 A_{DC} for 40°C ambient temperature.

Terms and abbreviations

Term/Abbreviation	Definition
AC 800M	Type of programmable controller manufactured by ABB.
ACS-AP-I	Types of control panel used with DCS880 drives
ACS-AP-W	
AI	Analog input; interface for analog input signals.
AO	Analog output; interface for analog output signals.
D2D	Drive-to-drive; communication link between drives.
DCS800	A product family of ABB drives.
DDCS	Distributed drives communication system; a protocol used in communication between ABB drive equipment.
DI	Digital input; interface for digital input signals.
DIO	Digital input/output; interface that can be used as a digital input or output.
DO	Digital output; interface for digital output signals.
Drive	Converter to control DC motors.
DriveBus	A communication link used by, for example, ABB controllers. DCS880 drives can be connected to the DriveBus link of the controller.
DriveAP	Adaptive Programming of the drive.
Drive composer	PC tool for commissioning and maintenance of ABB drives.
Drive control unit	Contains the electronics of the drive. The power unit is connected to the drive control unit.
EFB	Embedded fieldbus interface.
FAIO-01	Optional analog I/O extension module.
FBA	Fieldbus adapter.
FCAN-01	Optional CANopen adapter.
FCNA-01	Optional ControlNet adapter.
FDCO-0x	Optional DDCS communication module.
FDIO-01	Optional digital I/O extension module.
FDNA-01	Optional DeviceNet adapter.
FEA-03	Optional I/O extension adapter.
FECA-01	Optional EtherCAT® adapter.
FEN-01	Optional TTL encoder interface module.
FEN-11	Optional absolute encoder interface module.
FEN-21	Optional resolver interface module.
FEN-31	Optional HTL encoder interface module.
FENA-11	Optional Ethernet/IP, Modbus/TCP and PROFINET IO adapter.
FENA-21	Optional dual-port Ethernet/IP, Modbus/TCP and PROFINET IO adapter.
FEPL-02	Optional POWERLINK adapter.
FIO-01	Optional digital I/O extension module.
FIO-11	Optional analog I/O extension module.
FPBA-01	Optional PROFIBUS DP adapter.
FPTC-01	Optional thermistor protection module.
FPTC-02	Optional ATEX-certified thermistor protection module for potentially explosive atmospheres.
FSCA-01	Optional Modbus/RTU adapter.
FSO-xx	Optional safety functions module.
HTL	High-threshold logic.
I/O	Input/Output.
ModuleBus	A communication link used by, for example, ABB controllers. ACS880 drives can be connected to the optical ModuleBus link of the controller.
Network control	With fieldbus protocols based on the Common Industrial Protocol (CIP™), such as DeviceNet and Ethernet/IP, denotes the control of the drive using the Net Ctrl and Net Ref objects of the ODVA AC/DC Drive Profile. For more information, see www.odva.org , and the following manuals: <ul style="list-style-type: none"> FDNA-01 DeviceNet adapter module User's manual (3AFE68573360) FENA-01/-11 Ethernet adapter module User's manual (3AUA0000093568).

Term/Abbreviation	Definition
Parameter	User-adjustable operation instruction to the drive.
PID controller	Proportional-integral-derivative controller. The speed control is based on a PID algorithm.
PLC	Programmable logic controller.
Power unit	Contains the power electronics and power connections of the drive. The drive control unit is connected to the power unit.
PTC	Positive temperature coefficient.
PU	See power unit.
RDCO-0x	DDCS communication module.
RFG	Ramp function generator.
RO	Relay output; interface for a digital output signal. Implemented with a relay.
Signal	Value measured or calculated by the drive.
SSI	Synchronous serial interface.
STO	Safe torque off.
TTL	Transistor-transistor logic.
UPS	Uninterruptible power supply; power supply equipment with battery to maintain output voltage during power failure.

Cybersecurity disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is the customer's sole responsibility to provide and continuously ensure a secure connection between the product and the customer network or any other network (as the case may be). The customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Fault Tracing Thyristors

Tools

For commissioning and fault tracing

Following software tools are mandatory:

- Drive composer **pro**. Includes commissioning wizard, Adaptive Program and fast drive monitoring.

Following tools are mandatory in addition to standard tools:

- An oscilloscope including memory function with either galvanically isolating transformer or isolating amplifier (probe) for safe measurements. It can also be a hand held (portable) oscilloscope.
- A clamp on current probe. In case the scaling of the DC load current needs to be checked it must be a DC clamp on current probe.
- A voltmeter (at least CAT III 1000 V).



- 1000 V probes and test leads.



- An ESD-field service kit (ABB Service Finland code 0001ESD/MS-Antistatic).



- Make sure that all equipment in use is suitable for the voltage level applied to the power part!

Additionally for service and preventive maintenance

Following additional tools are mandatory for cleaning:

- An ESD safe blower/ESD vacuum cleaner (ABB Service Finland code 0006ESD/MUNTZ 555-ESD-S-E).



How to detect a faulty thyristor

Thyristor problems can be noticed differently:

A fuse is blown

This is an indication that a strong overcurrent has happened due to one of the following reasons:

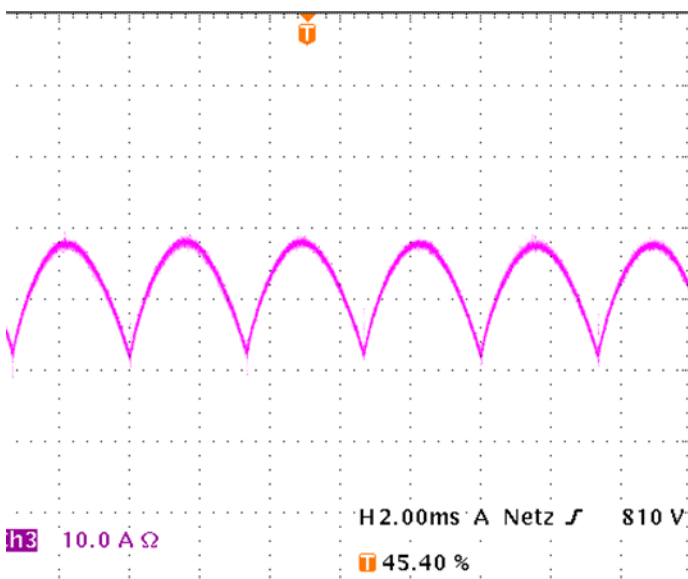
- An internal short circuit between the phases (line side/AC-side) because of a defective thyristor (short circuit inside a thyristor from anode to cathode).
- An internal short circuit between the phases (line side/AC-side) because of circulating current in a 4-Q converter (malfunction of the control electronics, no thyristor defective).
- An external short circuit at the DC terminals of the converter without sufficient impedance.
- A commutation fault during generating (active braking with high current, high EMF and with low AC voltage) of a 4-Q converter.

Note:

- In case of parallel fuses: If one of the parallel fuses is blown, all parallel fuses have to be changed. The 'undamaged' fuses might be 'half-blown' and will blow with the next high current.
- In case of serial fuses (e.g. DC-fuses): If one of the serial fuses is blown, all serial fuses have to be changed. The 'undamaged' fuses might be 'half-blown' and will blow with the next high current.

DC-current pulses measured using an oscilloscope

Connect an oscilloscope at the fixed AO named IACT (XAO:4/5 on the SDCS-CON-H01) and check for the proper amount of current pulses:



There should be six current pulses in positive direction.

In case of a 4-Q converter also the six current pulses for the negative current direction or other speed direction have to be checked.

Thyristor test

Also the thyristor test provided by the firmware can be used:

- Switch the drive to local mode (Drive composer entry/pro, control panel or local I/O).
- Start the thyristor test by means of 95.24 Service mode = Thyristor test and set On and Run within 20 s.
- During the thyristor test the main contactor will be closed and the thyristors are checked. The field current is not released while the thyristor test is active and thus the motor should not turn.
- When the thyristor test is finished check 05.22 Diagnostic for details.
- For more information consult the [DCS880 Firmware Manual](#).

Ripple monitor

The ripple monitor indicates that the ripple of the DC current is much higher than normal. In such a case, most often one thyristor does not work. Its missing current contribution causes a deep dip in the direct current.

The structure of the current loop (current controller) will force the other thyristors to compensate the dip by a certain overcurrent in order to keep the average current constant. Such a compensation results in a ripple monitoring fault during motoring mode operation with $\alpha \leq 90^\circ$.

The reason for a current less thyristor may be:

- A blown line fuse. This is possible only for converters with 20 ... 1000 A.
- A fuse has disconnected one of the six thyristors. This is possible only for converters with 900 ... 5200 A (six internal branch fuses).
- A loose gate/cathode connector.
- A thyristor does not get firing pulses or does not react to firing pulses.
- The current controller may be totally mismatched to the DC load.
- The AC mains network is causing that fault message. In this case, asymmetrical phase shift, uneven phase voltage or critical designed power factor correction equipment or harmonic reduction equipment can be the reason.

How to find a faulty thyristor

If a blown fuse is suspected, the problem is caused most often by a faulty thyristor. To make sure, that a thyristor is the reason and needs to be exchanged fault tracing must be done in two different ways, depending on the size of the converter.



In general, make sure, that all safety instructions, given within this manual or within the [Safety instructions](#), related to the machine or the application itself, are obeyed.

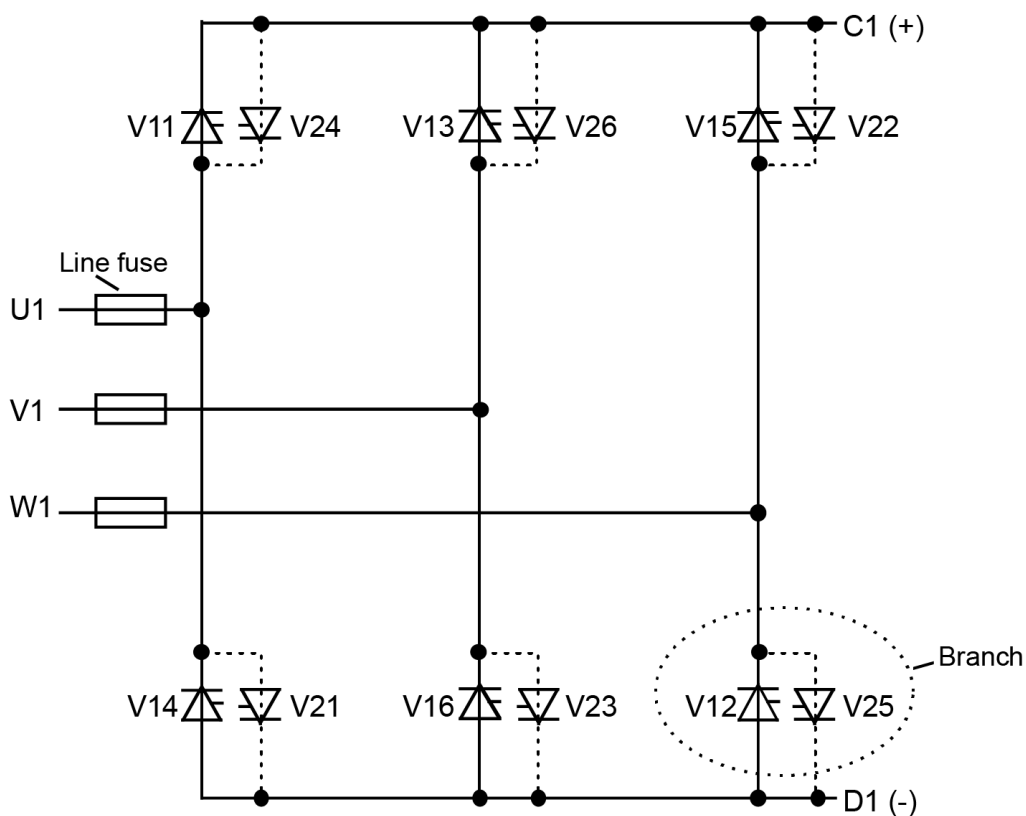
Converters size H1 ... H4 (20 ... 1000 A)

These converters require semiconductor fuses in the 3 AC lines.

- The converter must be disconnected from the mains.
- One motor armature cable should be disconnected from the converter.

Blown fuses

- Make sure, that the connection to the motor is open (e.g. disconnect motor cables).
- Using the OHM function of a normal multimeter, measurements must be made from each AC terminal to each DC terminal (U1 to C1, V1 to C1, W1 to C1, U1 to D1, V1 to D1 and W1 to D1):



SF_DCS_003_principle_b.ai

Bridge configuration H1 ... H4

- Normally, each measurement should show high resistance ($> 1 \text{ k}\Omega$).
- Target: Find a short circuit, indicated by low resistance ($< 1 \text{ }\Omega$) (destroyed thyristor).
- If the converter is designed with thyristor modules, then a module consists of two thyristors. In this case it is sufficient to know which thyristor module has a defective thyristor because the complete module must be replaced.
- After a thyristor module is replaced, the above mentioned measurement should be done another time to make sure that all faulty thyristors have been detected!

Note:

The RC/snubber circuit could also cause 0 Ω results for a short time.

The measurement, showing less resistance than 1 Ω should be made a second time with test leads applied to the terminals with opposite polarity; if this measurement shows the same result, one or two thyristors located in that path are faulty; they need to be replaced.

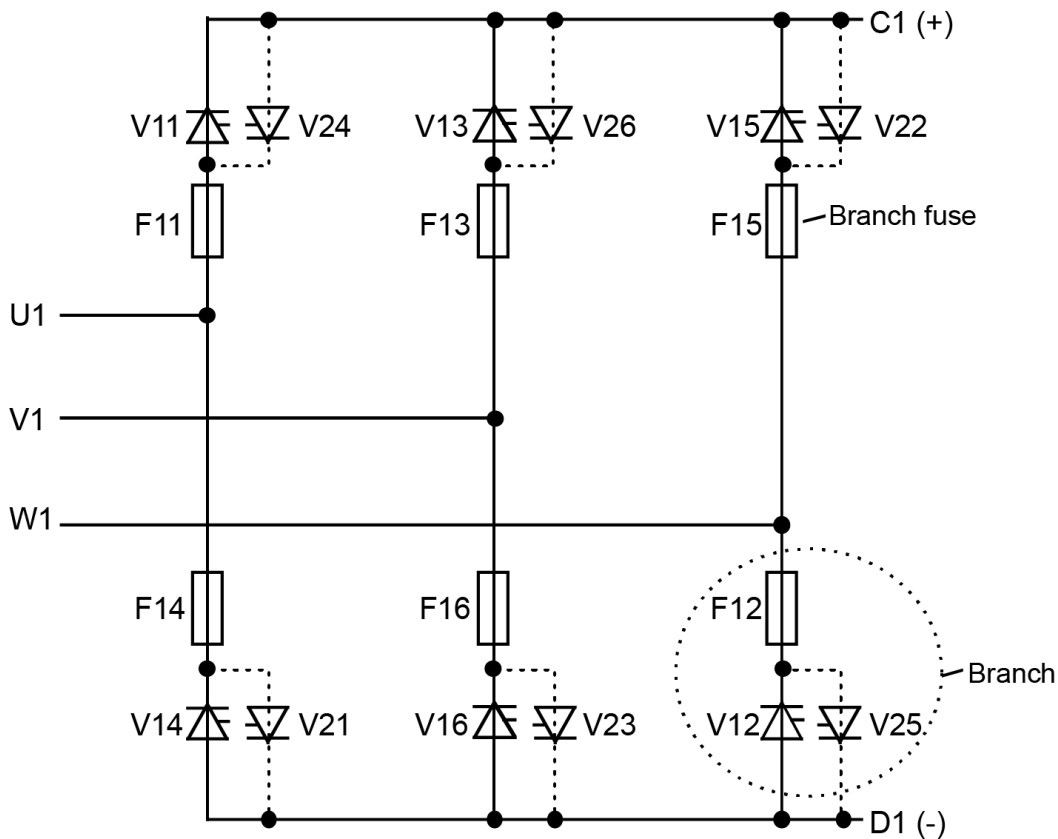
Converters size H5 ... H8 (900 ... 5200 A)

These converters are equipped with fuses in the branches of the power part.

- The converter must be disconnected from the mains.

Blown fuses

- Make sure, that the connection to the motor is open (e.g. disconnect motor cables).
- Using the OHM function of a normal multimeter, measurements must be made from each AC terminal to each DC terminal (U1 to C1, V1 to C1, W1 to C1, U1 to D1, V1 to D1 and W1 to D1).
- In case of a blown fuse, the faulty thyristor or the faulty pair of thyristors are already isolated at one side from the others and therefore the faulty branch is known:



Bridge configuration H5 ... H8

- Normally, each measurement should show high resistance ($> 1 \text{ k}\Omega$).
 - Target: Find a short circuit, indicated by low resistance ($< 1 \text{ }\Omega$) (destroyed thyristor).
 - Size H5 is designed with thyristor modules, then a module consists of two thyristors. In this case it is sufficient to know which thyristor module has a defective thyristor because the complete module must be replaced. Continue with related part [Exchange of Thyristors for Size H5](#) section [Find faulty thyristor](#).
 - For sizes H6 ... H8 the OHM test should be performed, when the thyristor is still clamped. Outside the converter a special thyristor clamping device is needed.
 - For 4-Q converters with anti-parallel thyristors or BCT's:
The selection of a forward or reverse thyristor or BCT (Bidirectional-Controlled-Thyristor) is done during the disassembly.
- Continue with related part [Exchange of Thyristors for Size H6, H7 or H8](#) section [Find faulty thyristor](#).
- After a thyristor was replaced, the OHM test should be done another time to make sure that all faulty thyristors have been detected! If the motor is still connected to the converter the result of the measurement may be wrong.

Ripple monitor

If the ripple monitor fault occurred, a fault tracing as described above must be carried out:

- Check the fuses and the thyristors, according to the statements before.
- If the power section seems to be ok, but still one or more thyristors don't take current, something went wrong in between the firing pulse generation and the thyristor's gate; in this case check:
 - Is a firing pulse present on the primary side of the firing pulse transformer?
 - Is a firing pulse present on the secondary side of the firing pulse transformer?
 - Is the firing pulse transferred to the gate of the thyristor (loose gate connector)? Are all electrical connections still healthy?
 - Can the thyristor be fired with the applied firing pulse? Is the pulse form of the firing pulse identical at all measuring positions?
- Check the settings of the current controller.
- Check the AC mains network by taking recordings of the line voltage and current at all 3 phases at the same time.

How to detect a faulty SDCS-BAB-F0x (H1 ... H4)

SDCS-BAB-F0x problems can be noticed differently:

- Fault messages related to the excitation.
- The field current is oscillating.
- A fuse F100 ... F102 on the SDCS-PIN-H01 is blown (sizes H1 ... H3) or a fuse F401 ... F403 in the drive is blown (size H4). This is an indication that a strong overcurrent has happened due an internal short circuit in the bridge connected to the SDCS-BAB-F0x because of a defective thyristor or diode.

How to find a faulty SDCS-BAB-F0x

If a blown fuse on the SDCS-PIN-H01 or in the drive is suspected, the problem is caused most often by a faulty SDCS-BAB-F0x. To make sure, that the SDCS-BAB-F0x is the reason and needs to be exchanged fault tracing must be done in two different ways, depending on the size of the converter.



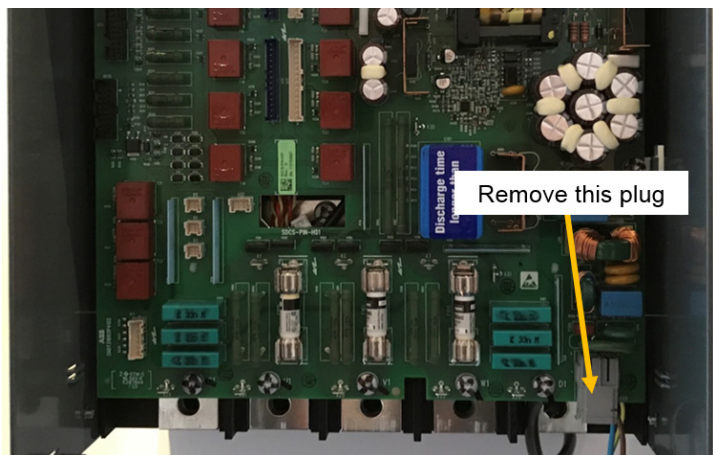
In general, make sure, that all safety instructions, given within this manual or within the [Safety instructions](#), related to the machine or the application itself, are obeyed.

Converters size H1 ... H3 (20 ... 520 A)

The supply for the SDCS-BAB-F0x is passed via the SDCS-PIN-H01. Thus fuses F100 ... F102 need to be measured, before the SDCS-BAB-F0x is checked.

- The converter must be disconnected from the mains.
- Follow the instructions [Remove faulty thyristor modules](#) until step 8 is done.

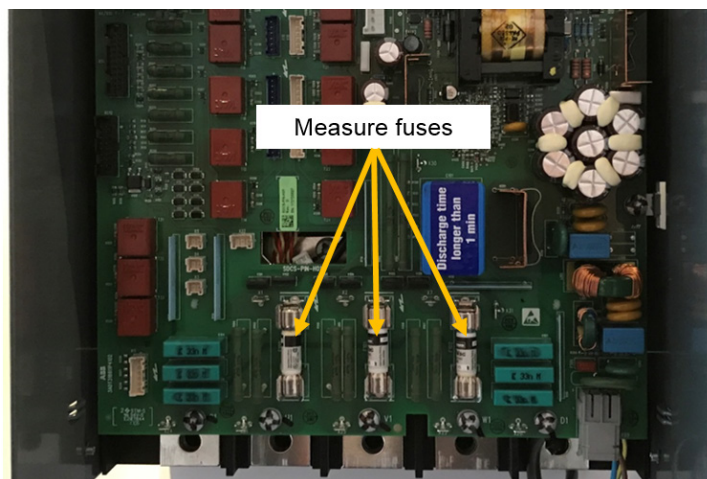
9. Remove the marked plugs at the SDCS-PIN-H01.



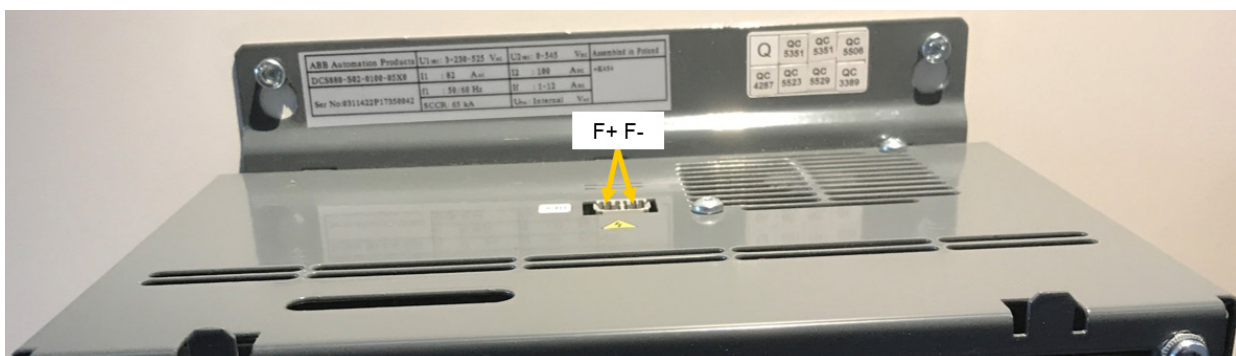
10. Remove field connection plug X10 from the top of the DCS880.



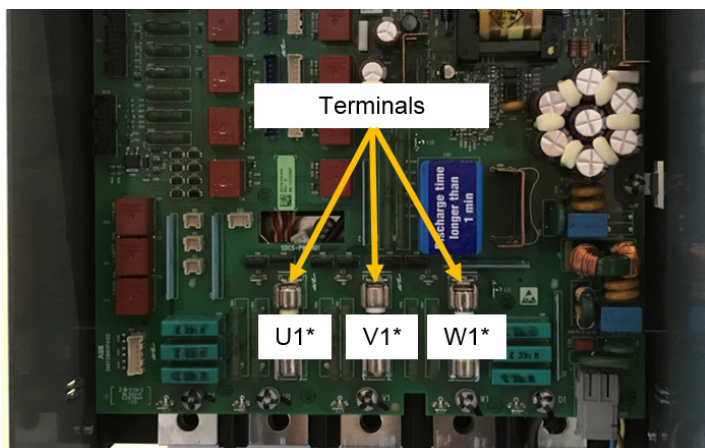
11. Measure fuses F100 ... F102 using the OHM function of a normal multimeter and exchange the broken ones.



12. The SDCS-BAB-F0x contains a 3-phase half-controlled bridge (B6H). Using the OHM function of a normal multimeter, measurements must be made from each AC terminal to each field exciter terminal (U1* to F+, V1* to F+, W1* to F+, U1* to F-, V1* to F- and W1* to F-).



- Normally, each measurement should show high resistance ($> 1 \text{ k}\Omega$).
- A short circuit is indicated by a low resistance ($< 1 \text{ k}\Omega$, destroyed thyristor or diode).
- If one of the measurements shows a short circuit, replace the SDCS-BAB-F0x.
- A measurement, showing less resistance than $1 \text{ }\Omega$ should be made for a second time. Apply the test leads with opposite polarity; if this measurement shows the same result, the SDCS-BAB-F0x is faulty and needs to be replaced.
- After the SDCS-BAB-F0x is replaced, the above mentioned measurement should be done another time to make sure that all is fine.



	Fuses (F100 ... F102)	SDCS-BAB-F0x	To do
Faulty?	Yes	No	Exchange SDCS-PIN-H01
	No	Yes	Exchange SDCS-BAB-F0x
	Yes	Yes	Exchange SDCS-BAB-F0x and fuses

Exchange the SDCS-BAB-F0x continue with chapter [Remove faulty SDCS-BAB-F0x](#).

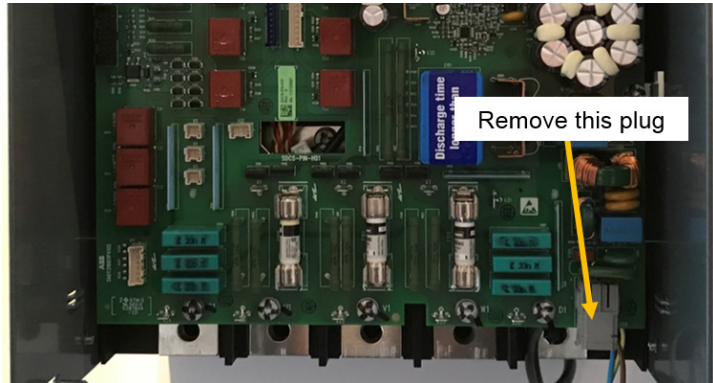
Exchange the SDCS-PIN-H01 continue with step 9 of the instructions [Remove faulty thyristor modules](#).

Converters size H4 (610 ... 1000 A)

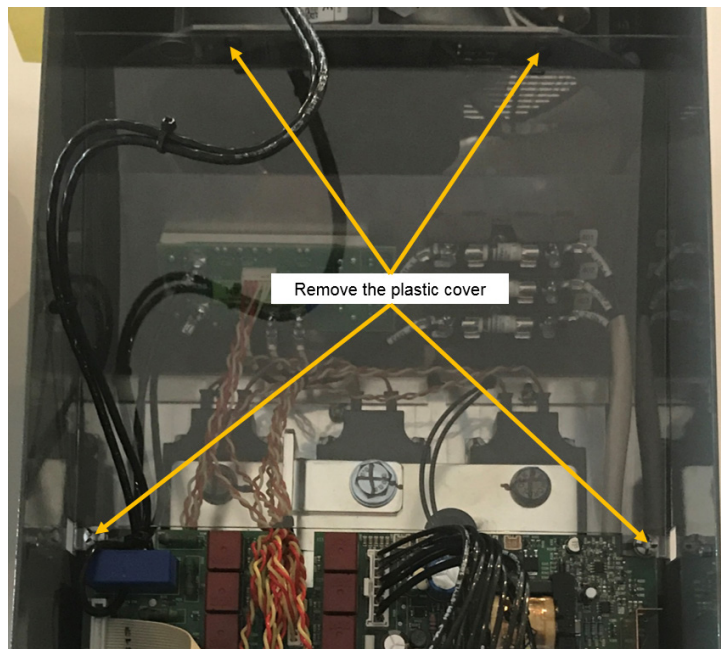
The supply for the SDCS-BAB-F0x is passed via fuses F401 ... F403. Thus, fuses F401 ... F403 need to be measured, before the SDCS-BAB-F0x is checked.

- The converter must be disconnected from the mains.
- Follow the instructions [Remove faulty thyristor modules](#) until step 8 is done.

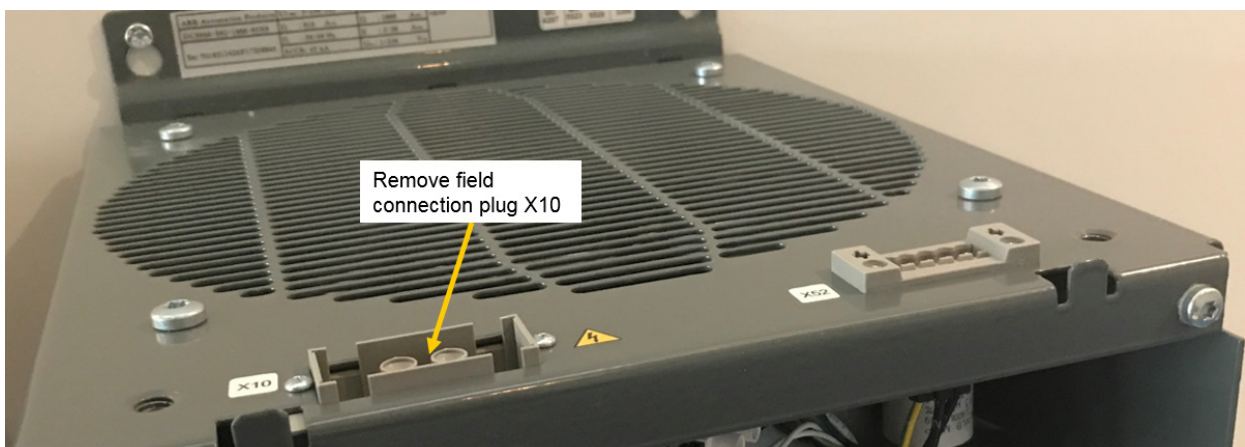
9. Remove the marked plugs at the SDCS-PIN-H01.



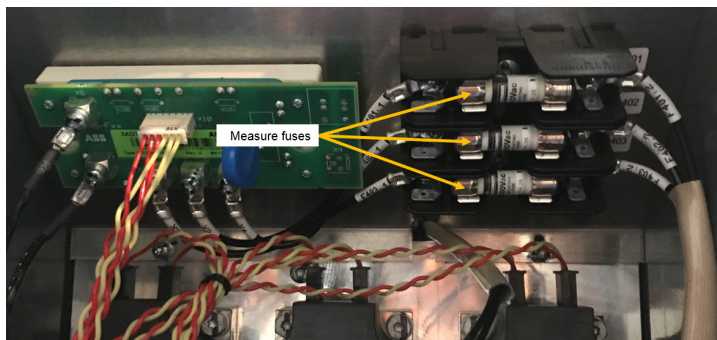
10. Remove the plastic cover.



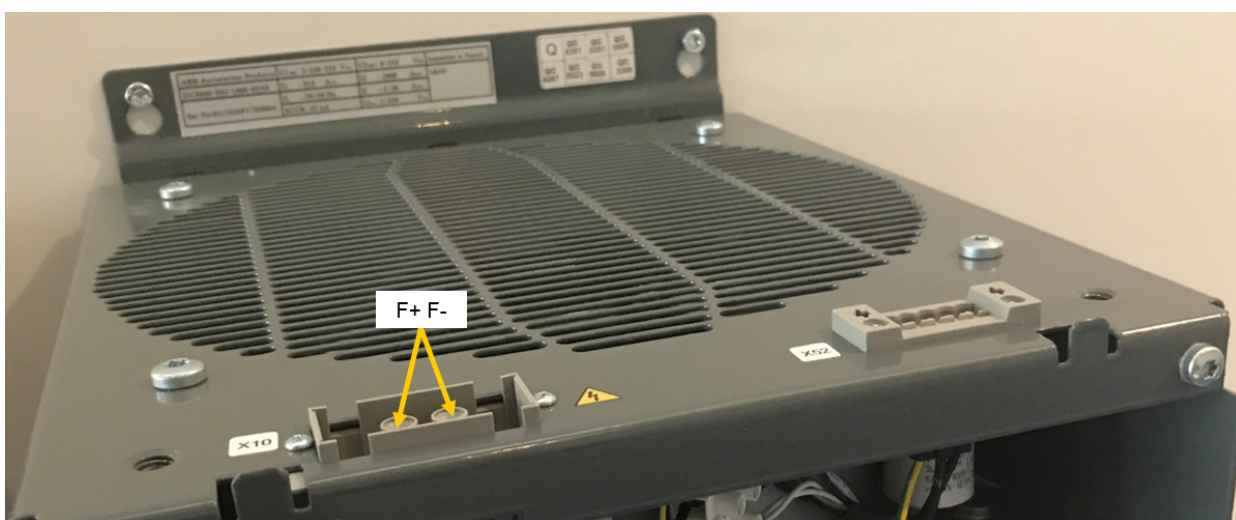
11. Remove field connection plug X10 from the top of the DCS880.



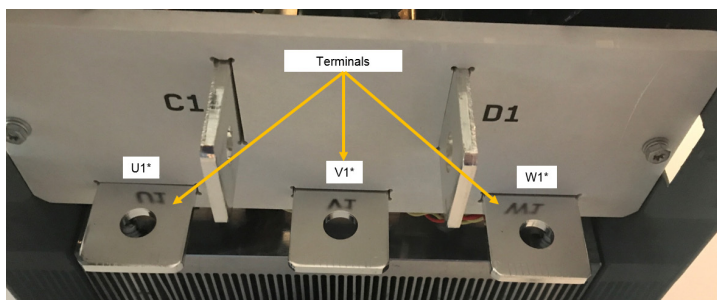
12. Measure fuses F401 ... F403 using the OHM function of a normal multimeter and exchange the broken ones.



13. The SDCS-BAB-F0x contains a 3-phase half-controlled bridge (B6H). Using the OHM function of a normal multimeter, measurements must be made from each AC terminal (U1* to F+, V1* to F+, W1* to F+, U1* to F-, V1* to F- and W1* to F-).



- Normally, each measurement should show high resistance ($> 1 \text{ k}\Omega$).
- A short circuit is indicated by a low resistance ($< 1 \text{ k}\Omega$, destroyed thyristor or diode).
- If one of the measurements shows a short circuit, replace the SDCS-BAB-F0x.



- A measurement, showing less resistance than 1Ω should be made for a second time. Apply the test leads with opposite polarity; if this measurement shows the same result, the SDCS-BAB-F0x is faulty and needs to be replaced.
- After the SDCS-BAB-F0x is replaced, the above mentioned measurement should be done another time to make sure that all is fine.

	Fuses (F401 ... F403)	SDCS-BAB-F0x	To do
Faulty?	Yes	No	Exchange fuses
	No	Yes	Exchange SDCS-BAB-F0x
	Yes	Yes	Exchange SDCS-BAB-F0x and fuses

Exchange the SDCS-BAB-F0x continue with chapter [Remove faulty SDCS-BAB-F0x](#).

Handling the Semiconductors

General Instruction how to handle semiconductors

Thyristor modules in converters sizes H1 ... H5 (20 ... 1190 A), busbars and fuses have to be mounted with the correct torque using a torque screw driver or torque wrench.

In converters sizes H6 (900 ... 2000 A), H7 (1900 ... 3000 A) and H8 (2050 ... 5200 A) the mounting force is indicated by an indicating spring welded to the mounting clamp, which is inside the unit.

Always mark suspected damaged components clearly after removing them from the circuit, to avoid confusion with "good" components.

When removing a damaged semiconductor, write down how and where it was installed (direction, location, connected gate leads and with BCT's the position of the gate connectors).

Check that the new and old components have the same type designation or that the new component can replace the old one. A semiconductor can be replaced by different compatible semiconductor according to the codes in the manufacturers' table.

Semiconductor components are high-precision products. All unnecessary used tools and objects might damage the easily dented and scratched surfaces of the semiconductors.

1. Keep new semiconductors as long as possible in their original packages.
2. Use protective gloves if possible.
3. Clean work area and hands frequently.
4. Use good illumination.

Exchange thyristors sizes H1 ... H4

Installation of thyristor modules and SDCS-BAB-F0x in converters size H1 ... H4 (20 ... 1000 A)

All DCS880 size H1 ... H4 are equipped with thyristor modules and a SDCS-BAB-F0x for excitation. In order to keep the operating temperature of the semiconductor module low, the joint between the heat sink and the module should have a good heat conducting ability. The electrical conductivity of the connectors must also be good. For this reason the following instructions must be observed with particular care.

Required tools

Special tools or material needed in addition to standard tools for the exchange of thyristor modules:

- Torx screwdrivers: TX10, TX20, TX25
- Torque spanner: Mounting torques for the the thyristor modules and SDCS-BAB-F0x to heat sink and electrical connections see table [Nominal mounting torque for thyristor modules and SDCS-BAB-F0x](#).
- Torque spanner for electrical connections: 13Nm (M8)
25 Nm (M10)
50 Nm (M12)
- Screws are metric type; use appropriate nuts.
- Tissue paper.
- Solvent (e.g. ethanol).
- Thermal joint compound (grease): Type Berulub FZ1 E3
Manufacturer: Carl Bechem GmbH, 58089 Hagen
ABB Service: GHSN 390 011 P 0051
- or
- Thermal joint compound: Type WLPF 20 (10 ml)
ABB Service: GHSN 390 011 P 10



Before the work is started, disconnect the converter completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Find faulty thyristor modules

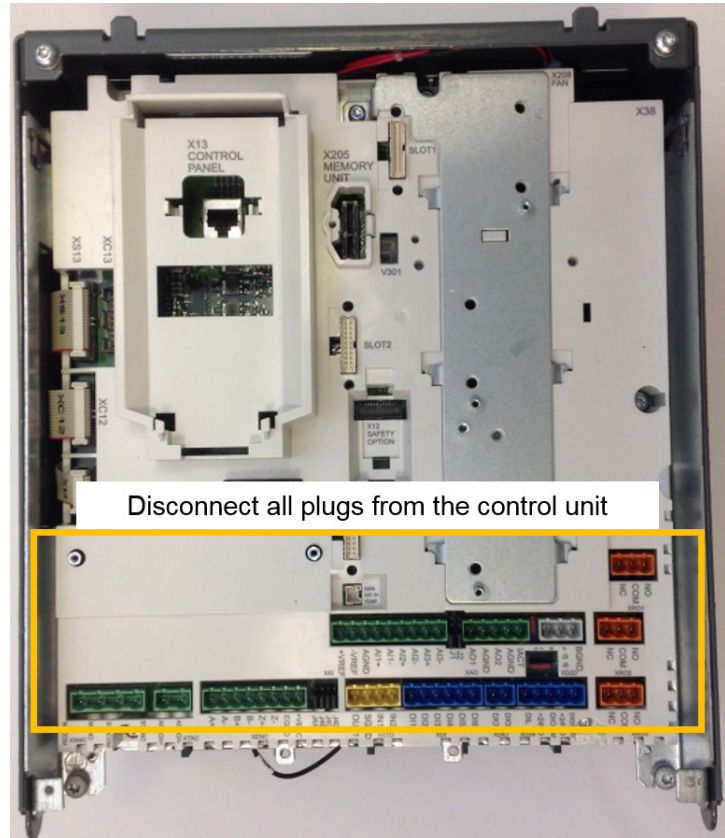
See [Fault Tracing Thyristors](#) of this publication.

Remove faulty thyristor modules

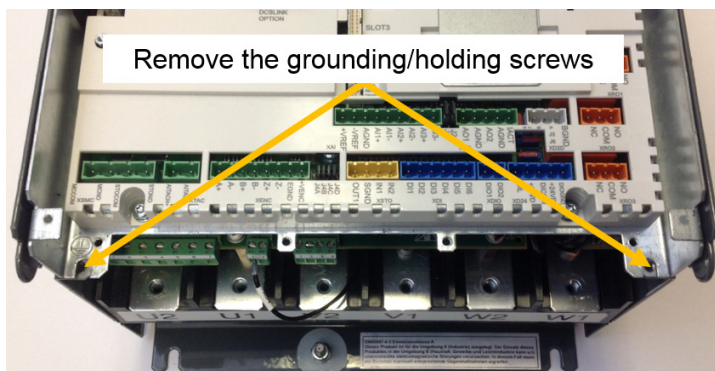
1. Remove control panel and design cover.



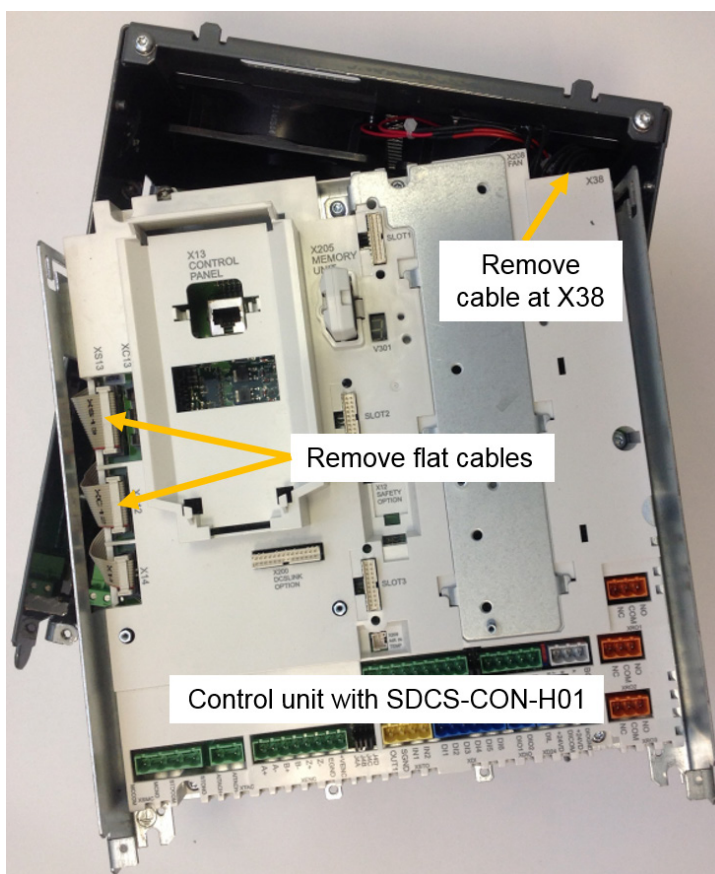
2. Disconnect all I/O plugs from the control unit.
3. Disconnect all connections from present plug in options.



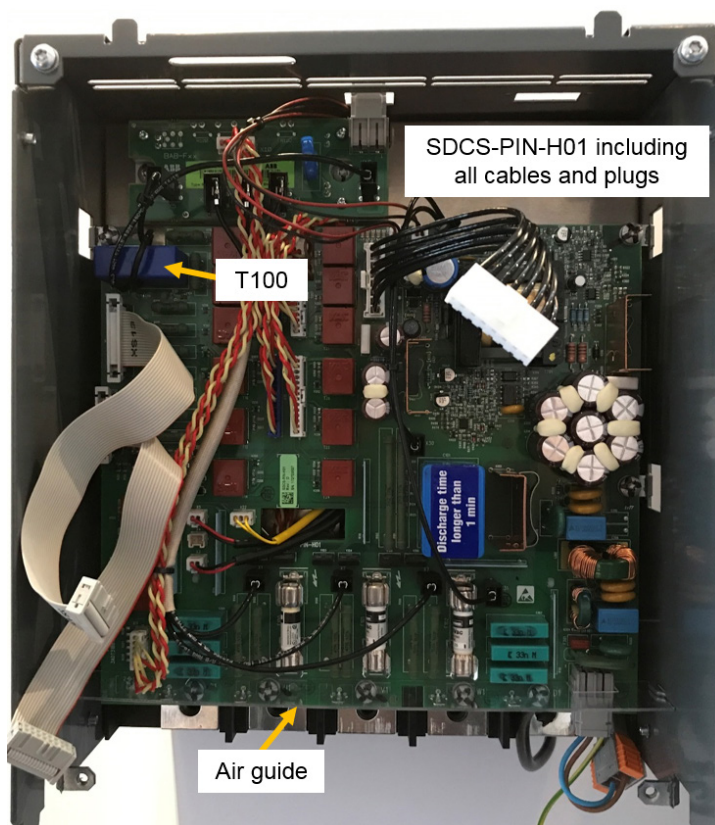
4. Remove the grounding/holding screws from the control unit.



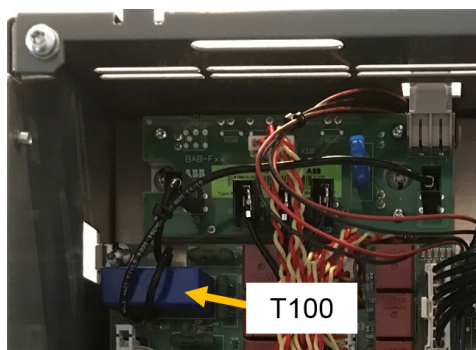
5. To unhinge the control unit pull it up and then out.
6. Before removing the control unit completely unplug the flat cables (XC12, XS13) and the cable connected at X38.
7. Remove the control unit completely.



8. The result looks like this.
9. Remove the air guide, all cables and plugs at the SDCS-PIN-H01.
 - X99 auxiliary power supply.
 - XC12, XS13, X38 flat cables/cable from SDCS-CON-H01 to SDCS-PIN-H01.
 - X4, X5/X6, X15/X10 on the SDCS-BAB-F0x.
 - X30, X31 snubber resistor.
 - X41 ... X44 fans supply.
 - X1, X2, X7 line voltage for SDCS-BAB-F0x.
 - X11 firing pulses for SDCS-BAB-F0x.
 - X15 ... X18 gate leads.
 - X3 ... X5 current transformers.
 - X22 temperature sensor.



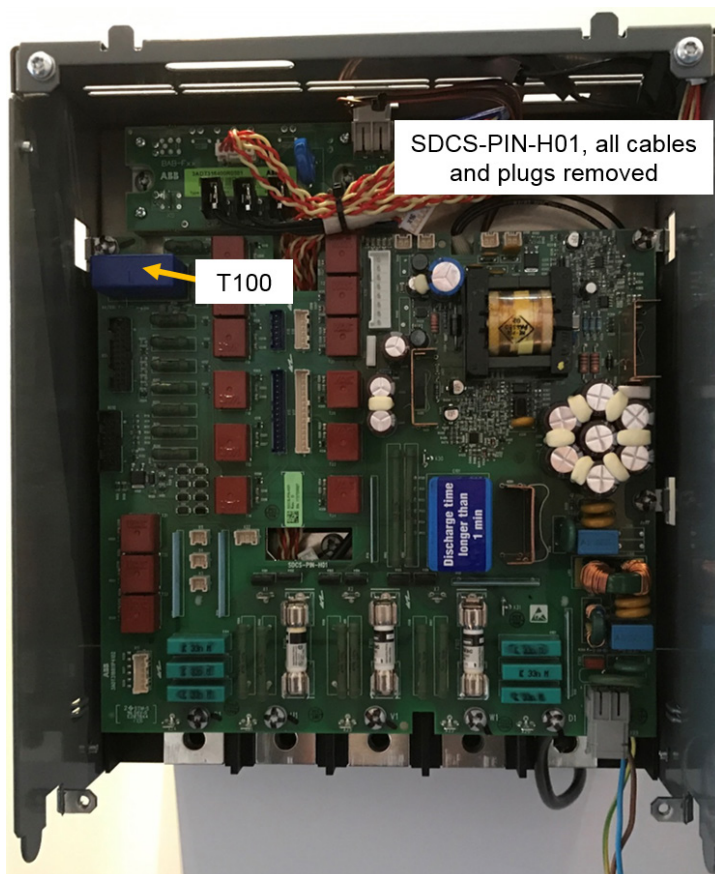
10. Keep the winding direction and amount of windings through T100 in mind:



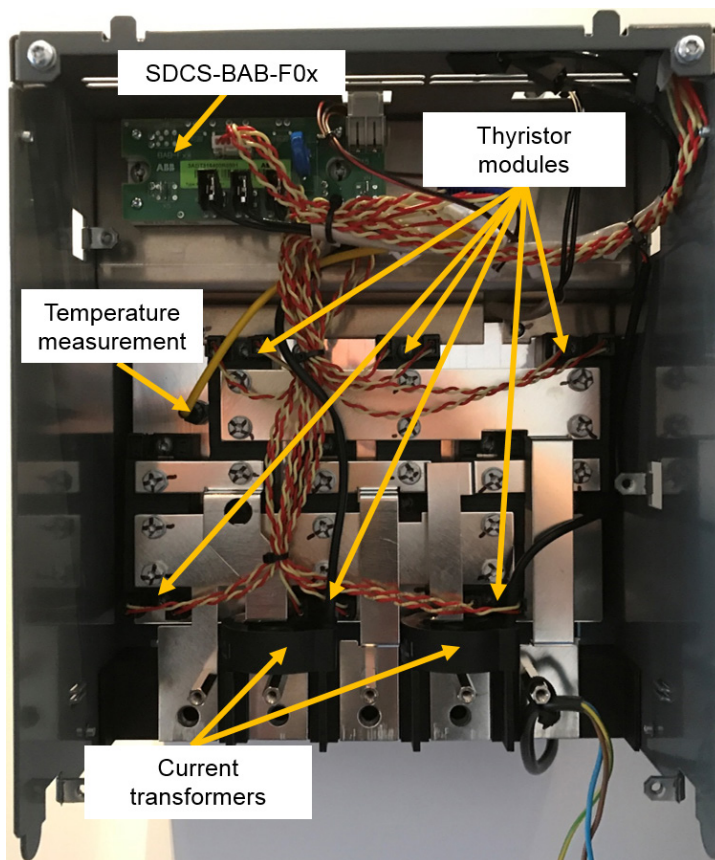
Size	Converter type	Used type	Used fuses	T100 threads	I _F [A]
H1	DCS880-S01-0020 ... DCS880-S02-0025	SDCS-BAB-F01	F100 ... F102 on SDCS-PIN-H01 KTK 25 = 25 A	4 ①	0.3 ... 6
H1	DCS880-S01-0045 ... DCS880-S02-0100	SDCS-BAB-F01	F100 ... F102 on SDCS-PIN-H01 KTK 25 = 25 A	3 ①	1 ... 12
H2	DCS880-S01-0135 ... DCS880-S02-0300	SDCS-BAB-F01	F100 ... F102 on SDCS-PIN-H01 KTK 25 = 25 A	2 ①	1 ... 18
H3	DCS880-S01-0315 ... DCS880-S02-0520	SDCS-BAB-F02	F100 ... F102 on SDCS-PIN-H01 KTK 25 = 25 A	1 ①	2 ... 25
H4	DCS880-S01-0610 ... DCS880-S02-1000	SDCS-BAB-F02	F401 ... F403 in drive KTK 30 = 30 A	1 ①	2 ... 30

① Number of threads through the hole in the T100 (e.g. 3 threads equal 2 loops)

11. The result should look like this.



12. Remove the SDCS-PIN-H01.



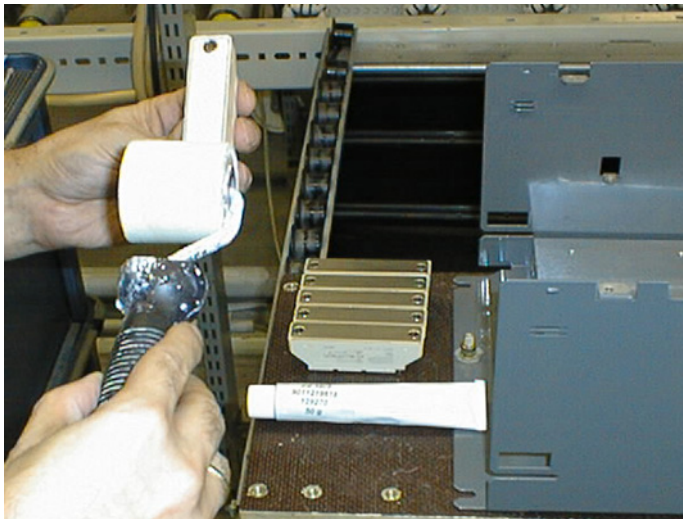
13. Remove the gate leads from the faulty thyristor module and mark the connectors clearly.

Exchange thyristors sizes H1 ... H4

14. Remove the busbars necessary to get full access to the faulty thyristor module.
15. If a current transformer must be removed, mark its position, direction and the connections clearly.
Note:
Remove only as many parts as needed around the faulty thyristor module.
16. Remove the faulty thyristor module and mark it clearly as defective.

Install new thyristor modules

1. Ensure that the new thyristor module is of the correct type (see [Appendix](#) of this manual).
2. Remove old heat-conducting compound (grease) from the heat sink. Clean the mounting surfaces (heat sink and thyristor module) with an appropriate solvent (e.g. ethanol) by means of tissue paper. When the heat sink is clean, spread out the heat-conducting compound with a rubber spatula or by hand.
3. Apply a **thin** layer of heat-conducting compound to the new thyristor module.



4. Spread the heat-conducting compound evenly by moving the thyristor module forward and backward on the heat sink.
5. Tighten all clamping screws by hand until the screw heads touch the bottom of the thyristor module. Then pre-torque the screws to 2.0 Nm.

Note:

If the thyristor module is mounted by means of four screws, tighten the screws crosswise.

6. Tighten the screws to nominal torque according to table [Nominal mounting torque for thyristor modules and SDCS-BAB-F0x](#).

Thyristor modules and SDCS-BAB-F0x		Nominal mounting torque	
Size (width)	Type	Electrical connections	Thyristor module to heat sink
20 mm block	SKKT27, 57, 106	2.6 ... 3.4 Nm	4.25 ... 5.75 Nm
20 mm block	MCC26, 56, 95	2.5 ... 4 Nm	2.5 ... 4 Nm
34 mm block	MCC162, 200	4.5 ... 5.5 Nm	2.25 ... 2.75 Nm
50 mm block	MCC255, 312	11 ... 13 Nm	4.5 ... 7 Nm
50 mm block	TT250	10.8 ... 13.2 Nm	4.25 ... 5.75 Nm
60 mm block	MCC501	10.2 ... 13.8 Nm	4.25 ... 5.75 Nm
60 mm block	MT3	10.8 ... 13.2 Nm	5.1 ... 6.9 Nm
60 mm block	TT425	10.8 ... 12.6 Nm	5.1 ... 6.9 Nm
-	SDCS-BAB-F01	-	2.7 ... 3.3 Nm
-	SDCS-BAB-F02	1.9 ... 2.1 Nm	2.7 ... 3.3 Nm

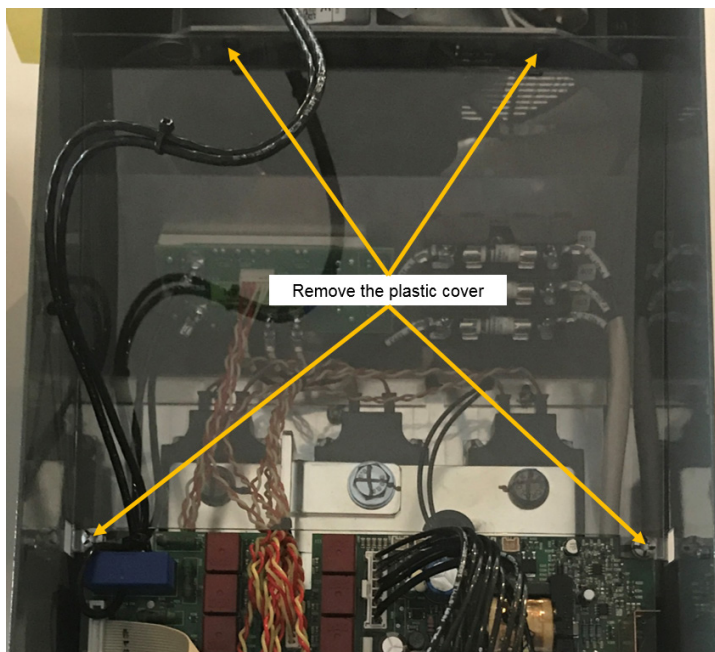
7. Reinstall the current transformer. Make sure, its position and direction is correct.
8. Reinstall the busbars. Make sure, the correct torque is applied according to table [Nominal mounting torque for for thyristor modules and SDCS-BAB-F0x](#).
9. Reconnect all gate leads to the thyristor module.
10. Perform an OHM test to make sure the thyristor is ok.
11. Reinstall the SDCS-PIN-H01 board.
12. Reconnect all cables and plugs at the SDCS-PIN-H01:
 - X22 temperature sensor.
 - X3 ... X5 current transformers.
 - X15 ... X18 gate leads.
 - X11 firing pulses for SDCS-BAB-F0x.
 - X1, X2, X7 line voltage for SDCS-BAB-F0x.

- X41 ... X44 fans supply.
 - X30, X31 snubber resistor.
 - X4, X5/X6, X15/X10 on the SDCS-BAB-F0x.
 - XC12, XS13, X38 flat cables/cable from SDCS-CON-H01 to SDCS-PIN-H01.
 - X99 auxiliary power supply.
13. At the SDCS-CON-H01 reconnect the flat cables (XC12, XS13), the cable connected at X38 and re-hinge the control unit.
 14. Reconnect the grounding/holding screws at the control unit.
 15. Reconnect all I/O plugs at the control unit and all connetions at the present plug in options.
 16. Reinstall the design cover and the control panel.

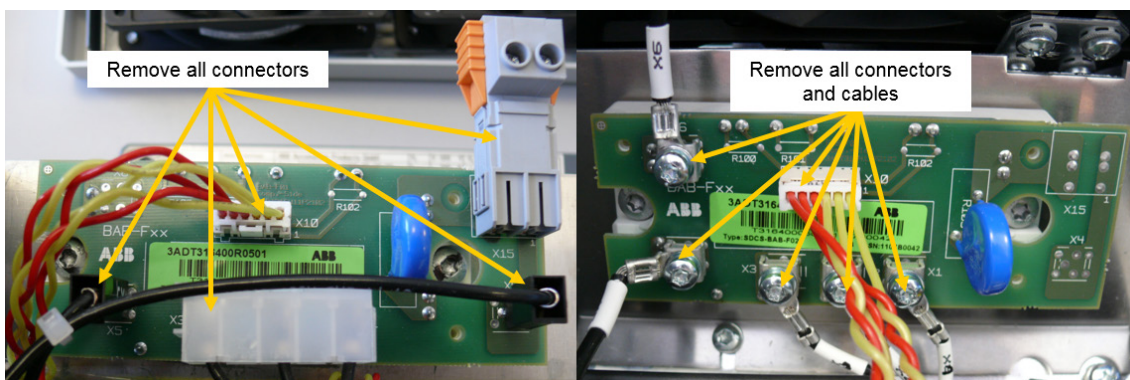
Remove faulty SDCS-BAB-F0x

- Follow the instructions Remove faulty thyristor modules until step 8 is done.

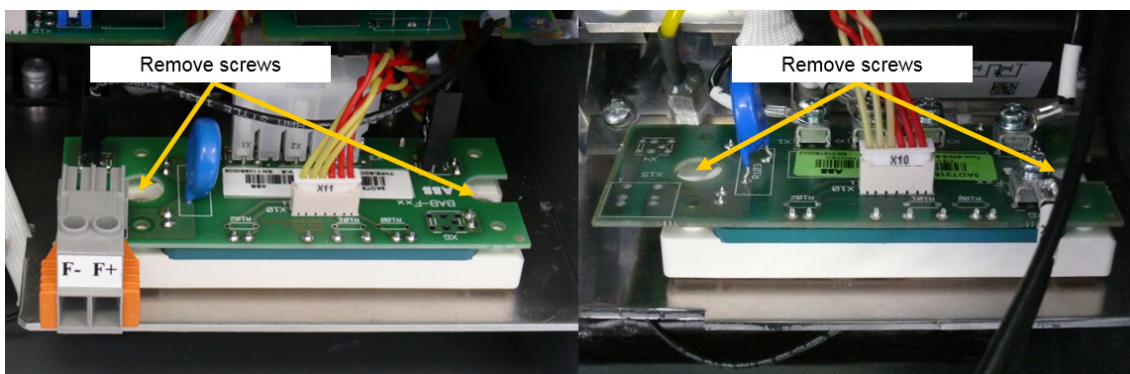
9. If existing remove the plastic cover.



10. Remove all connectors (SDCS-BAB-F01) or cables (SDCS-BAB-F02) from the faulty SDCS-BAB-F0x and mark them clearly.



11. Remove the faulty SDCS-BAB-F0x and mark it clearly as defective.

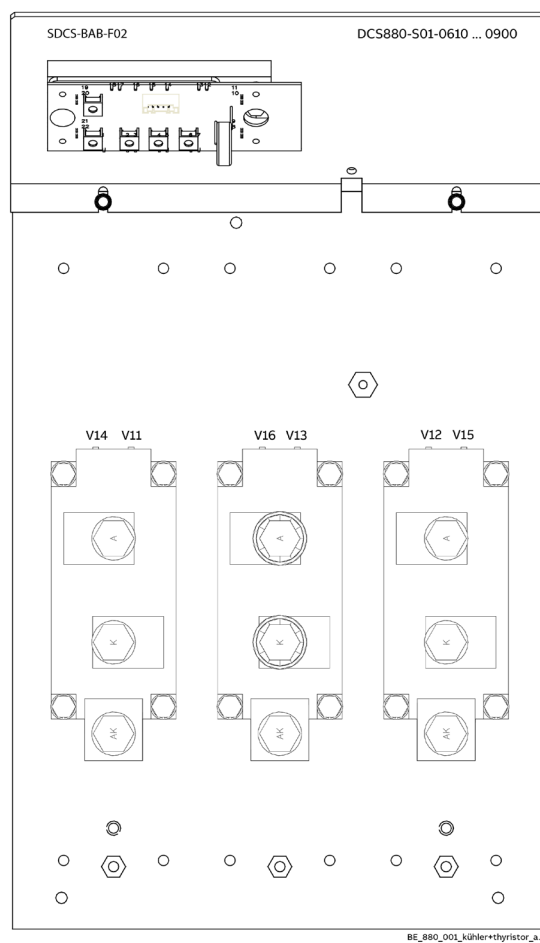
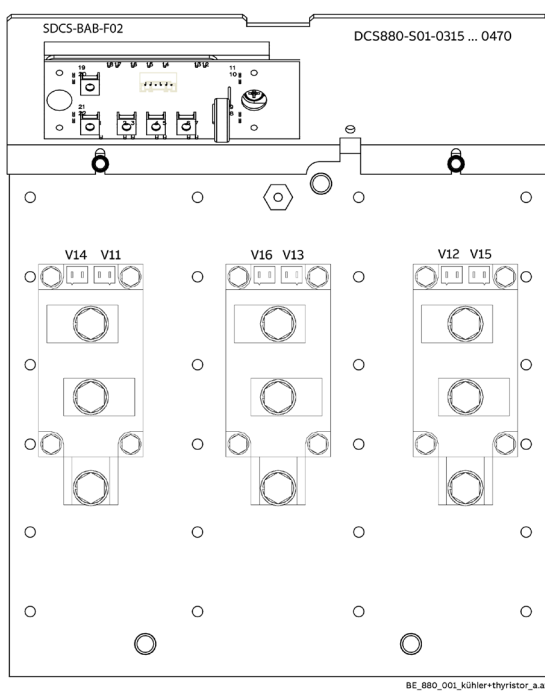
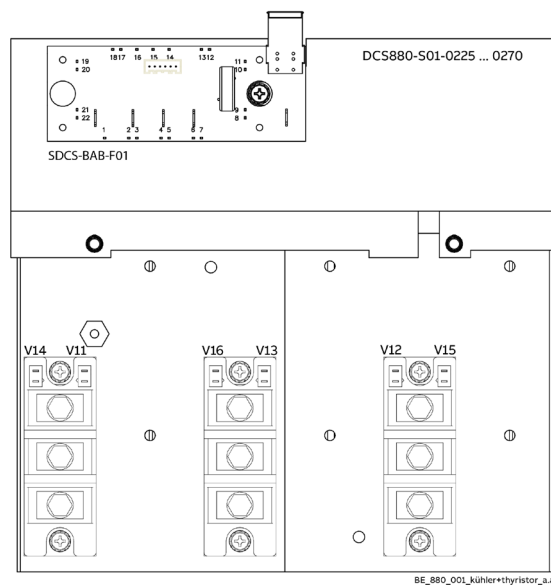
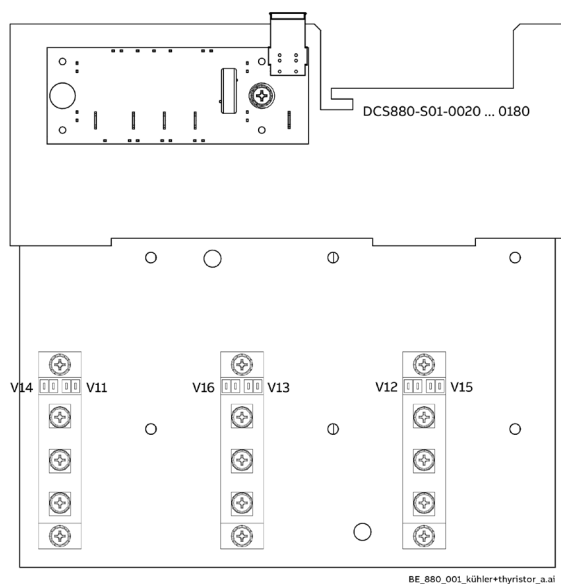


Install new SDCS-BAB-F0x

1. Ensure that the new SDCS-BAB-F0x is of the correct type, either SDCS-BAB-F01 or SDCS-BAB-F02.
2. Remove old heat conducting compound (grease) from the heat sink. Clean the mounting surfaces (heat sink and SDCS-BAB-F0x bridge) with an appropriate solvent (e.g. ethanol) by means of tissue paper. When the heat sink is clean, spread out the heat conducting compound with a rubber spatula or by hand.
3. Apply a thin layer of heat conducting compound to the new SDCS-BAB-F0x bridge.
4. Spread the heat conducting compound evenly by moving the SDCS-BAB-F0x forward and backward on the heat sink.
5. Tighten all clamping screws by hand until the screw heads touch the bottom of the thyristor module. Then tighten the screws to 2.0 Nm torque.
6. Tighten the screws to nominal torque according to table [Nominal mounting torque for thyristor modules and SDCS-BAB-F0x](#).
7. Reconnect all connectors or cables to the SDCS-BAB-F0x.
8. If existing, reconnect the plastic cover.
9. Follow the instructions [Install new thyristor modules](#) beginning with step 13.

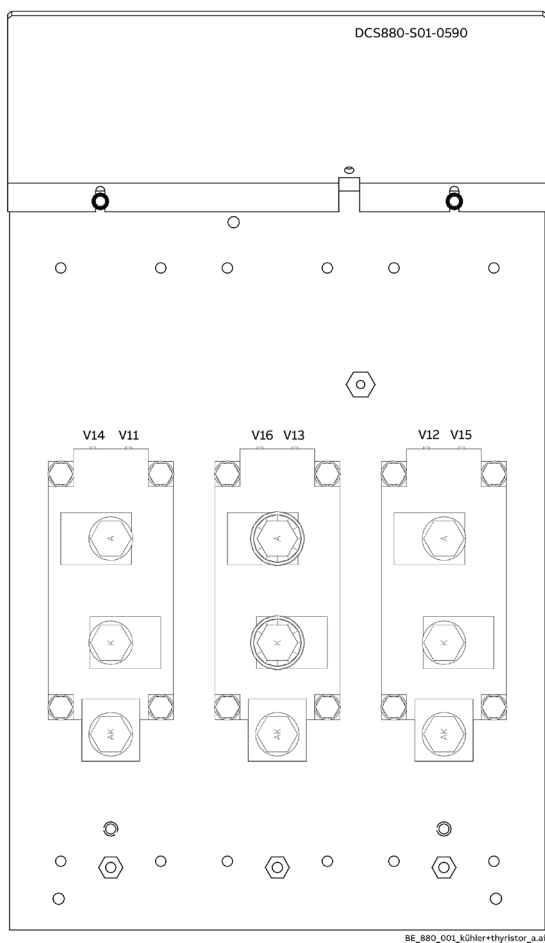
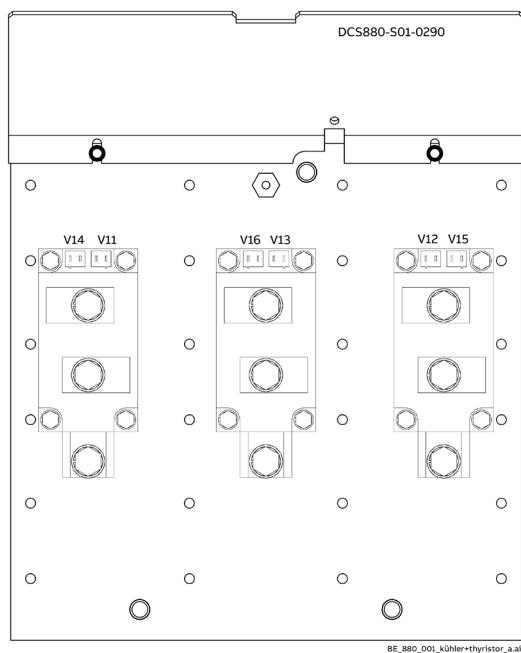
Thyristor module and SDCS-BAB-F0x location in DCS880-S01 (2-Q) units

400 V_{AC} and 525 V_{AC} types:



Exchange thyristors sizes H1 ... H4

600 V_{AC} types:

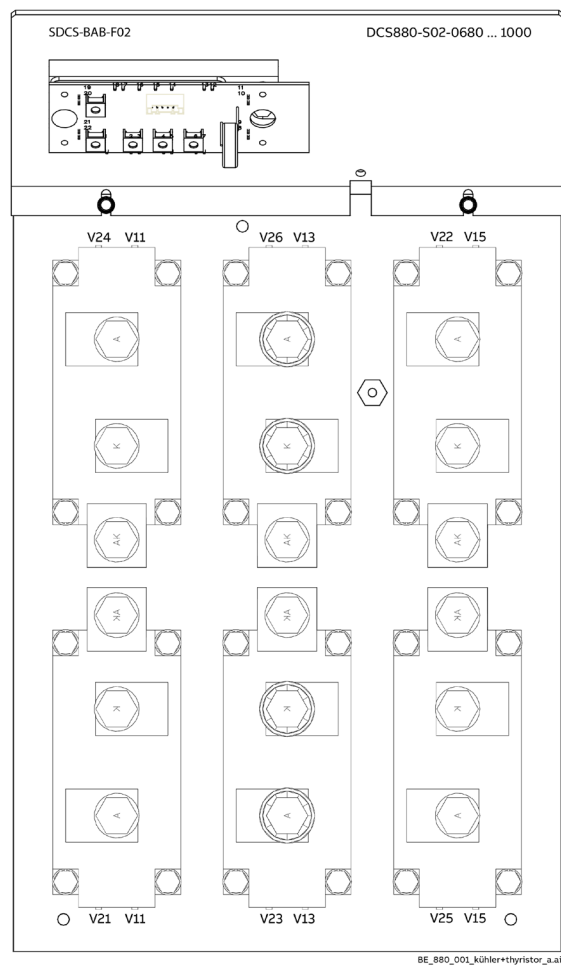
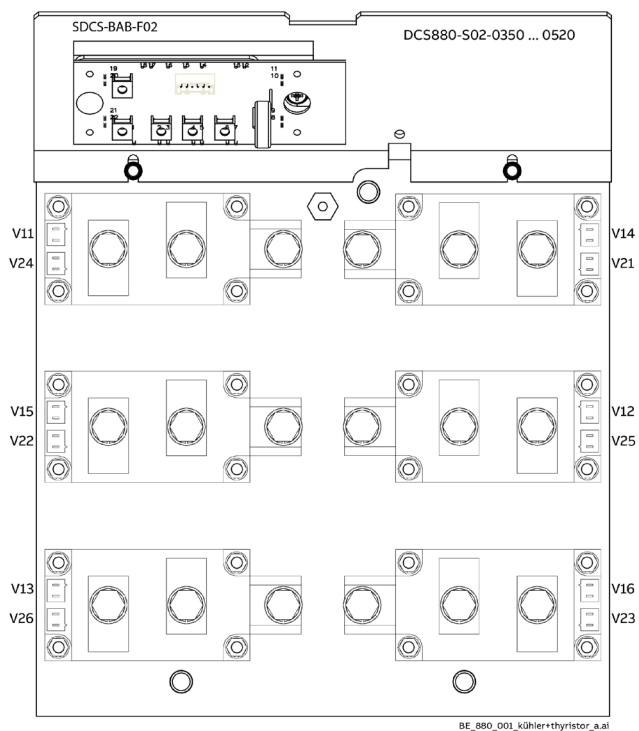
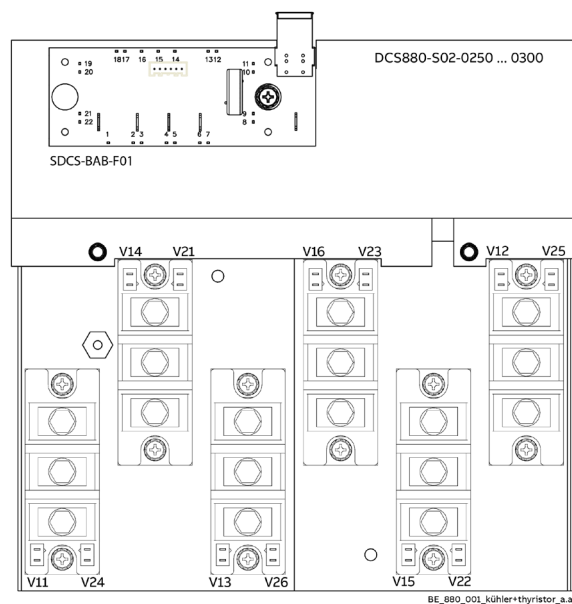
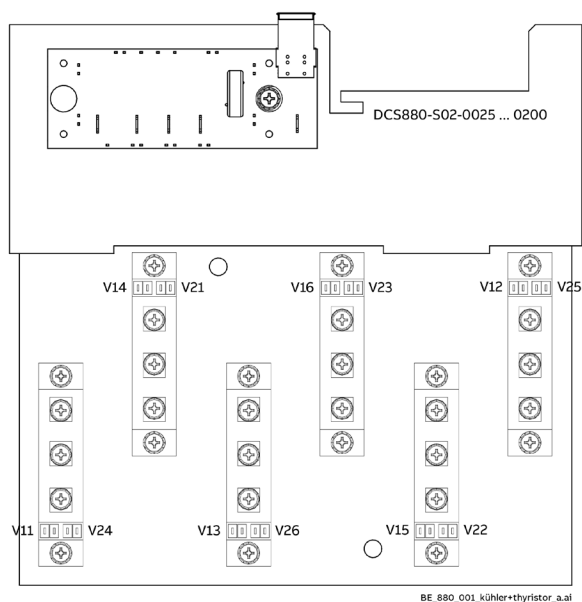


Note:

These drawings are only showing the location of the thyristor modules and the SDCS-BAB-F0x, the actual converter module sizes are different!

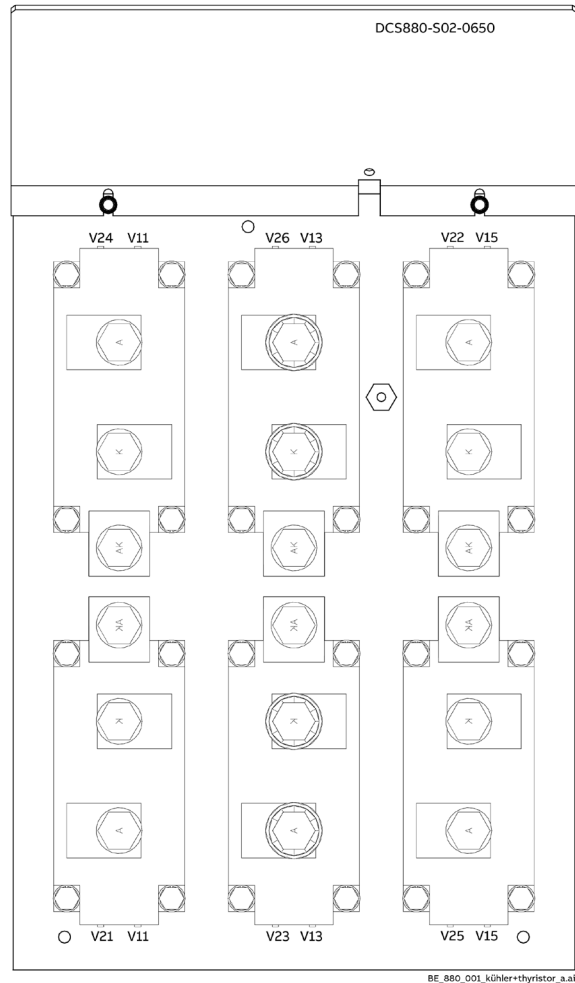
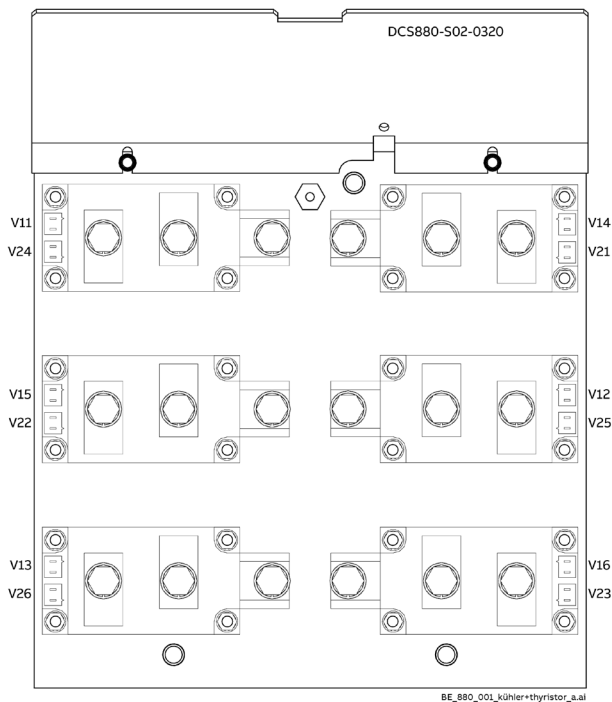
Thyristor module and SDCS-BAB-F0x location in DCS880-S02 (4-Q) units

400 V_{AC} and 525 V_{AC} types:



Exchange thyristors sizes H1 ... H4

600 V_{AC} types:



Note:

These drawings are only showing the location of the thyristor modules and the SDCS-BAB-F0x, the actual converter module sizes are different!

Thyristor module terminals and SDCS-BAB-F0x

The terminal description is stamped or marked by a sticker on all thyristor modules and the bride connected at the SDCS-BAB-F0x.

For all firing pulse cables is valid:

- **Yellow** is gate lead.
- **Red** is cathode lead.

Exchange thyristors size H6

Installation of thyristor modules in converters size H6 (900 ... 2000 A)

All DCS800 converters sizes H6/H7/H8 are equipped with disk type thyristors. The structure of the disc type semiconductor component is such that it requires a certain compression force to operate. The prevention of overheating of the component essentially depends on good heat dissipation between the semiconductor and the conducted heat sink. It is thus important that all joints have good thermal and electrical conduction.

Required tools

Special tools or material needed in addition to standard tools for the exchange of thyristor modules:

- Torx screwdrivers: TX10, TX20, TX25.
- Torque spanner for electrical connections: 13Nm (M8).
25 Nm (M10).
50 Nm (M12).
- Screws are metric type; use appropriate nuts.
- 17 mm ring spanner for fuse and busbar connections.
- 17 mm ring spanner for press clamp.
- Tissue paper.
- Solvent (e.g. ethanol).
- Thermal joint compound (grease): Type Berulub FZ1 E3.
Manufacturer: Carl Bechem GmbH, 58089 Hagen.
ABB Service: GHSN 390 011 P 0051.
3ADT 621 023 P1.
- Disassembly tool:

Note:

For more detailed information about the wiring of the power part, see [Hardware Manual](#).

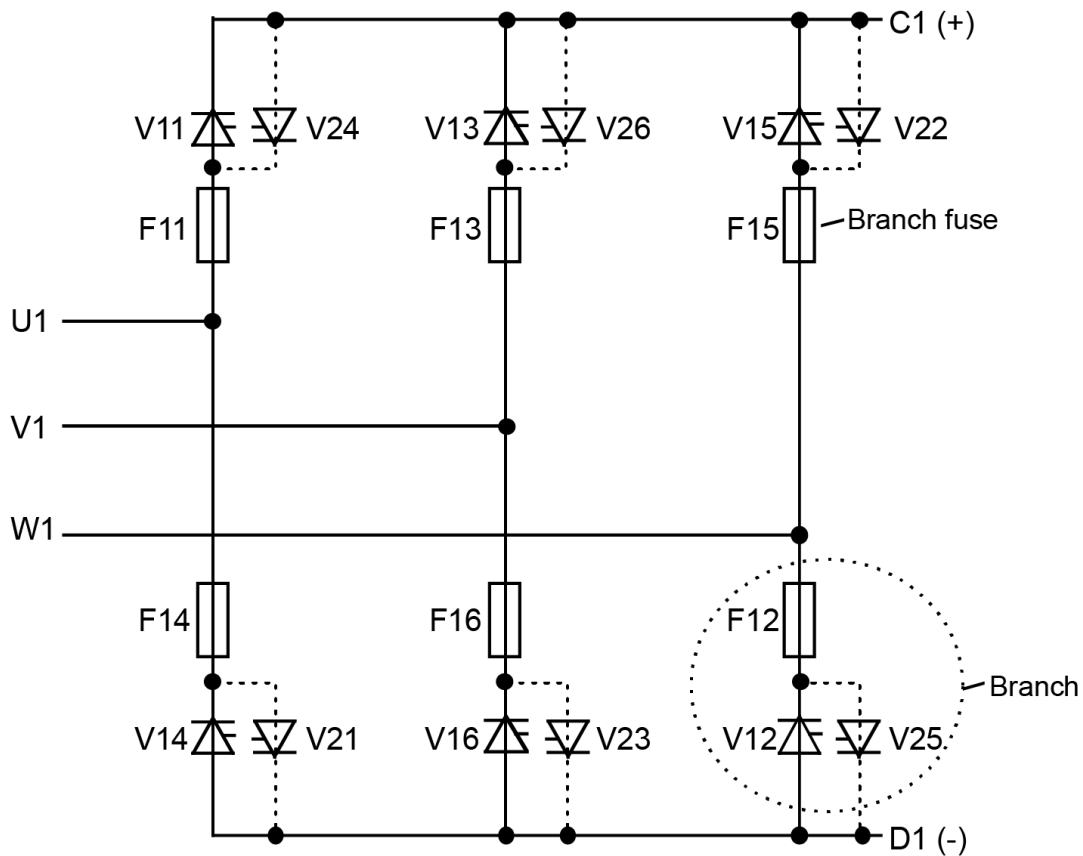
Therefore strict observance of the build in instructions given below is of utmost importance. Make sure that the new component can replace the old one in accordance with the spare part list (see [Appendix](#) of this manual). Semiconductors and heat sinks are to be handled carefully to avoid scratches and other damage. Avoid touching the contact surfaces. Do not lift the semiconductor with the gate wire. Do not lift the semiconductor by touching the current contact surfaces. Do not damage the welding flange or the contact surface.



Before the work is started, disconnect the converter completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Find faulty thyristor modules

1. Check the branch fuses by performing an OHM test.
2. Find the defective branches by performing an OHM test (both polarities) between U1, V1, W1 and C1, D1.



SF_DCS_003_principle_b.ai

Bridge configuration H5 ... H8

3. Disconnect the branching fuses of the defective branches.
4. Find the defective thyristors by performing an OHM test (both polarities) over their heat sinks.
5. In a 4-quadrant converter exchange **both** thyristors clamped between the same heatsinks.

Note:

Because "Disc Type" semiconductors need a certain compression force to operate properly, a measurement outside the clamped heat sinks might be wrong.

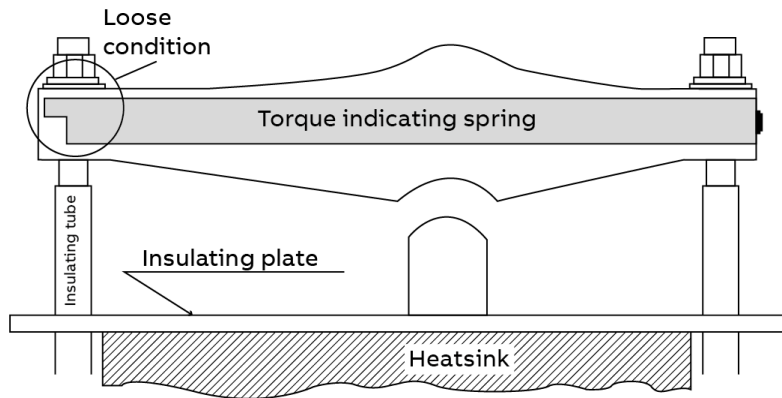
Remove faulty thyristor

1. Remove the screws of the DC-busbars and branch fuses preventing the stack to be prized open.

Note:

It depends on the location of the defective thyristor which DC-busbar and fuses have to be disconnected.

2. Write down the direction and location of the thyristors to be removed and mark their gate leads.
3. Remove the gate leads if possible.
4. Loosen the mounting clamp at the top of the thyristor stack.

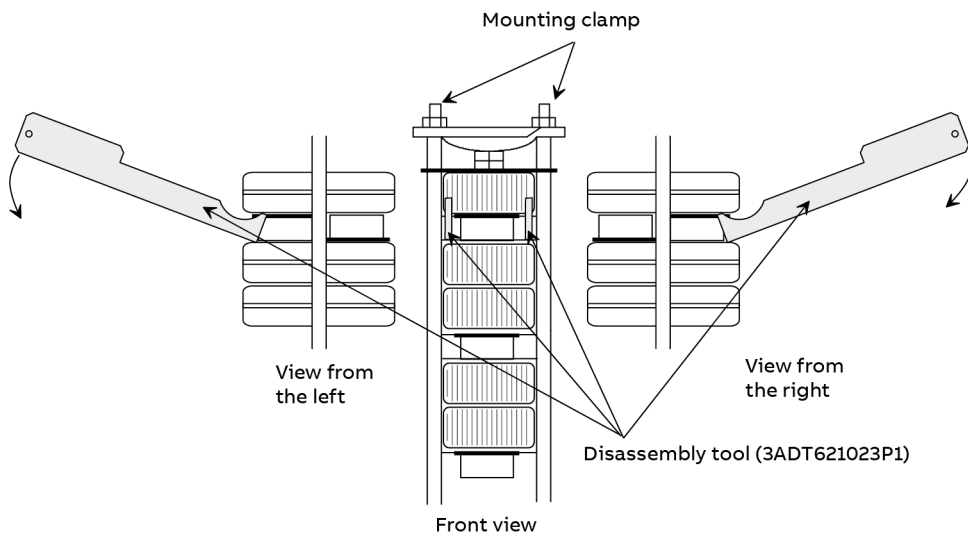


Attention:

While loosening the mounting clamp the indicating spring must be pulled out a little, otherwise the spring will be damaged!

Do not remove the nuts totally, otherwise the threaded rods will fall down!

5. Attach the disassembly tool (3ADT 621 023 P1) at the faulty thyristor and prize open the upper and lower heat sinks.



6. Remove the thyristors.



Attention:

To center the thyristors spring pins are used. The pins are inlaid into all lower heat sinks. Open the gap wide enough that the thyristor and the pins are not damaged while removing the thyristor!

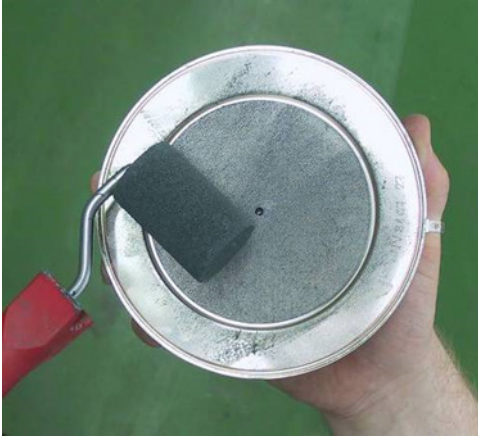
Install new thyristor

1. Ensure that the new thyristor is of the correct type (see [Appendix+](#) of this manual). Keep the semiconductor and its surroundings clean.

Note:

Do not touch the polished surfaces of the thyristor.

2. Clean all parts with tissue paper moistened with solvent, which have had or will have contact with the thyristor or each other (lower/upper heat sink). Do not clean the surfaces of grease too thoroughly, because the aluminum surfaces will oxidize in a few seconds. Dry all surfaces.
3. Clean the polished surfaces of the semiconductor with a piece of tissue paper moistened with solvent. Dry all surfaces. Spread a **thin** layer of conducting paste on both sides of the thyristor, if necessary use a rubber spatula.

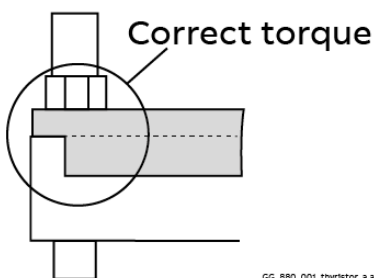


4. Connect the gate leads if possible.
 5. Centre the thyristors by means of the spring pins.
- Note:**
Be sure that the thyristor is installed in the right direction. Do not pinch or cut the gate leads or any other cable.
6. Turn the thyristor so that the gate leads point in the right direction.
 7. Tighten the nuts of the mounting clamp by hand so that the clamp is in parallel with the contact surface of the heat sinks.

Note:

The indicating spring is a very sensitive instrument and must be handled with care.

8. Tighten each nut in turn, half a turn at a time with the help of a ring spanner until the indicating spring clicks into position "correct torque". Do not tighten the screws any further.



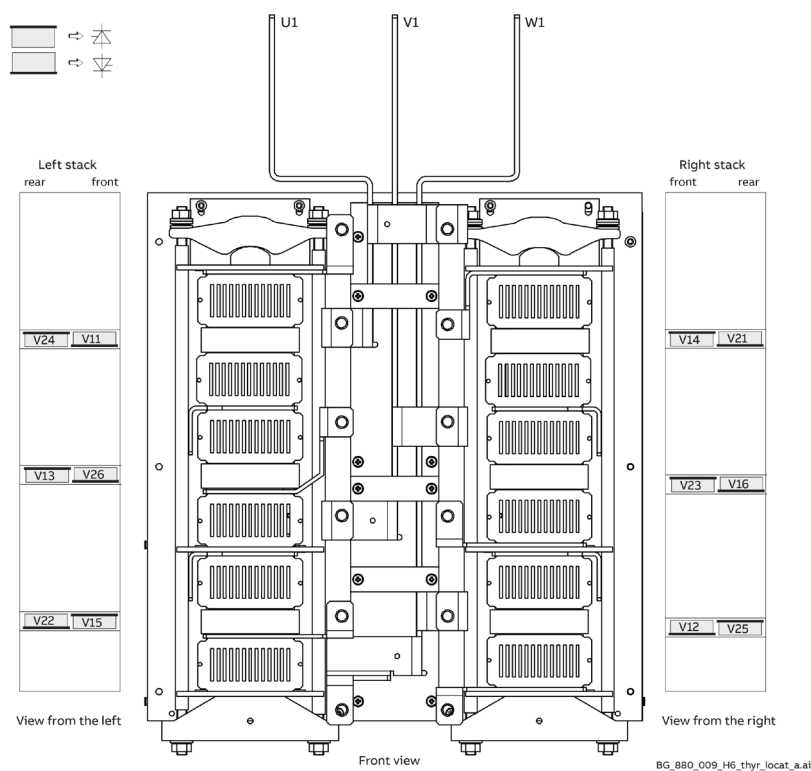
Note:

The correct torque is indicated by means of the welded indicating spring.

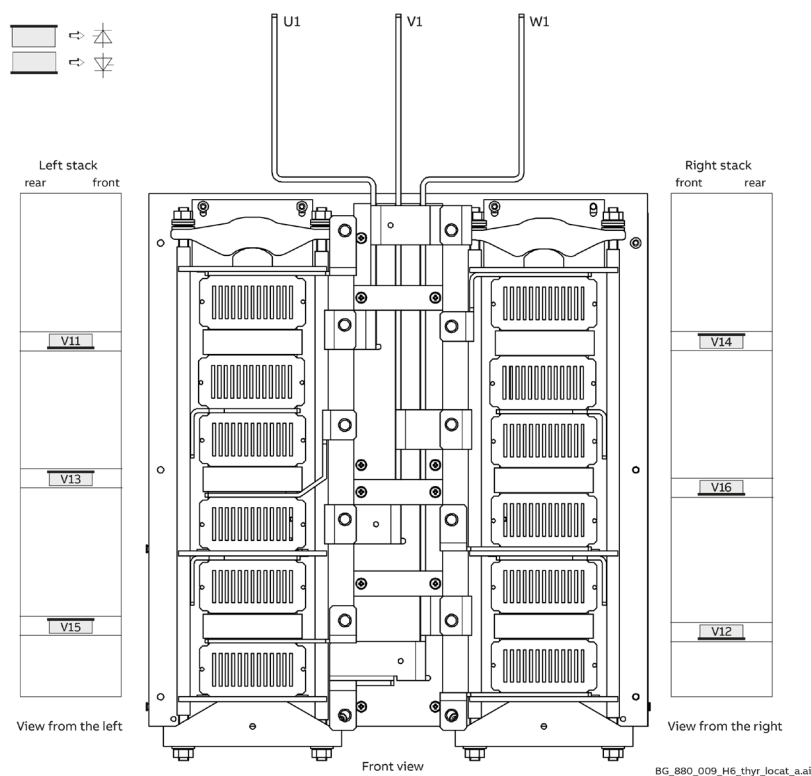
9. Perform an OHM test to make sure the thyristor is ok.
10. Reconnect the DC-busbars, branch fuses and all other dismantled parts.
11. Perform an OHM test between U1, V1, W1 and C1, D1 to make sure the power part is ok.

Location of thyristors in frame H6 (4-Q bridge)

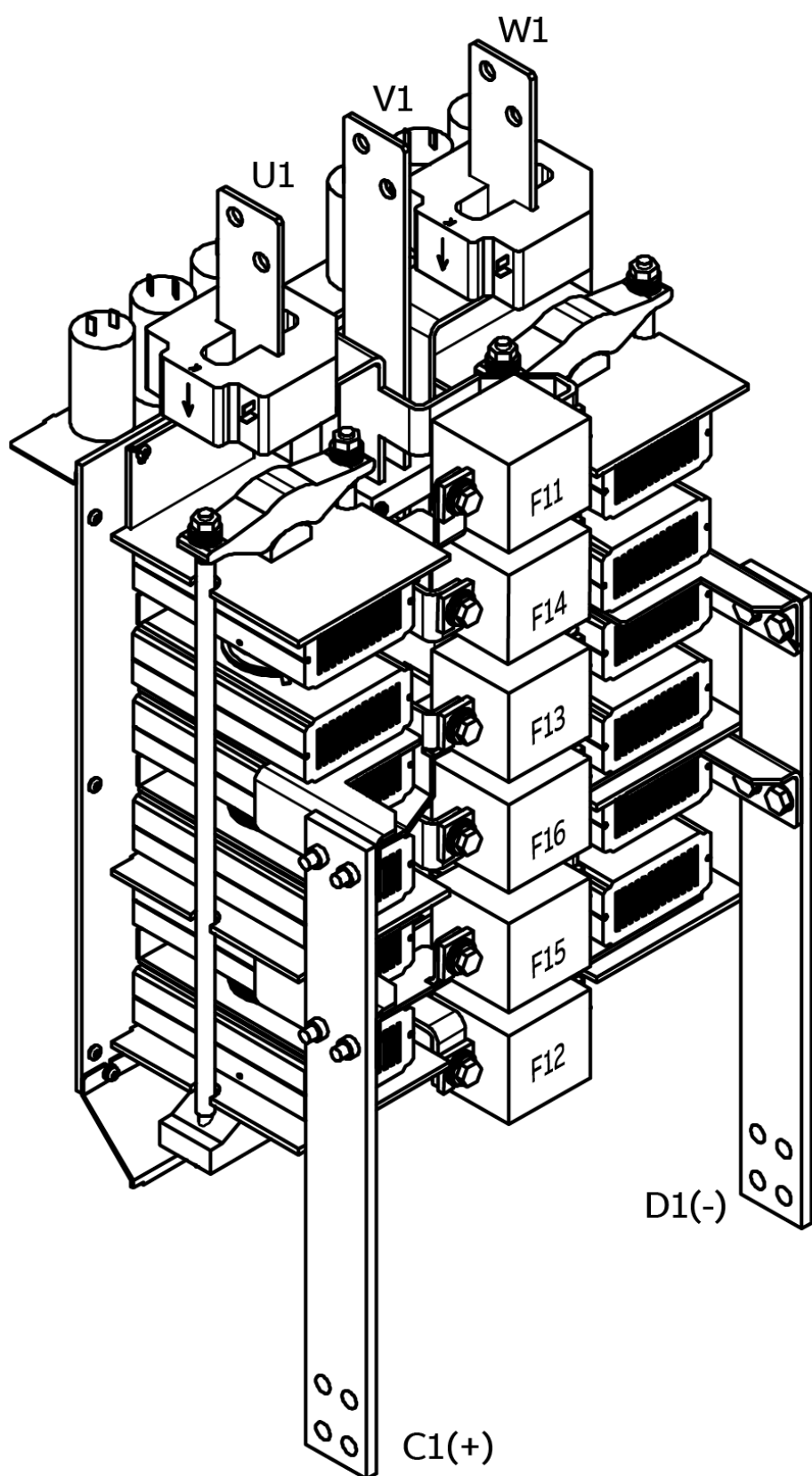
Attention: Exchange **both** thyristors clamped between the same heatsinks.



Location of thyristors in frame H6 (2-Q bridge)



Exchange thyristors size H6

Location of branch fuses frame H6

BG_880_008_H6_fuse_locat_a.ai

Exchange thyristors size H7

Installation of thyristor modules in converters size H7 (1900 ... 3000 A)

All DCS800 converters sizes H6/H7/H8 are equipped with disk type thyristors. The structure of the disc type semiconductor component is such that it requires a certain compression force to operate. The prevention of overheating of the component essentially depends on good heat dissipation between the semiconductor and the conducted heat sink. It is thus important that all joints have good thermal and electrical conduction.

Required tools

Special tools or material needed in addition to standard tools for the exchange of thyristor modules:

- Torx screwdrivers: TX10, TX20, TX25.
- Torque spanner for electrical connections: 13Nm (M8).
25 Nm (M10).
50 Nm (M12).
- Screws are metric type; use appropriate nuts.
- 17 mm ring spanner for fuse and busbar connections.
- 24 mm ring spanner for press clamp.
- Tissue paper.
- Solvent (e.g. ethanol).
- Thermal joint compound (grease): Type Berulub FZ1 E3.
Manufacturer: Carl Bechem GmbH, 58089 Hagen
ABB Service: GHSN 390 011 P 0051.
- Disassembly tool: DCF 1066721 P1.

Note:

For more detailed information about the wiring of the power part, see [Hardware Manual](#).

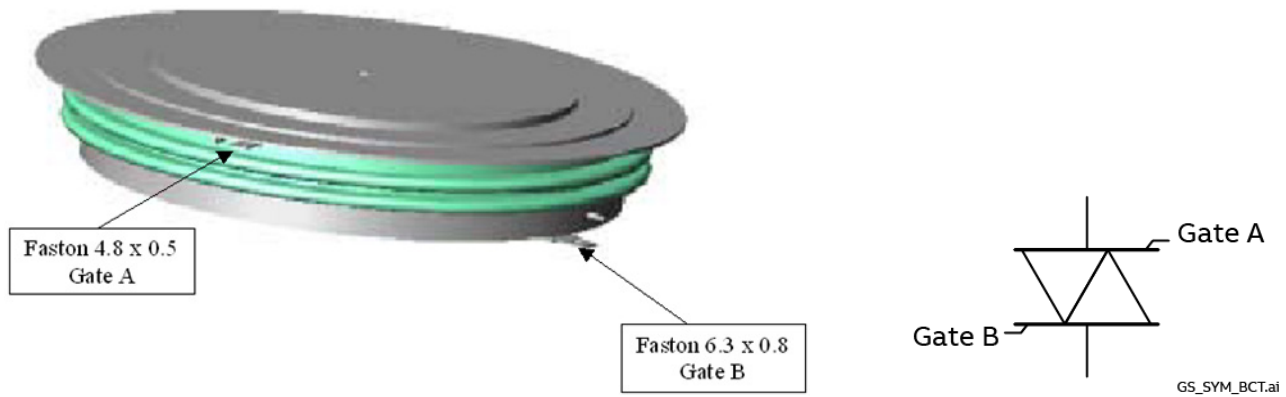
Therefore strict observance of the build in instructions given below is of utmost importance. Make sure that the new component can replace the old one in accordance with the spare part list (see [Appendix](#) of this manual). Semiconductors and heat sinks are to be handled carefully to avoid scratches and other damage. Avoid touching the contact surfaces. Do not lift the semiconductor with the gate wire. Do not lift the semiconductor by touching the current contact surfaces. Do not damage the welding flange or the contact surface.



Before the work is started, disconnect the converter completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Bidirectional-Controlled-Thyristors (BCTs)

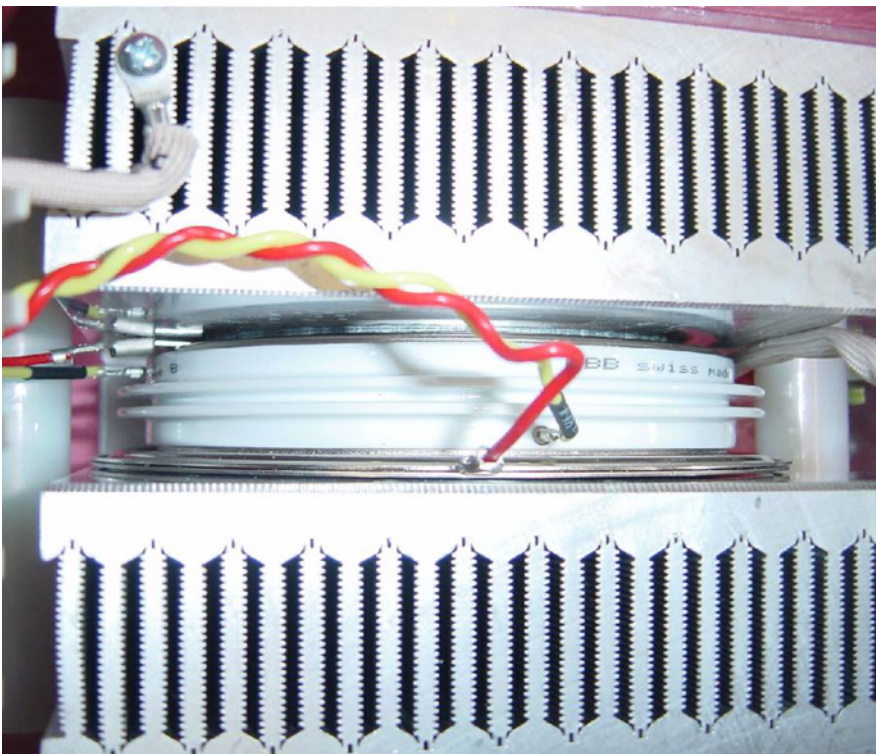
In some converter modules size H7 so called BCTs (**B**idirectional-**C**ontrolled-**T**hystors) are used. BCTs are a pair of anti-parallel thyristors in one disk type housing. They can easily identified by the second pair of gate leads. The second gate is marked with **Gate B** on the thyristor:



Note:

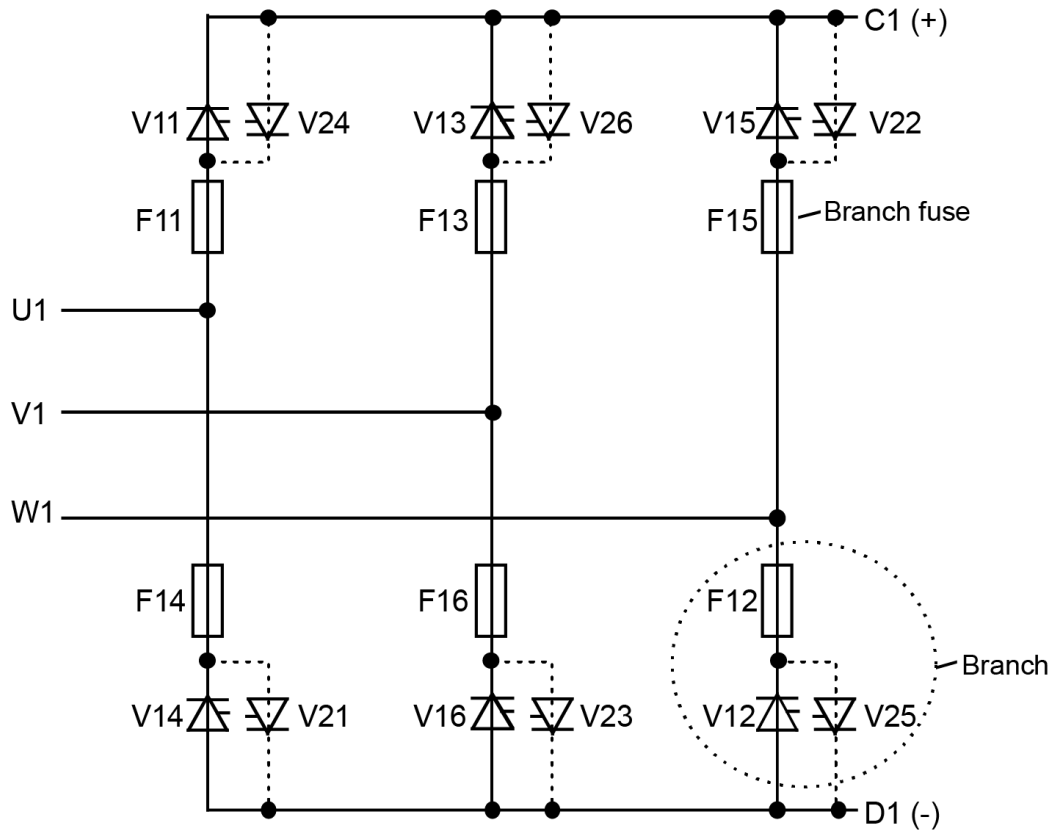
The Faston connectors of the gates are of different size.

Gate A should always be in front of the clamped heat sinks due to cooling reasons. Location of BCTs gate A when built in:



Find faulty thyristor modules

1. Check the branch fuses by performing an OHM test.
2. Find the defective branches by performing an OHM test (both polarities) between U1, V1, W1 and C1, D1.



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Bridge configuration H5 ... H8

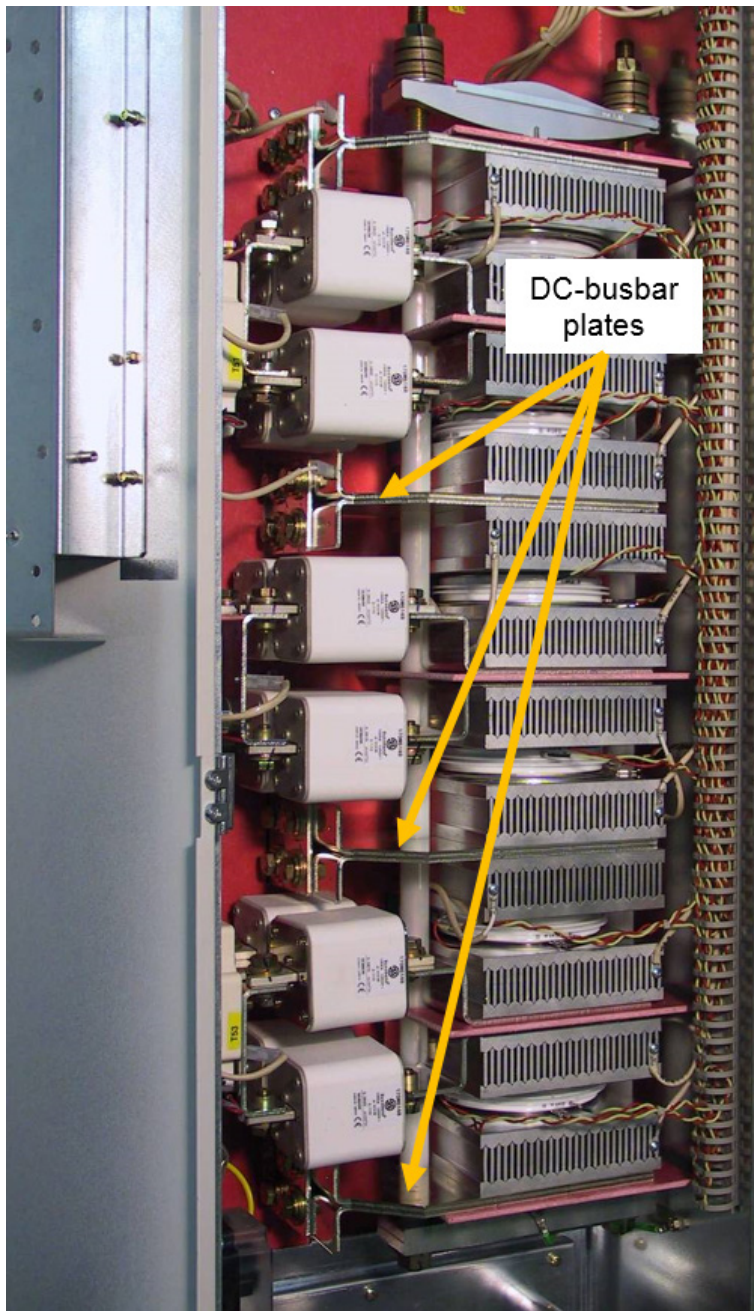
3. Disconnect the branching fuses of the defective branches.
4. Find the defective thyristors by performing an OHM test (both polarities) over their heat sinks.
5. In a 4-quadrant converter with BCTs change the BCT.
6. In a 4-quadrant converter with 2 single thyristors exchange **both** thyristors clamped between the same heatsinks.

Note:

Because "Disc Type" semiconductors need a certain compression force to operate properly, a measurement outside the clamped heat sinks might be wrong.

Remove faulty thyristor

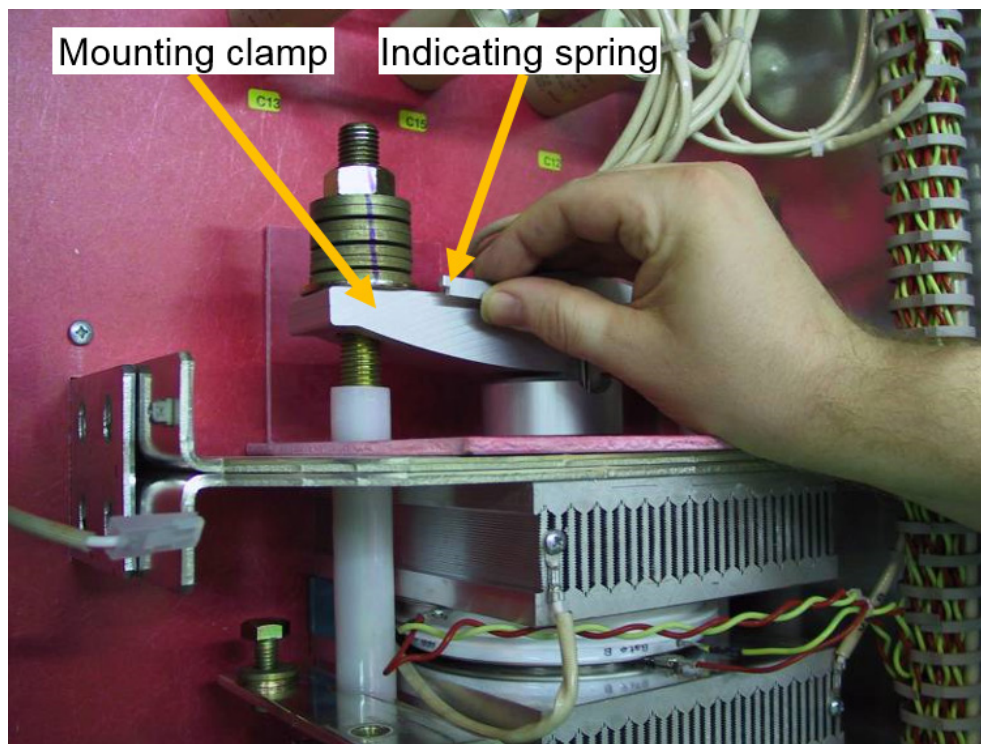
1. Replace all blown fuses and reconnect all fuses taken out during search for the faulty thyristor.
2. Remove the screws of the DC-busbar plates adjacent to the defective thyristors.



Note:

It depends on the location of the defective thyristor which DC-busbar plates have to be disconnected.

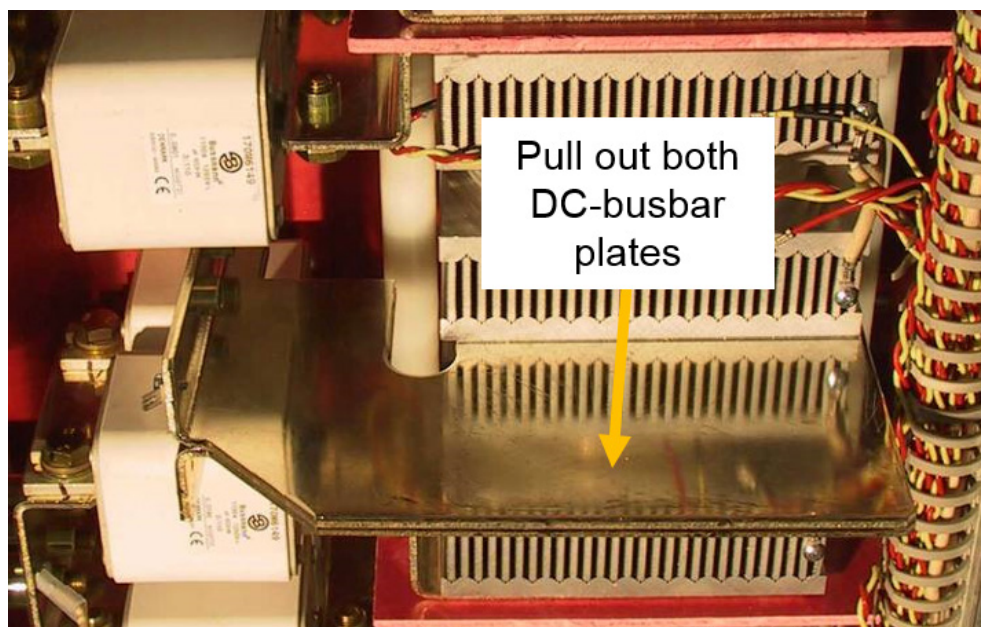
3. Write down the direction and location of the thyristors to be removed and mark their gate leads. In case of BCTs add the position of the gates.
4. Remove the gate leads if possible.
5. Loosen the mounting clamp at the top of the thyristor stack.


Attention:

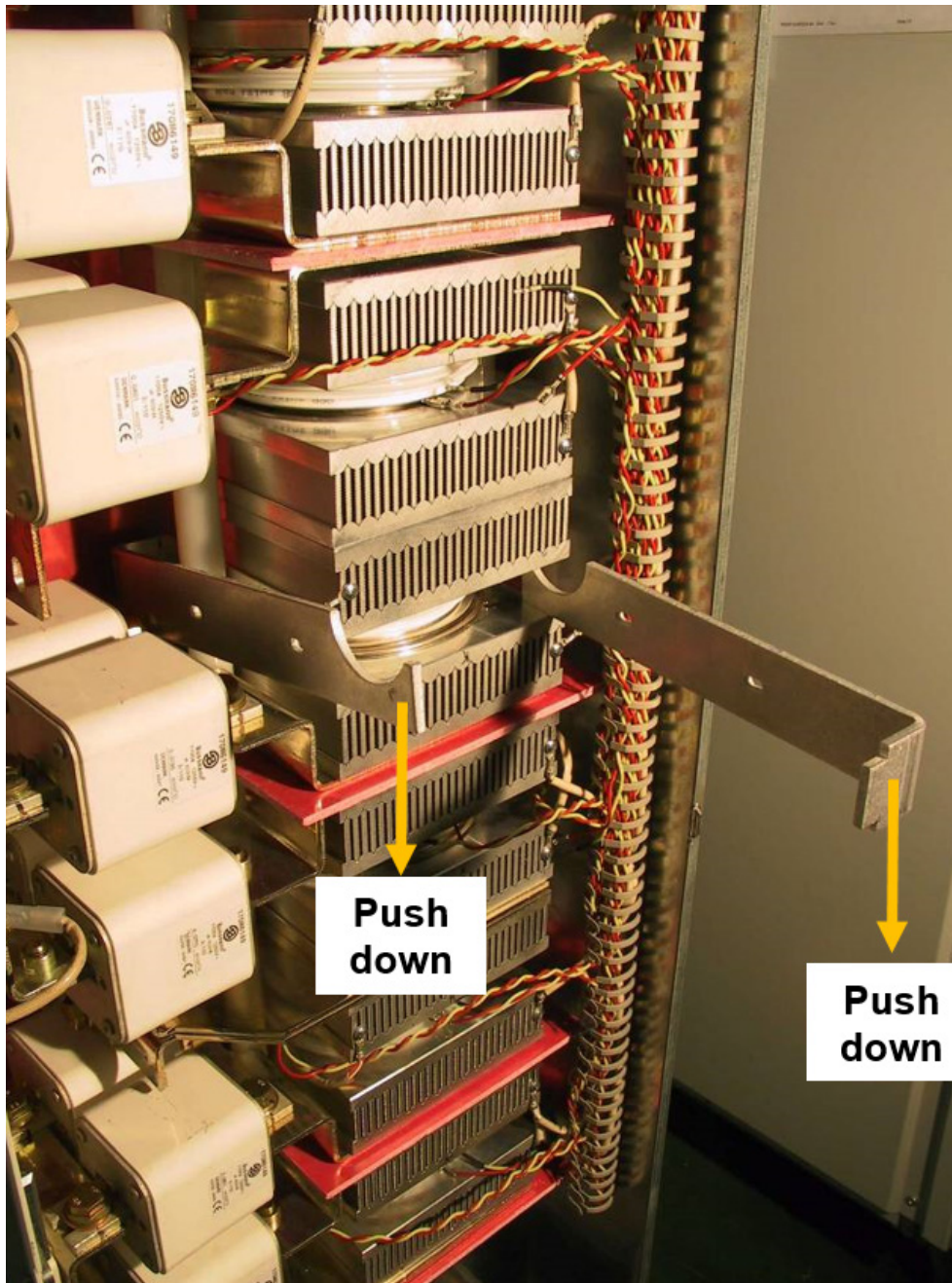
While loosening the mounting clamp the indicating spring must be pulled out a little, otherwise the spring will be damaged!

Do not remove the nuts totally, otherwise the threaded rods will fall down!

6. Pull out both DC-busbar plates.



7. Attach the disassembly tool (DCF 1066721 P1) at the faulty thyristor and prize open the upper and lower heat sinks.



8. Remove the thyristors with e.g. a pair of pliers.

**Attention:**

To center the thyristors spring pins are used. The pins are inlaid into all lower heat sinks. Open the gap wide enough that the thyristor and the pins are not damaged while removing the thyristor!

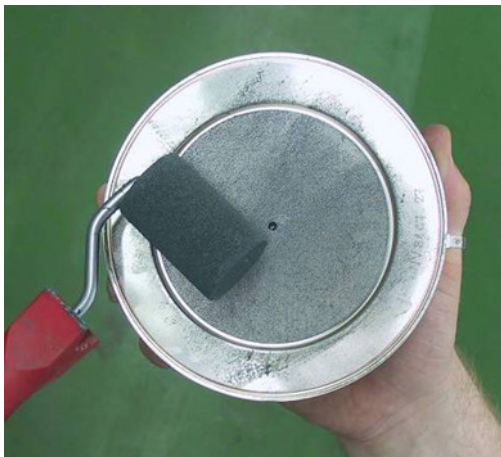
Install new thyristor

1. Ensure that the new thyristor is of the correct type (see [Appendix](#) of this manual). Keep the semiconductor and its surroundings clean.

Note:

Do not touch the polished surfaces of the thyristor.

2. Clean all parts with tissue paper moistened with solvent, which have had or will have contact with the thyristor or each other (lower/upper heat sink). Do not clean the surfaces of grease too thoroughly, because the aluminum surfaces will oxidize in a few seconds. Dry all surfaces.
3. Clean the polished surfaces of the semiconductor with a piece of tissue paper moistened with solvent. Dry all surfaces. Spread a **thin** layer of conducting paste on both sides of the thyristor, if necessary use a rubber spatula.

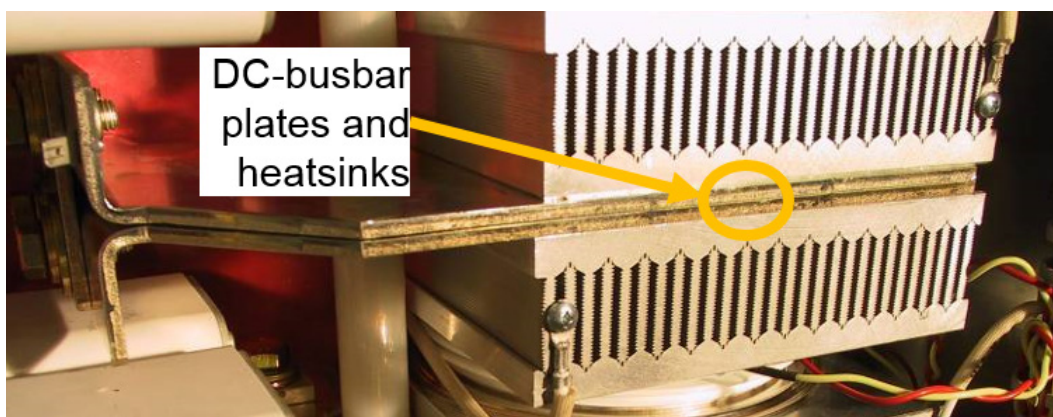


4. Centre the thyristors by means of the spring pins.

Note:

Be sure that the thyristor is installed in the right direction. Do not pinch or cut the gate leads or any other cable.

5. Turn the thyristor so that the gate leads point in the right direction. When changing BCTs make sure, that gate A is in front (see [Bidirectional-Controlled-Thyristors](#)).
6. Connect the gate leads if possible.
7. Insert first the top DC-busbar plate and then the bottom one.

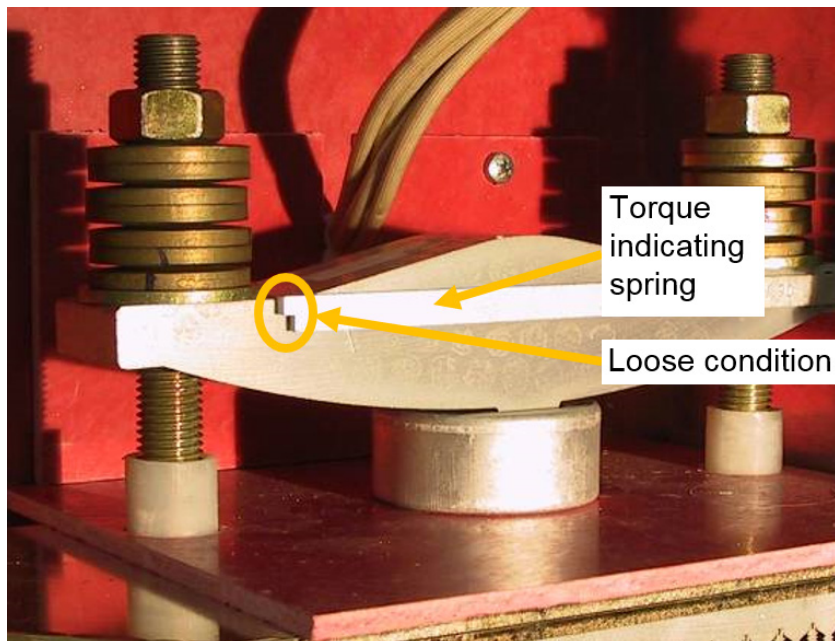


Note:

The DC-busbar plates should line up with the adjacent heat sinks.

8. Reconnect the DC-busbars.

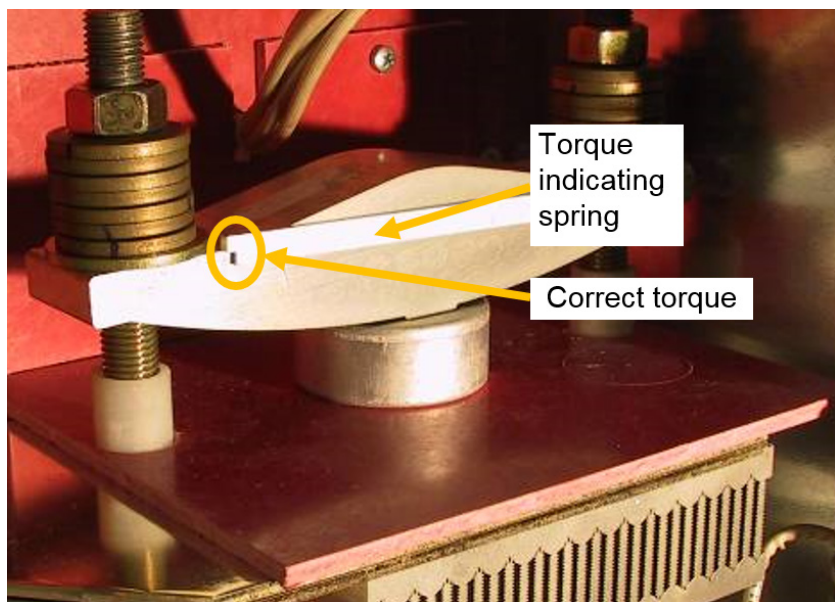
9. Tighten the nuts of the mounting clamp by hand so that the clamp is in parallel with the contact surface of the heat sinks.



Note:

The indicating spring is a very sensitive instrument and must be handled with care.

10. Tighten each nut in turn, half a turn at a time with the help of a ring spanner until the indicating spring clicks into position "correct torque". Do not tighten the screws any further.



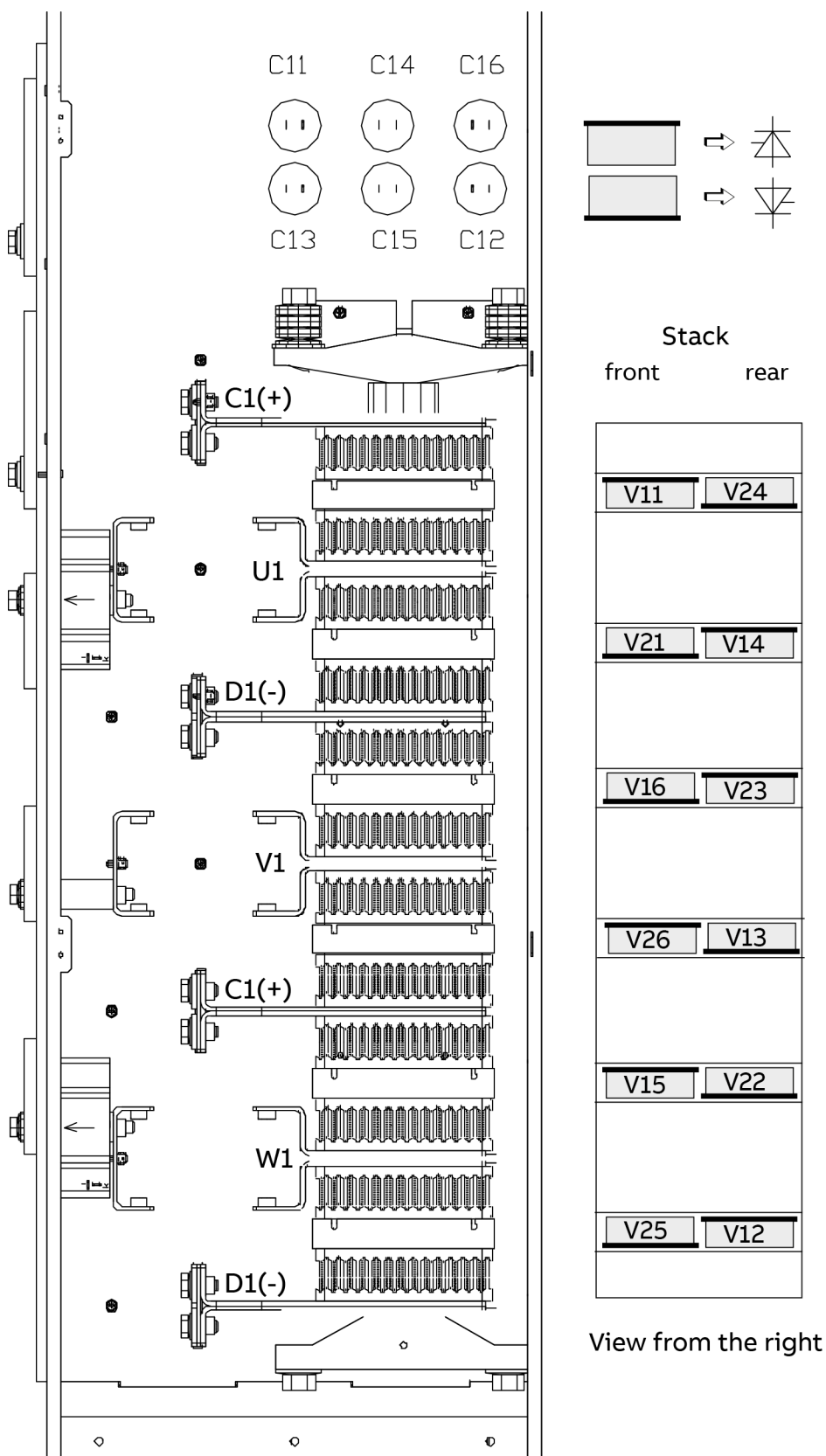
Note:

The correct torque is indicated by means of the welded indicating spring.

11. Perform an OHM test to make sure the thyristor is ok.
12. Reconnect all other dismantled parts.
13. Perform an OHM test between U1, V1, W1 and C1, D1 to make sure the power part is ok.

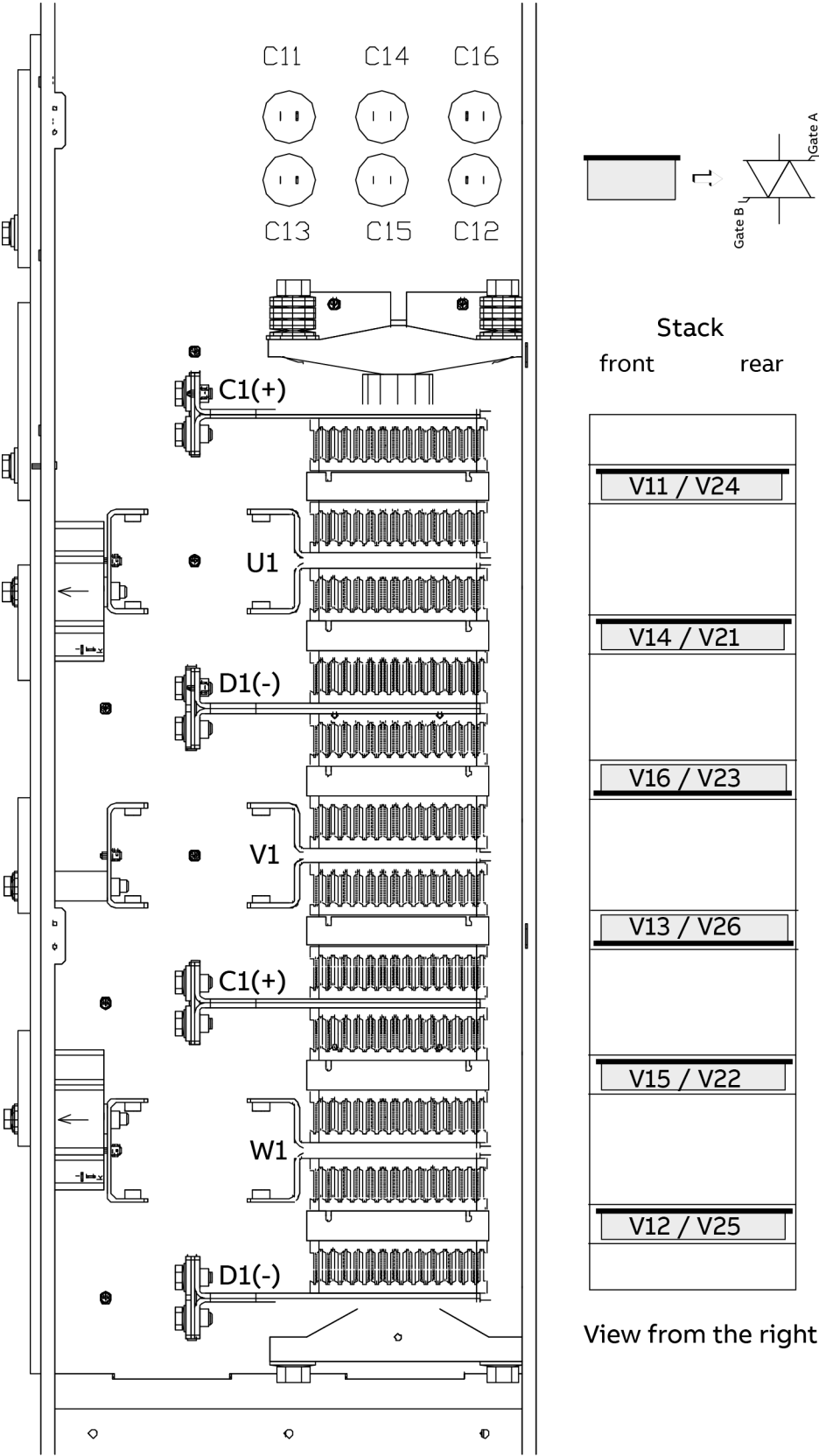
Location of thyristors in frame H7 (4-Q bridge with single thyristors)

Attention: Exchange **both** thyristors clamped between the same heatsinks.



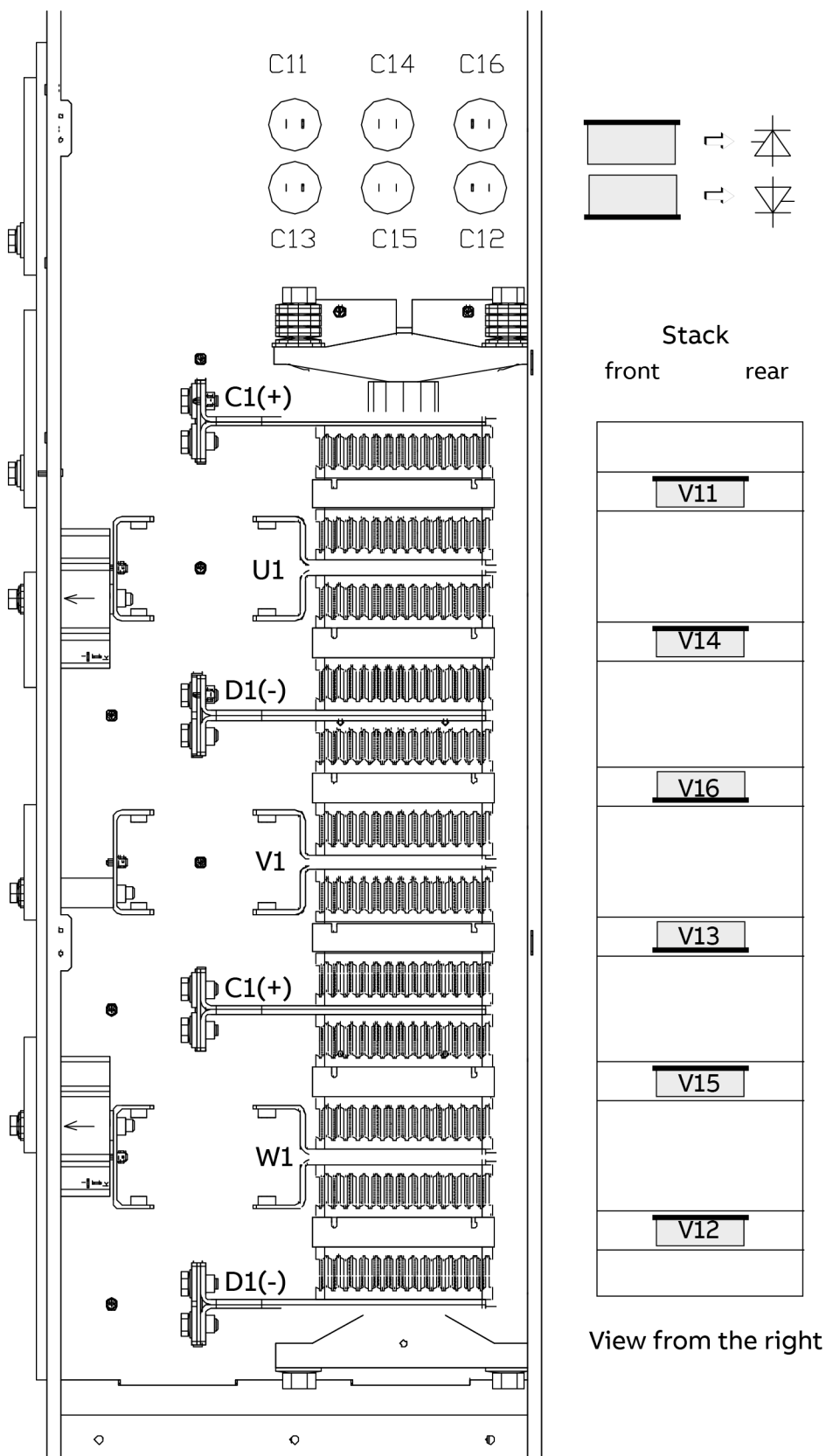
BG_880_007_H7_thyr_locat_a.ai

Location of thyristors in frame H7 (4-Q bridge with BCTs)



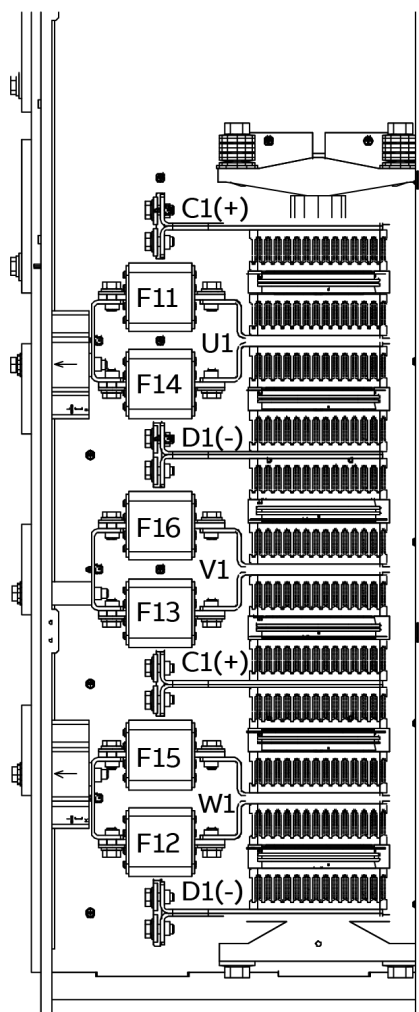
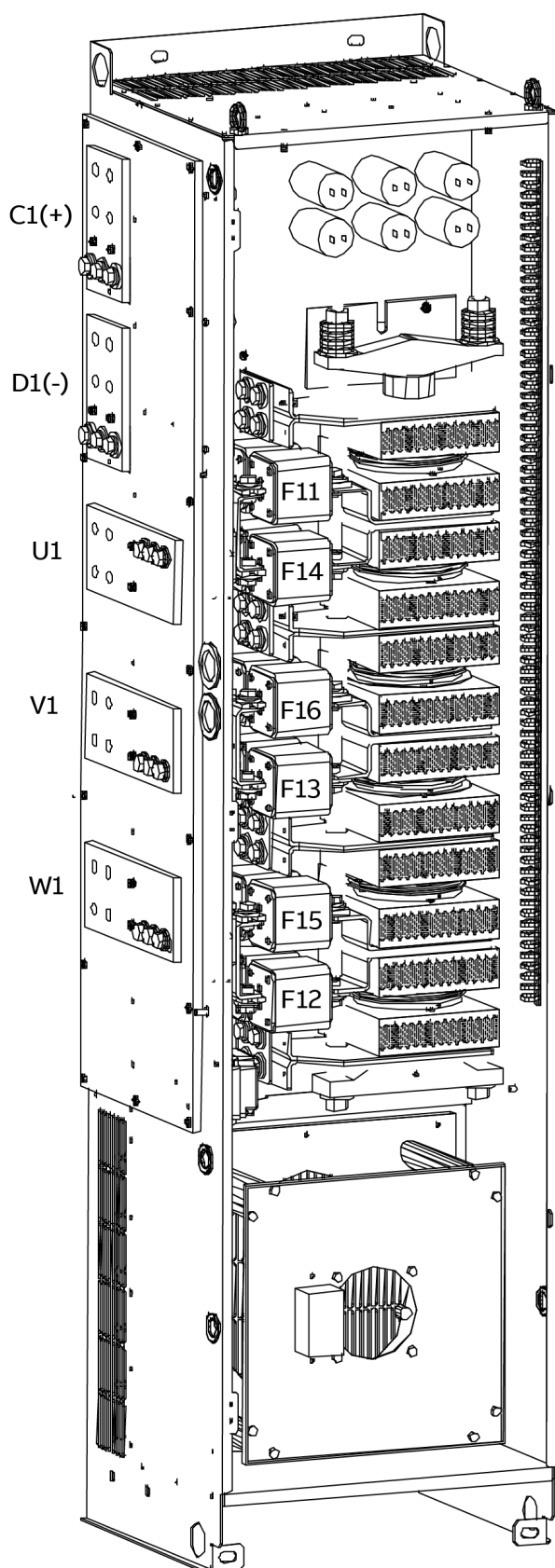
BG_880_007_H7_thyr_locat_a.ai

Location of thyristors in frame H7 (2-Q bridge with single thyristors)



BG_880_007_H7_thyr_locat_a.ai

Location of branch fuses frame H7



BG_880_006_H7_fuse_locat_a.ai

Exchange thyristors size H8

Installation of thyristor modules in converters size H8 (2500 ... 5200 A)

All DCS800 converters sizes H6/H7/H8 are equipped with disk type thyristors. The structure of the disc type semiconductor component is such that it requires a certain compression force to operate. The prevention of overheating of the component essentially depends on good heat dissipation between the semiconductor and the conducted heat sink. It is thus important that all joints have good thermal and electrical conduction.

Required tools

Special tools or material needed in addition to standard tools for the exchange of thyristor modules:

- Torx screwdrivers: TX10, TX20, TX25.
- Torque spanner for electrical connections: 13Nm (M8).
25 Nm (M10).
50 Nm (M12).
- Screws are metric type; use appropriate nuts.
- 17 mm ring spanner for fuse and busbar connections.
- 24 mm ring spanner for press clamp.
- Tissue paper.
- Solvent (e.g. ethanol).
- Thermal joint compound (grease): Type Berulub FZ1 E3.
Manufacturer: Carl Bechem GmbH, 58089 Hagen.
ABB Service: GHSN 390 011 P 0051.
- Disassembly tool: DCF 1066721 P1.

Note:

For more detailed information about the wiring of the power part, see [Hardware Manual](#).

Therefore strict observance of the build in instructions given below is of utmost importance. Make sure that the new component can replace the old one in accordance with the spare part list (see [Appendix](#) of this manual). All thyristors are always mounted in the same direction, independent of current, voltage, number of quadrants (2-Q or 4-Q), left or right side connection.

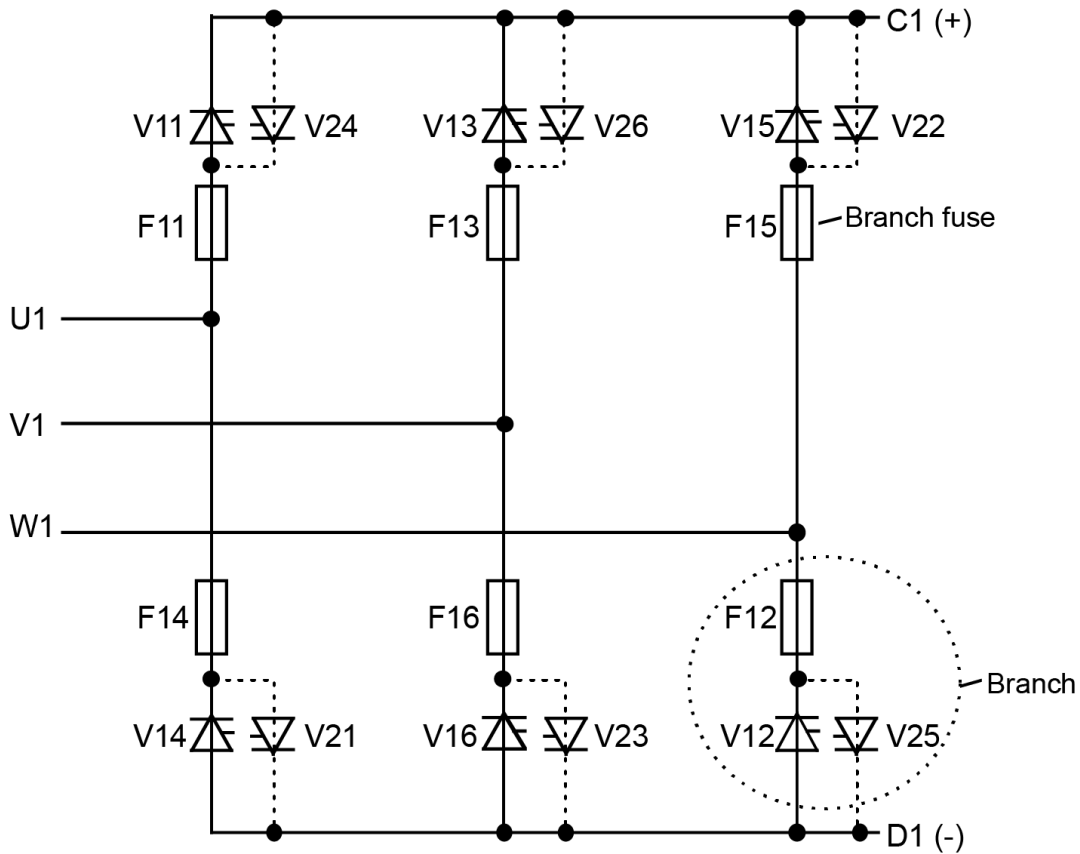
Semiconductors and heat sinks are to be handled carefully to avoid scratches and other damage. Avoid touching the contact surfaces. Do not lift the semiconductor with the gate wire. Do not lift the semiconductor by touching the current contact surfaces. Do not damage the welding flange or the contact surface.



Before the work is started, disconnect the converter completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Find faulty thyristor modules

1. Check the branch fuses by performing an OHM test.
2. Find the defective branches by performing an OHM test (both polarities) between U1, V1, W1 and C1, D1.



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Bridge configuration H5 ... H8

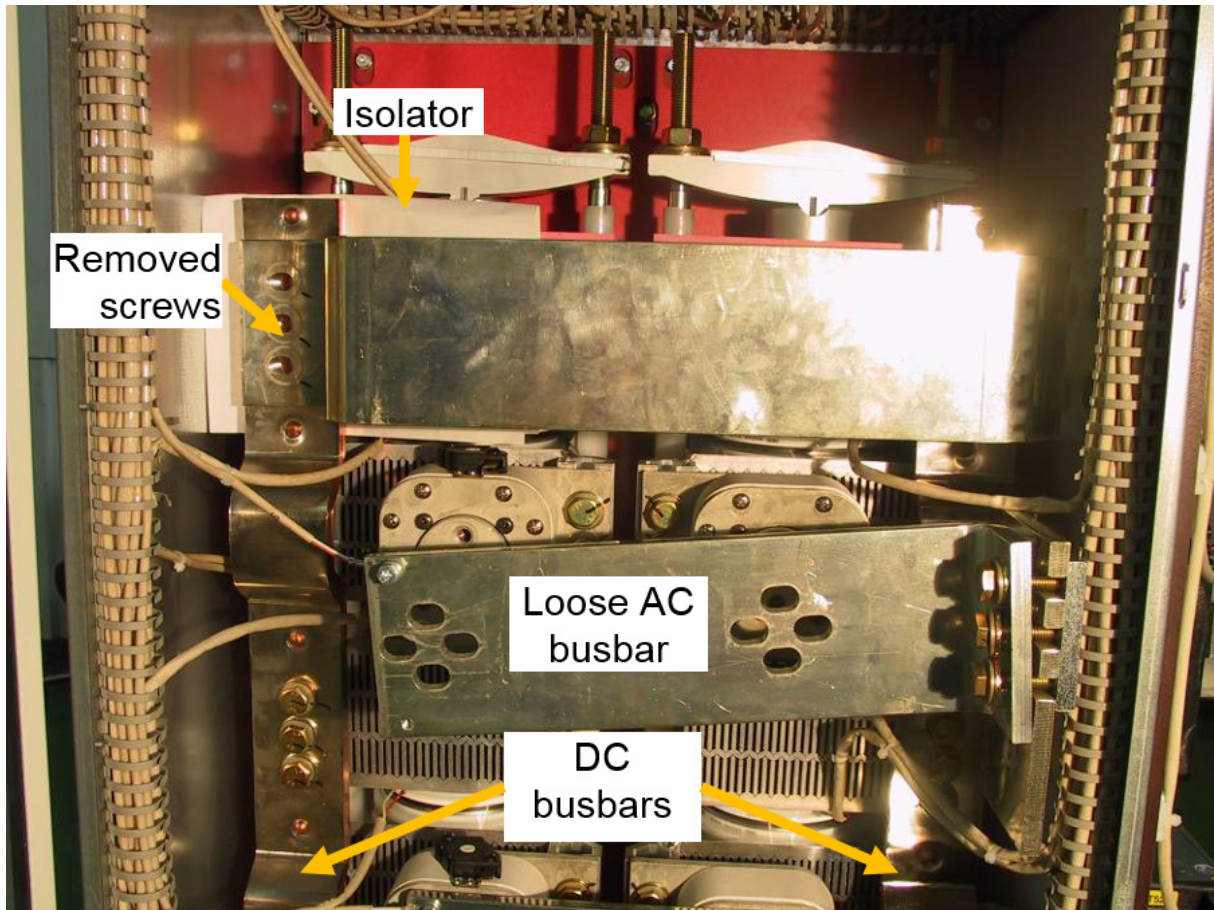
3. Remove the AC busbars, of the defective branches.

4-quadrant converter:

4. Remove all screws of the DC - busbars either above or below the fuses of the defective branches.

Note:

The connection is made with a screw socket, which may fall down, when all screws are removed.



5. Put a small piece of isolator (e.g. paper) between the DC-busbar and the heat sink to insulate the anti-parallel thyristors from each other.
6. Find the defective thyristors by performing an OHM test (both polarities) over their heat sinks.

2-quadrant converter:

7. Find the defective thyristors by performing an OHM test (both polarities) over their heat sinks.

Note:

Because "Disc Type" semiconductors need a certain compression force to operate properly, a measurement outside the clamped heat sinks might be wrong. To be sure which thyristor is broken change only one thyristor, clamp the heat sinks again and repeat step three.

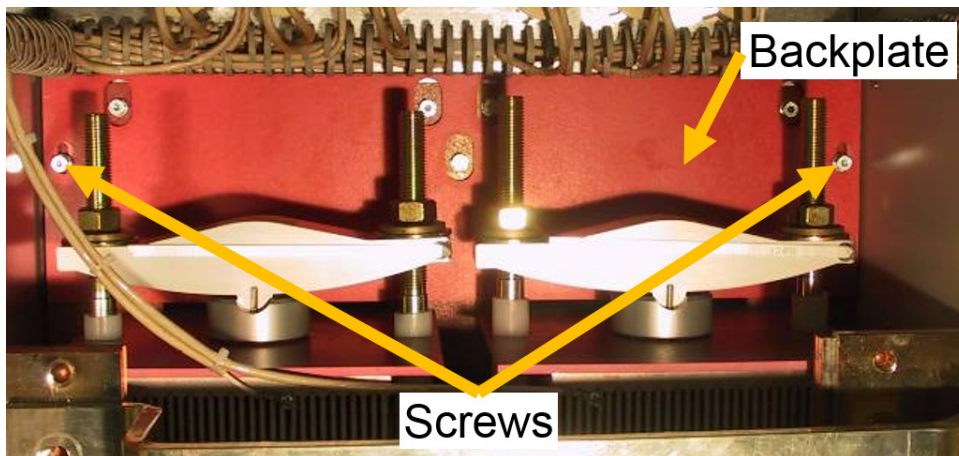
Remove faulty thyristor

1. Remove the screws of all DC/AC - busbars preventing the stack to be prized open. Remove the branch fuses, if the defective thyristors are covered by them.

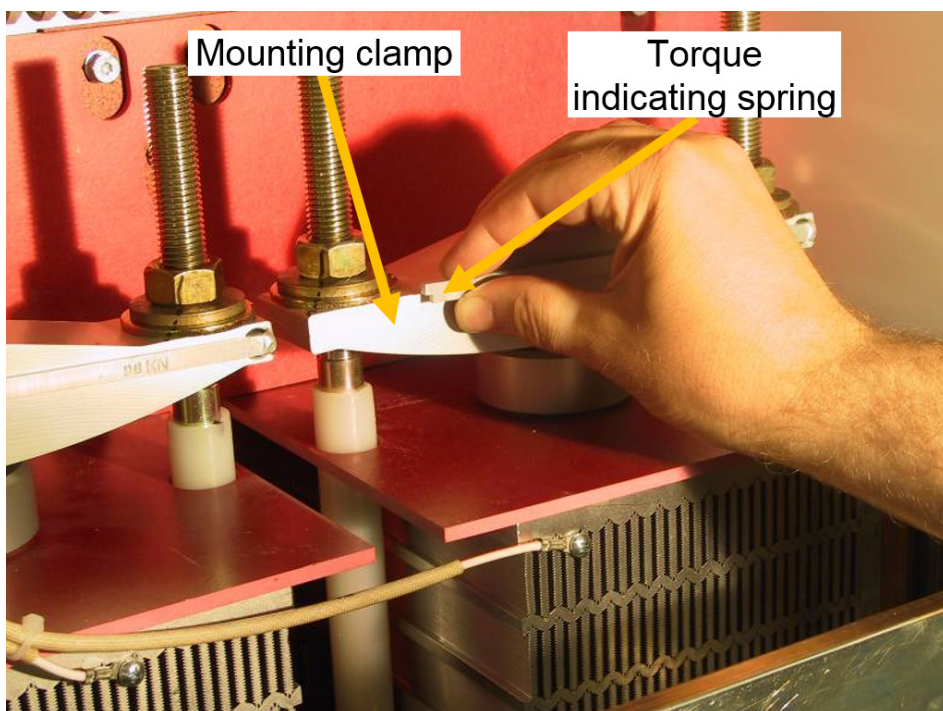
Note:

It depends on the location of the defective thyristors, which DC/AC - busbars have to be disconnected.

2. Loosen the screws holding the backplate and make sure the backplate can move up.



3. Write down the direction and location of the defective thyristors to be removed and mark their gate leads.
4. Remove the gate leads if possible.
5. Loosen the mounting clamp at the top of the thyristor stack.

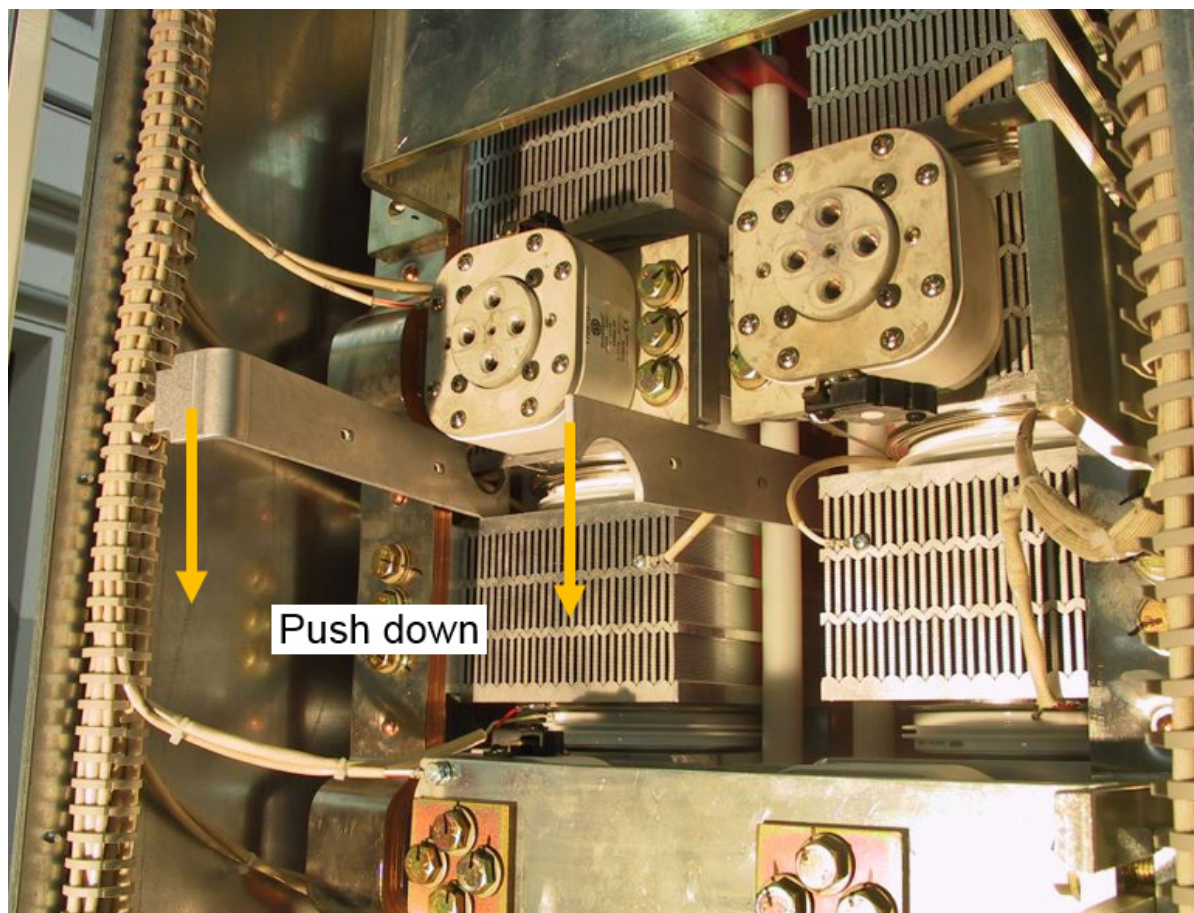


Attention:

While loosening the mounting clamp the indicating spring must be pulled out a little, otherwise the spring will be damaged!

Do not remove the nuts totally, otherwise the threaded rods will fall down!

6. Attach the disassembly tool (DCF 1066721 P1) at the faulty thyristor and prize open the upper and lower heat sinks.



7. Remove the thyristors with e.g. a pair of pliers.

**Attention:**

To center the thyristors spring pins are used. The pins are inlaid into all lower heat sinks. Open the gap wide enough that the thyristor and the pins are not damaged while removing the thyristor!

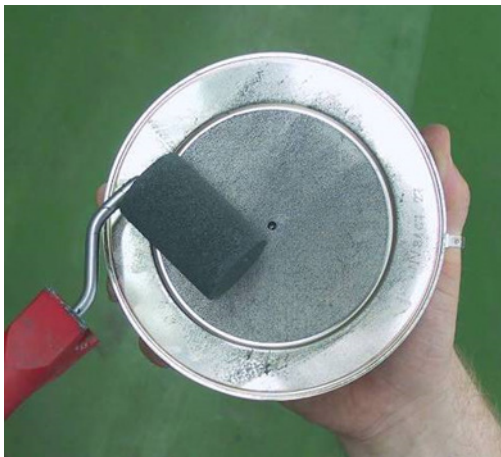
Install new thyristor

1. Ensure that the new thyristor is of the correct type (see [Appendix](#) of this manual). Keep the semiconductor and its surroundings clean.

Note:

Do not touch the polished surfaces of the thyristor.

2. Clean all parts with tissue paper moistened with solvent, which have had or will have contact with the thyristor or each other (lower/upper heat sink). Do not clean the surfaces of grease too thoroughly, because the aluminum surfaces will oxidize in a few seconds. Dry all surfaces.
3. Clean the polished surfaces of the semiconductor with a piece of tissue paper moistened with solvent. Dry all surfaces. Spread a **thin** layer of conducting paste on both sides of the thyristor, if necessary use a rubber spatula.

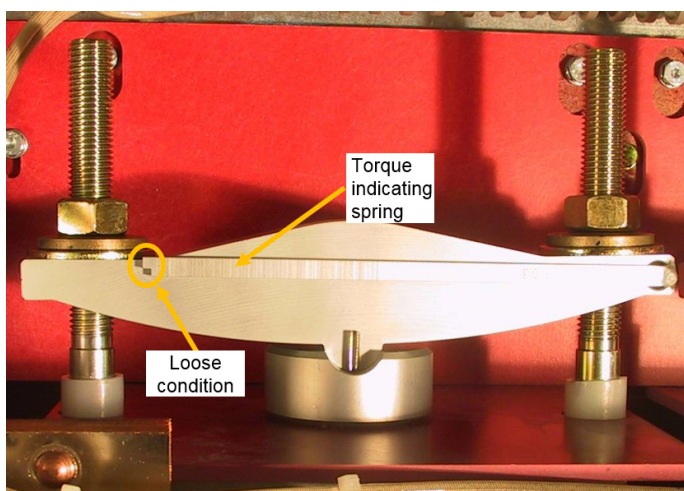


4. Centre the thyristors by means of the spring pins.

Note:

Be sure that the thyristor is installed in the right direction. Do not pinch or cut the gate leads or any other cable.

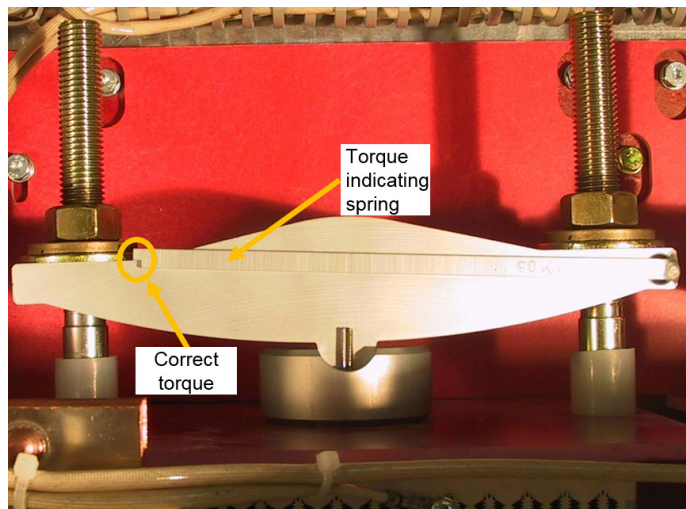
5. Turn the thyristor so that the gate leads point in the right direction.
6. Connect the gate leads if possible.
7. Tighten the nuts of the mounting clamp by hand so that the clamp is in parallel with the contact surface of the heat sinks.



Note:

The indicating spring is a very sensitive instrument and must be handled with care.

8. Tighten each nut in turn, half a turn at a time with the help of a ring spanner until the indicating spring clicks into position "correct torque". Do not tighten the screws any further.

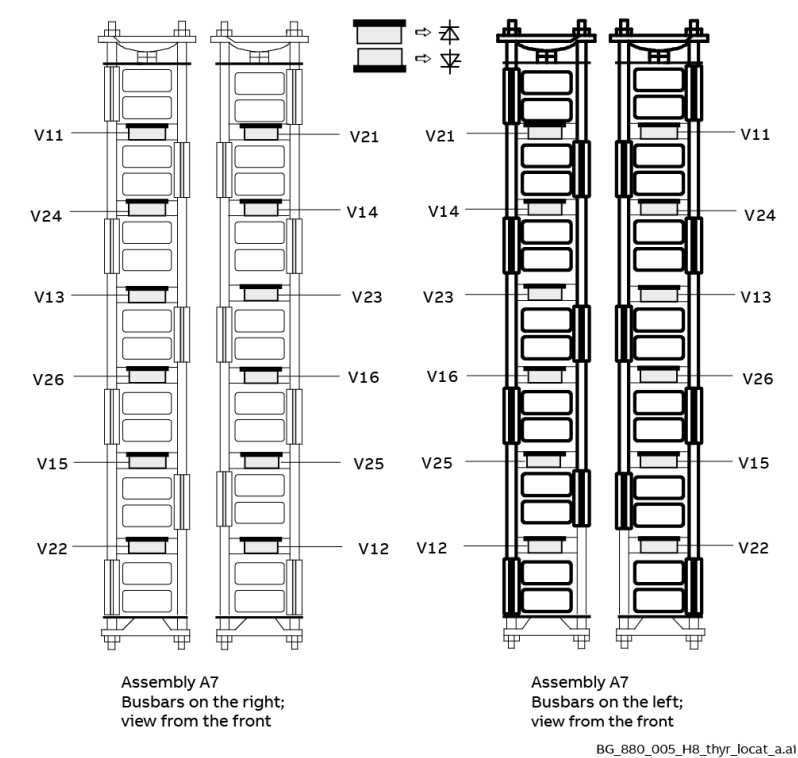


Note:

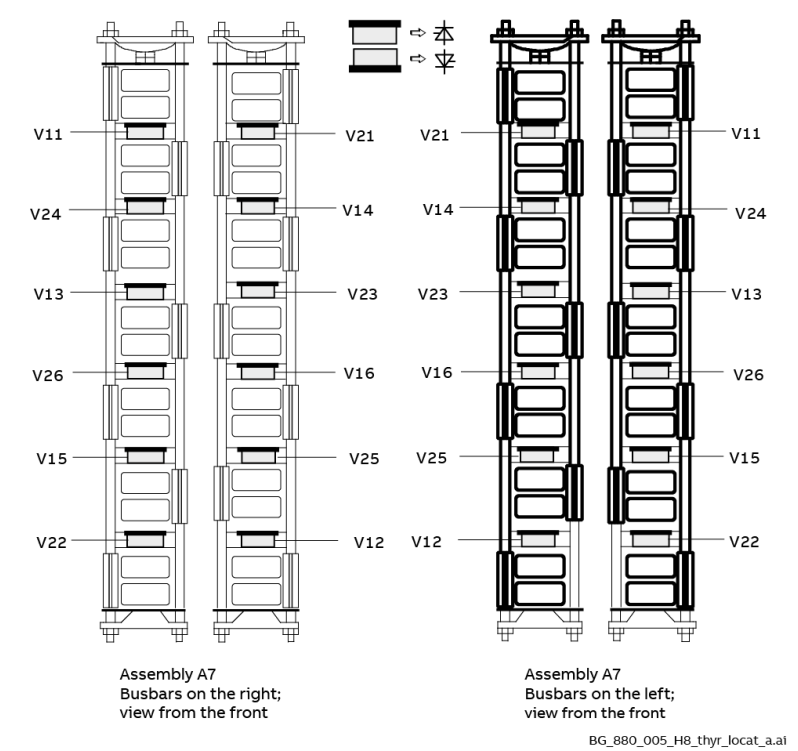
The correct torque is indicated by means of the welded indicating spring.

9. Perform an OHM test to make sure the thyristor is ok.
10. Reconnect the backplate, branch fuses, DC-/AC-busbars and all other dismantled parts.
11. Perform an OHM test between U1, V1, W1 and C1, D1 to make sure the power part is ok.

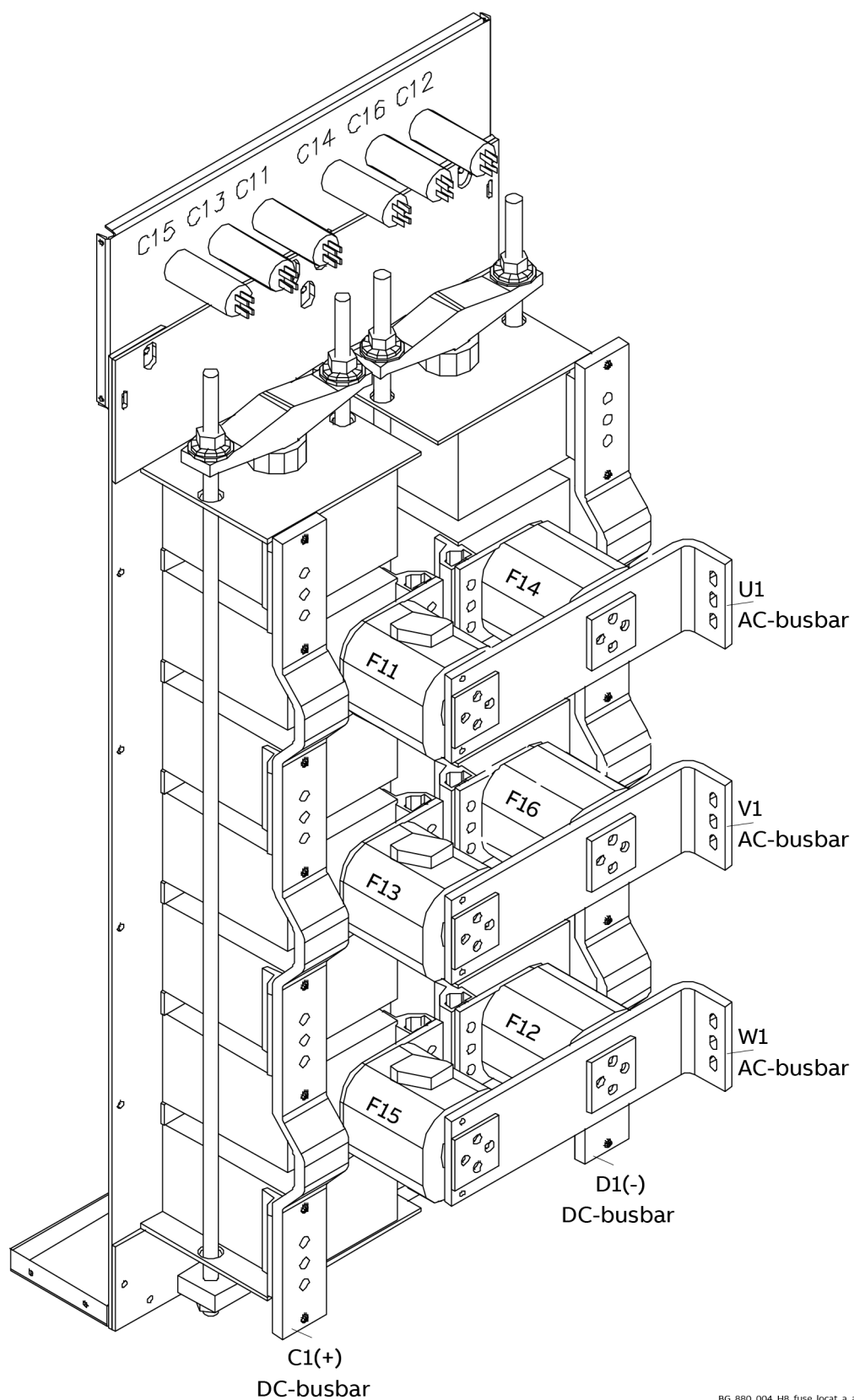
Location of thyristors in frame H8 (4-Q bridge)



Location of thyristors in frame H8 (2-Q bridge)

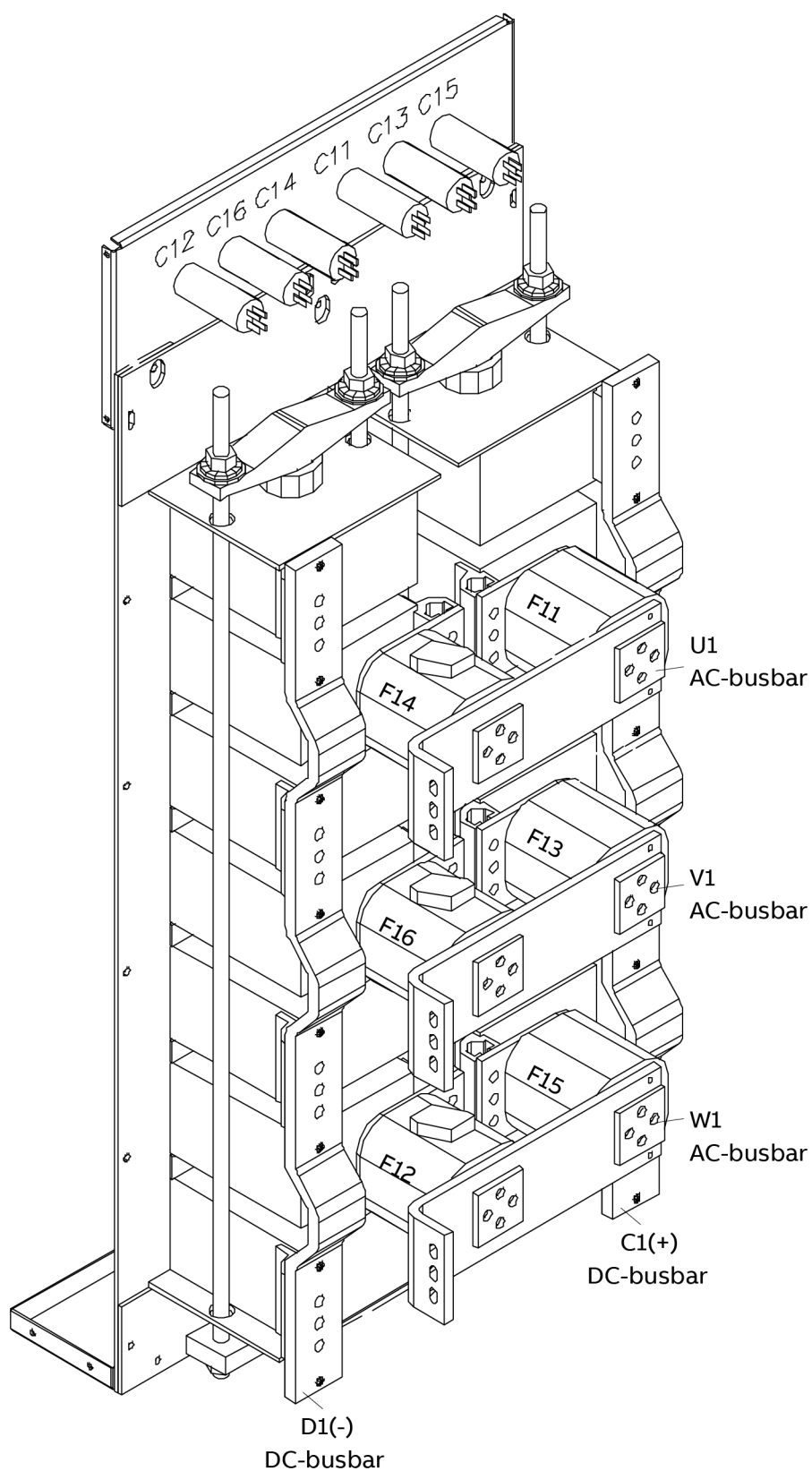


Location of branch fuses frame H8 (busbars on the right)



BG_880_004_H8_fuse_locat_a.ai

Location of branch fuses frame H8 (busbars on the left)



BG_880_004_H8_fuse_locat_a.ai

3. Exchange the control unit

Remove the old control unit

1. Remove control panel and design cover.



2. Remove the memory unit from X205.

The drive is equipped with a memory unit that is plugged into X205 on the control unit. The memory unit contains the firmware, the parameters and the application program (as option).

When a control unit is replaced, the parameter settings can be retained by transferring the memory unit from the defective control unit to the new control unit.

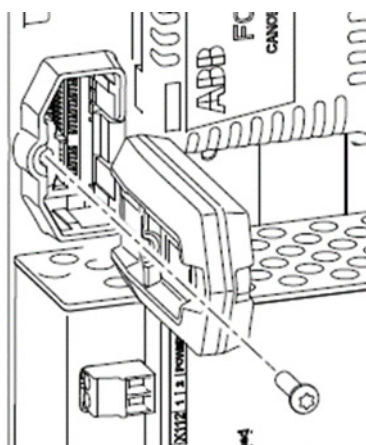


WARNING!

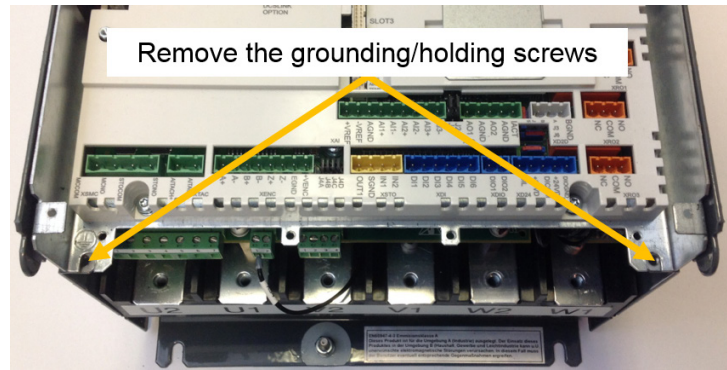
Do not remove or insert a memory unit when the drive is powered.

Replacing the memory unit

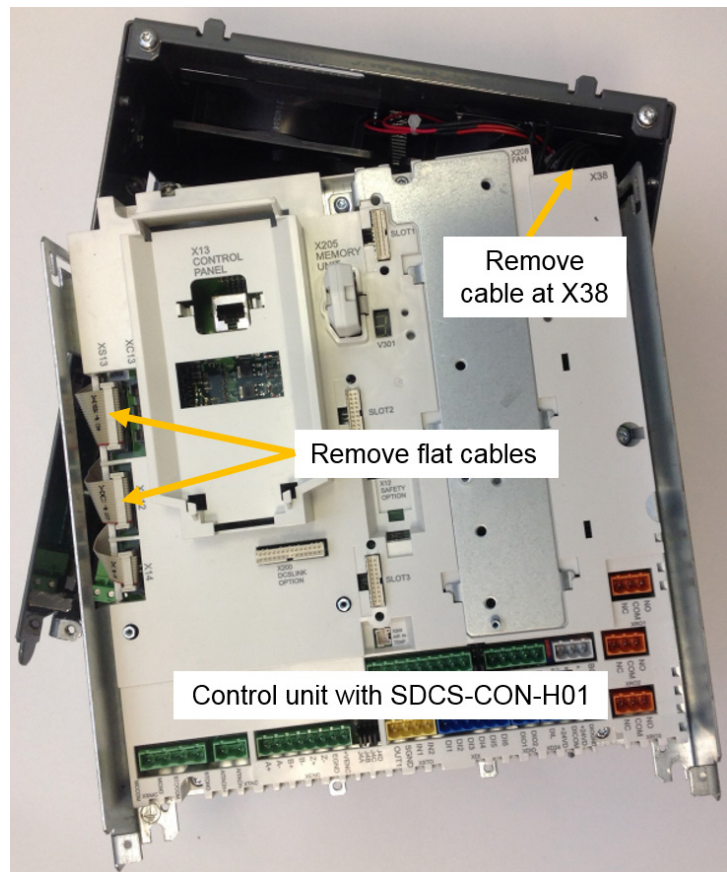
Unscrew the memory unit and pull it out.
Replace the memory unit in reverse order.



5. Remove the grounding/holding screws from the control unit.



6. To unhinge the control unit pull it up and then out.
7. Before removing the control unit completely unplug the flat cables (XC12, XS13) and the cable connected to X38.



Install the new control unit

1. Reconnect the flat cables at the control unit (XC12, XS13), the cable at X38 and re-hinge the it.
2. Reconnect the grounding/holding screws at the control unit.
3. Reconnect all I/O plugs at the control unit.
4. Reinstall all plug in options (do not forget the screws), the memory unit, the design cover and the control panel.

4. Set type code of the thyristor power controller

Follow the instructions in chapter [Set type code](#).

Safe Torque Off (STO)

Contents of this chapter

This chapter describes the acceptance test, repetitive function test and the STO revalidation test.

Note:

This is not the original operation manual of the STO function for the DCS880.

Description

The STO function can be used, for example, to construct safety or supervision circuits that stop the drive in case of danger (such as an emergency stop circuit). Another possible application is a prevention of unexpected start-up switch that enables short-time maintenance operations like cleaning or work on non-electrical parts of the machinery without switching off the power supply to the drive.

When activated, the STO function disables the control voltage of the power semiconductors of the drive output stage, thus preventing the drive from generating the torque required to rotate the motor. If the motor is running when STO is activated, it coasts to a stop.

The STO function has a redundant architecture, that is, both channels must be used in the safety function implementation.

The STO function of the drive complies with these standards:

Standard	Name
EN 60204-1:2006 + AC:2010	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
IEC 61800-5-2:2016 EN 61800-5-2:2017	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional
IEC 62061:2015 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 principles for design
EN ISO 13849-2:2012	Safety of machinery – Safety-related parts of control systems – Part 2: Validation

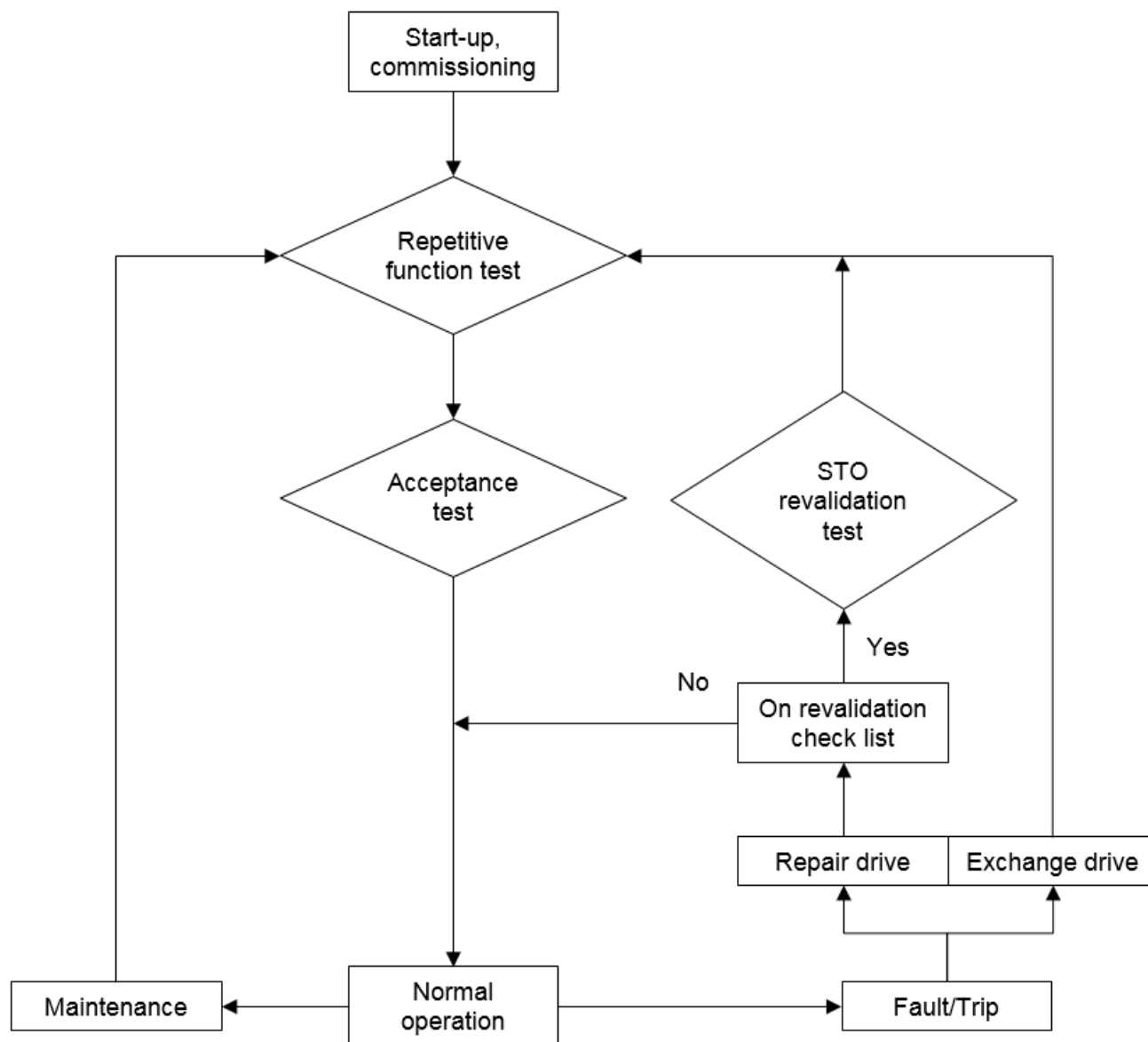
The function also corresponds to Prevention of unexpected start-up as specified by EN 1037:1995 + A1:2008 and Uncontrolled stop (stop category 0) as specified in EN 60204-1:2006 + AC:2010.

Operation principle

1. The STO activates when the activation switch is opened, or safety relay contacts open.
2. The STO inputs on the drive control unit de-energize (low active).
3. The control unit cuts off the firing pulses from the drive thyristors.
4. The control program generates an indication as defined by 31.22 STO indication run/stop (refer to [DCS880 Firmware Manual](#)).
5. Motor coasts to a stop (if running). The drive cannot restart while the activation switch or safety relay contacts are open. After the contacts close, a new start command is required to start the drive.

Flow chart

Acceptance test, repetitive function test and STO revalidation test:



Maintenance

The STO function shall be maintained by periodic testing. To perform the maintenance, do the following:

- Repetitive function test.
- Acceptance test.

Fault/Trip

If the drive was repaired and the changed hardware is not in the revalidation check list below, no test is needed. After a fault/trip the STO function shall be tested depending on the type of repair.

If the complete drive module has been exchanged, do the following:

- Repetitive function test.
- Acceptance test.

If the drive was repaired and the changed hardware is in the revalidation check list below, do the following:

- STO revalidation test.
- Repetitive function test.
- Acceptance test.

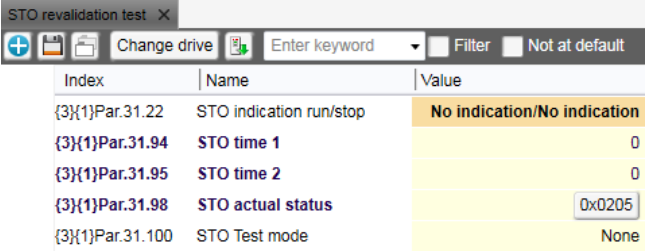
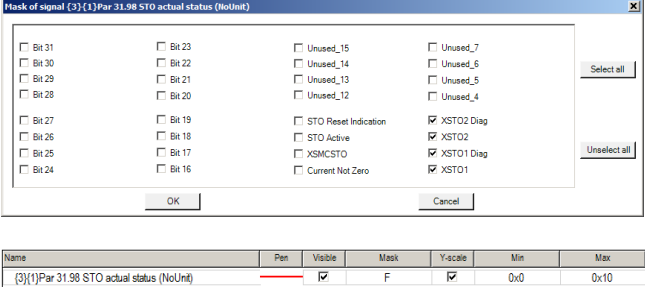
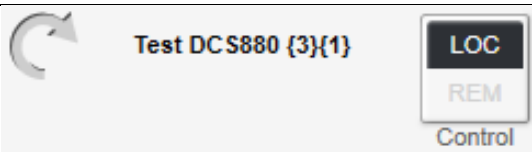
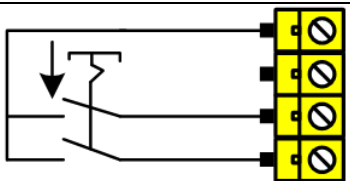
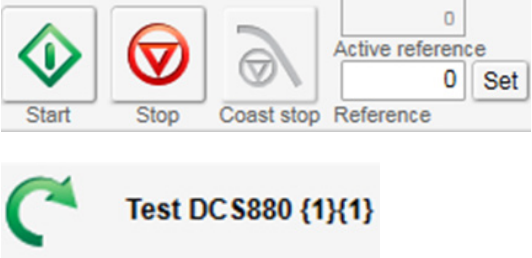
Revalidation check list

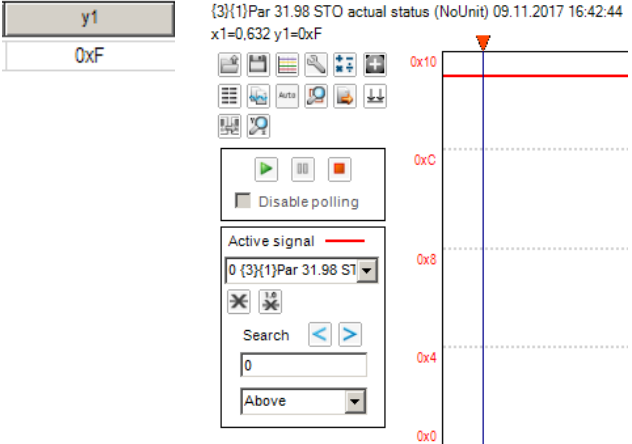
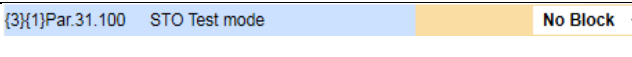
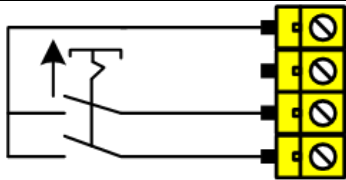
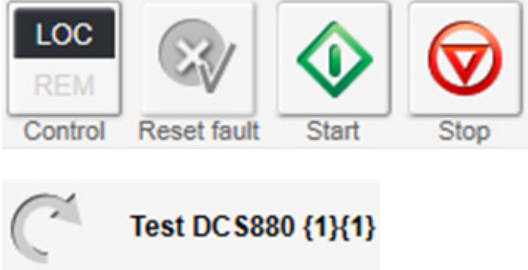
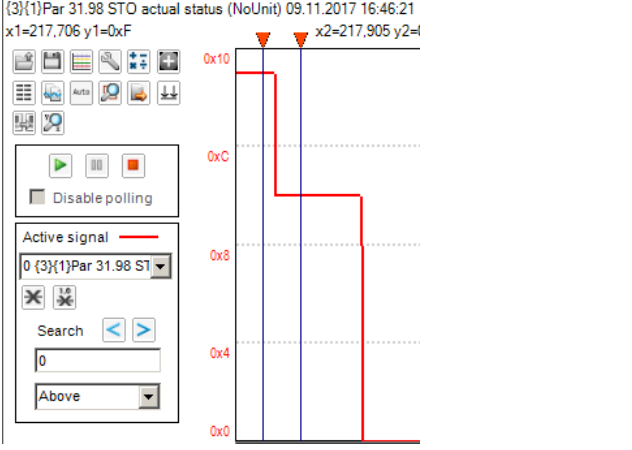
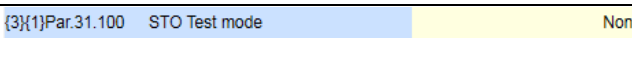
Spare part / Size	H1	H2	H3	H4	H5	H6	H7	H8
Up- or downgrade firmware	X	X	X	X	X	X	X	X
Memory unit	X	X	X	X	X	X	X	X
SDCS-CON-H01	X	X	X	X	X	X	X	X
SDCS-PIN-H01	X	X	X	X	X			
SDCS-POW-H01						X	X	X
SDCS-PIN-H41						X	X	X
SDCS-PIN-H51						X	X	X
SDCS-OPL-H01							X	X
SDCS-DSL-H10								
SDCS-DSL-H12							X	X
SDCS-DSL-H14								X
SDCS-SUB-H01	X	X	X	X	X			
SDCS-DPI-H01								
Line fuse								
Branch fuse					X	X	X	X
Thyristor	X	X	X	X	X	X	X	X
Converter fan								
Ribbon cable	X	X	X	X	X	X	X	X
Control panel (ACS-AP-x)								
F-type plug in option (except FSE-31, FSO-21)								
FSO-21, FSE-31	X	X	X	X	X	X	X	X

STO revalidation test

Test procedure

For this test Drive composer pro is needed.

Step	Action	Comment
1	Set 31.22 STO indication run/stop = No indication/No indication.	22 STO indication run/stop No indication/No indication
2	Write down the values of: – 31.94 STO time 1 = – 31.95 STO time 2 =	94 STO time 1 0 ms 95 STO time 2 0 ms
3	Create a custom workspace: – 31.22 STO indication run/stop. – 31.94 STO time 1. – 31.95 STO time 2. – 31.98 STO actual status. – 31.100 STO Test mode.	
4	Create monitor with 31.98 STO actual status and select following bits: – XSTO1. – XSTO1 Diag. – XSTO2. – XSTO2 Diag. Mask = F. Set the Max in the monitor to 0x10.	
5	Set the drive to local.	
6	If open, close the STO terminal circuit.	
7	Give a run (press Start) command and zero speed reference to the drive. Note: It is important that there is no current flow during this test.	

Step	Action	Comment
8	Start the monitor value must be 0xF.	
9	Set 31.100 STO Test mode = No Block.	
10	Open the STO terminal circuit.	 <p>XSTO: 1/+24V XSTO: 2/SGND XSTO: 3/IN1 XSTO: 4/IN2</p>
11	Remove the run command (press Stop), if it is still given.	
12	Stop the monitor.	
13	Set 31.100 STO Test mode = None.	

Evaluation of the graph and observations

Step	Action	Comment
1	At the start of the procedure the monitor value of 31.98 STO actual status must be 0xF.	<div><div><div>y1</div><div>0xF</div></div><div><div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div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Observation of abnormalities

- Re-try of the validation test is allowed once.
- The root cause could be the Drive composer pro. Close the program and reconnect.
- There could be a current flow through the machine. This is very likely if 31.94 STO time 1 and 31.95 STO time 2 are about 300 ms and fault 5093 Safe off main contactor XSMCSTO is present.
- If the failure persists exchange the SDCS-CON-H01.
- Then re-do the test.

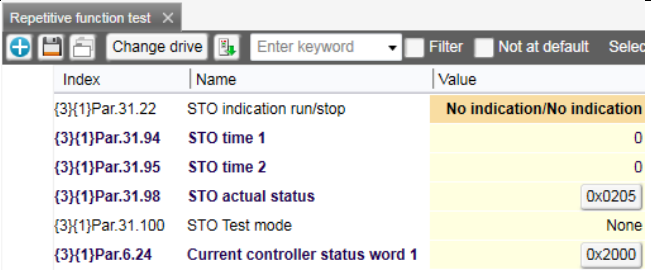
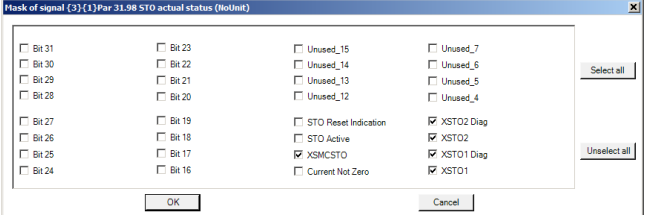
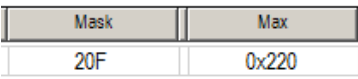
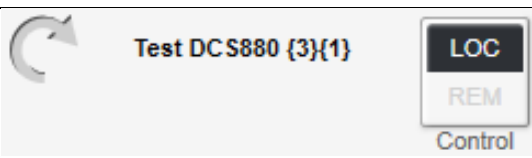
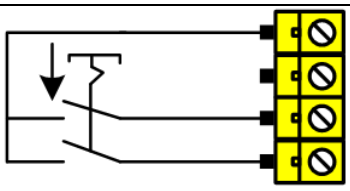
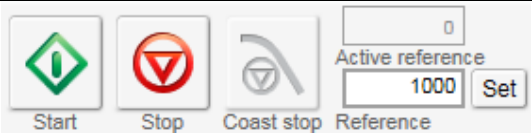
Repetitive function test (fault shutdown path)



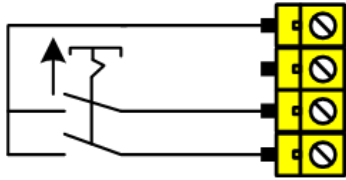

Fault shutdown path

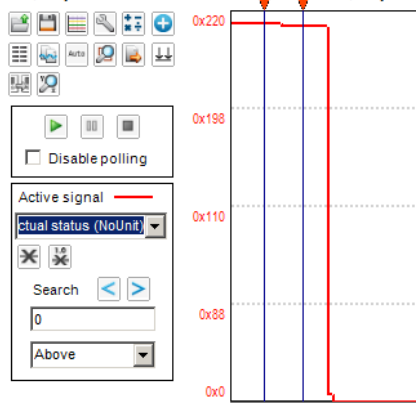
Due to the special nature of STO in DC drives a load switching device, e.g. a mains contactor (MC), an air circuit breaker (ACB), a DC breaker (DCB) or a high speed DC breaker (HSDCB) must be installed in the power circuit of the system and be opened by relay XSMC:STO on the SDCS-CON-H01 in case of a drive hardware fault.

Test procedure

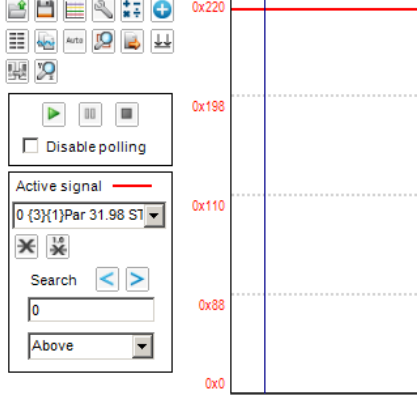
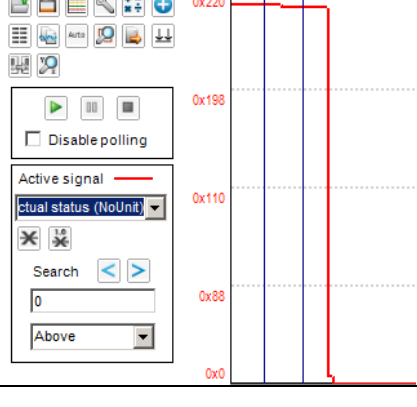
For this test Drive composer pro is needed.

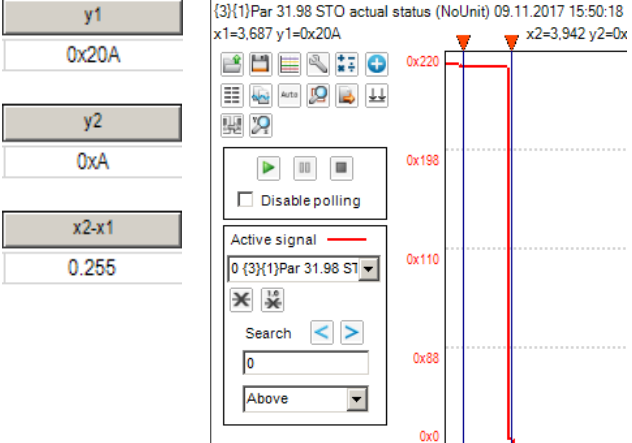
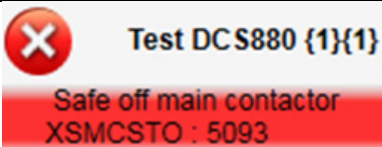
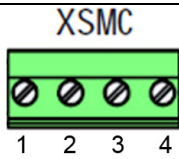
Step	Action	Comment
1	Set 31.22 STO indication run/stop = No indication/No indication.	22 STO indication run/stop No indication/No indication
2	Write down the values of: – 31.94 STO time 1 = – 31.95 STO time 2 =	94 STO time 1 0 ms 95 STO time 2 0 ms
3	Create a custom workspace: – 31.22 STO indication run/stop. – 31.94 STO time 1. – 31.95 STO time 2. – 31.98 STO actual status. – 31.100 STO Test mode. – 06.24 Current Controller status word 1.	
4	Create monitor with 31.98 STO actual status and select following bits: – XSTO1. – XSTO1 Diag. – XSTO2. – XSTO2 Diag. – XSMCSTO. Mask = 20F. Set the Max in the monitor to 0x220.	 
5	Set the drive to local.	
6	If open, close the STO terminal circuit.	
7	Give a run (press Start) command and a suitable reference to the drive. Note: It is important that there is a current flow during this test. Any current flow is sufficient.	

Step	Action	Comment																																																			
		 Test DC S880 {1}{1}																																																			
8	Check following bits in 06.24 Current controller status word 1: <ul style="list-style-type: none"> – 06.24.b09 = 0 = Drive is motoring. – 06.24.b12 = 0 = Discontinuous armature current (recommendation not mandatory). – 06.24.b13 = 0 = Armature current not zero. 	<table border="1"> <thead> <tr> <th>Bit</th><th>Name</th><th>Value</th></tr> </thead> <tbody> <tr><td>0</td><td>0 = Fans</td><td>1</td></tr> <tr><td>1</td><td>1 = reserved</td><td>0</td></tr> <tr><td>2</td><td>2 = reserved</td><td>0</td></tr> <tr><td>3</td><td>3 = Field heating</td><td>0</td></tr> <tr><td>4</td><td>4 = Field current direction</td><td>0</td></tr> <tr><td>5</td><td>5 = Field exciter</td><td>1</td></tr> <tr><td>6</td><td>6 = Dynamic braking</td><td>0</td></tr> <tr><td>7</td><td>7 = Main contactor</td><td>1</td></tr> <tr><td>8</td><td>8 = Dynamic braking con...</td><td>0</td></tr> <tr><td>9</td><td>9 = Energy flow</td><td>0</td></tr> <tr><td>10</td><td>10 = US style DC contactor</td><td>1</td></tr> <tr><td>11</td><td>11 = Firing pulses</td><td>1</td></tr> <tr><td>12</td><td>12 = Continuous current</td><td>0</td></tr> <tr><td>13</td><td>13 = Zero current</td><td>1</td></tr> <tr><td>14</td><td>14 = DC-breaker (contin...</td><td>0</td></tr> <tr><td>15</td><td>15 = DC-breaker (pulse)</td><td>0</td></tr> </tbody> </table>	Bit	Name	Value	0	0 = Fans	1	1	1 = reserved	0	2	2 = reserved	0	3	3 = Field heating	0	4	4 = Field current direction	0	5	5 = Field exciter	1	6	6 = Dynamic braking	0	7	7 = Main contactor	1	8	8 = Dynamic braking con...	0	9	9 = Energy flow	0	10	10 = US style DC contactor	1	11	11 = Firing pulses	1	12	12 = Continuous current	0	13	13 = Zero current	1	14	14 = DC-breaker (contin...	0	15	15 = DC-breaker (pulse)	0
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14	14 = DC-breaker (contin...	0																																																			
15	15 = DC-breaker (pulse)	0																																																			
9	Start the monitor value must be 0x20F.	<div> <div>y1</div> <div>0x20F</div> <div> <div>{3}{1}Par 31.98 STO actual status (NoUnit) 09.11.2017 15:41:29 x1=0.179 y1=0x20F</div> <div>  <div> <div>0x220</div> <div>0x198</div> <div>0x110</div> <div>0x88</div> <div>0x0</div> </div> <div> <input type="checkbox"/> Disable polling </div> <div> <div>Active signal</div> <div>0 {3}{1}Par 31.98 ST</div> <div> <input type="checkbox"/> <input type="checkbox"/> </div> <div>Search</div> <div>0</div> <div>Above</div> </div> </div> </div> </div>																																																			
10	Set 31.100 STO Test mode = No Block.	<div> <div>{3}{1}Par.31.100</div> <div>STO Test mode</div> <div>No Block</div> </div>																																																			
11	Open the STO terminal circuit.																																																				
12	Remove the run command (press Stop), if it is still given.	<div> <div> <div>LOC</div> <div>REM</div> <div>Control</div> </div> <div> <div>✕</div> <div>✓</div> <div>Reset fault</div> </div> <div> <div>▶</div> <div>Start</div> </div> <div> <div>◀</div> <div>Stop</div> </div> </div> <div>  Test DC S880 {1}{1} </div>																																																			


Step	Action	Comment
13	Stop the monitor.	<p>{3}{1}Par 31.98 STO actual status (NoUnit) 09.11.2017 15:50:17 x1=3,582 y1=0x20F</p> 
14	Set 31.100 STO Test mode back to None.	<p>{3}{1}Par.31.100 STO Test mode</p> <p>None</p>

Evaluation of the graph and observations

Step	Action	Comment
1	At the start of the procedure the monitor value of 31.98 STO actual status must be 0x20F.	<p>y1 0x20F</p> <p>{3}{1}Par 31.98 STO actual status (NoUnit) 09.11.2017 15:41:29 x1=0,179 y1=0x20F</p> 
2	After opening the STO circuit the value of 31.98 STO actual status must be 0x20A.	<p>y1 0x20F</p> <p>y2 0x20A</p> <p>{3}{1}Par 31.98 STO actual status (NoUnit) 09.11.2017 15:50:17 x1=3,582 y1=0x20F</p> 

Step	Action	Comment						
3	After about 300 ms the value of 31.98 STO actual status must be 0xA. Shortly after the value of 31.98 STO actual status must be 0x0.							
4	Compare the values of 31.94 STO time 1 and 31.95 STO time 2. Their values must be within ± 50 ms of 300 ms.	<table border="1"> <tr> <td>{3}{1}Par.31.94</td> <td>STO time 1</td> <td>286</td> </tr> <tr> <td>{3}{1}Par.31.95</td> <td>STO time 2</td> <td>286</td> </tr> </table>	{3}{1}Par.31.94	STO time 1	286	{3}{1}Par.31.95	STO time 2	286
{3}{1}Par.31.94	STO time 1	286						
{3}{1}Par.31.95	STO time 2	286						
5	Drive must show fault 5093 Safe off main contactor XSMCSTO. It will also show fault 5092 STO overall fault. Most likely also fault 3280 Mains low voltage is displayed.							
6	Relay XSMC:STO (3, 4) on the SDCS-CON-H01 must have been opened.							
7	The load switching element e.g. a mains contactor (MC), an air circuit breaker (ACB), a DC breaker (DCB) or a high speed DC breaker (HSDCB) connected to XSMC:STO must have been opened.							
8	The control board must be rebooted (cycle auxiliary power) afterwards, as relay XSMC:STO is only closed once during the boot of the drive.							
9	Test the function of connector XSMC when the motor is stopped. <ul style="list-style-type: none"> Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. Ensure that the drive operates as follows: <ul style="list-style-type: none"> Unplug connector XSMC. Give a start command. The motor should not generate torque. The used load switching device, e.g. a mains contactor (MC), an air circuit breaker (ACB), a DC breaker (DCB) or a high speed DC breaker (HSDCB) must not close. Re-plug connector XSMC. Reset any active faults. Restart the drive and check that the motor runs normally.							
10	Document and sign the repetitive function test which verifies that the fault shutdown path of the safety function is safe and accepted for operation in the machine log book.							

Acceptance test

Action	<input checked="" type="checkbox"/>
 WARNING! Follow the Safety instructions . Ignoring the instructions can cause physical injury or death, or damage to the equipment.	<input type="checkbox"/>
Ensure that the drive can be run and stopped freely during start-up.	<input type="checkbox"/>
Stop the drive (if running), switch off mains- and auxiliary power and isolate the drive from the power lines by disconnectors.	<input type="checkbox"/>
Check the STO circuit connections against the wiring diagram.	<input type="checkbox"/>
Close the disconnectors and switch on mains- and auxiliary power.	<input type="checkbox"/>
Test the operation of the STO function when the motor is stopped. <ul style="list-style-type: none"> – Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. – Ensure that the drive operates as follows: <ul style="list-style-type: none"> – Open the STO circuit. The drive generates an indication if one is defined for ‘stopped’ state in 31.22 STO indication run/stop (see DCS880 Firmware Manual). – Give a start command to verify that the STO function blocks the drive operation. The motor should not generate torque. – Close the STO circuit. – Reset any active faults. Restart the drive and check that the motor runs normally. 	<input type="checkbox"/>
Test the operation of the STO function when the motor is running. <ul style="list-style-type: none"> – Start the drive and ensure the motor is running. – Ensure that the drive operates as follows: <ul style="list-style-type: none"> – Open the STO circuit. The motor should stop and should not generate torque. The drive generates an indication if one is defined for ‘running’ state in 31.22 STO indication run/stop (see DCS880 Firmware Manual). – Reset any active faults and try to start the drive. – Ensure that the motor stays at standstill and the drive operates as described above in testing the operation when the motor is stopped. – Close the STO circuit. – Reset any active faults. Restart the drive and check that the motor runs normally. 	<input type="checkbox"/>
Test the operation of the failure detection of the drive. The motor can be stopped or running. <ul style="list-style-type: none"> – Open the 1st channel of the STO circuit (wire connected to IN1). If the motor was running, it should coast to a stop. The drive generates fault FA81 Safe torque off 1 loss (see DCS880 Firmware Manual). – Give a start command to verify that the STO function blocks the drive’s operation. The motor should not generate torque. – Close the STO circuit. – Reset any active faults. Restart the drive and check that the motor runs normally. – Open the 2nd channel of the STO circuit (wire connected to IN2). If the motor was running, it should coast to a stop. The drive generates fault FA82 Safe torque off 2 loss (see DCS880 Firmware Manual). – Give a start command to verify that the STO function blocks the drive’s operation. The motor should not generate torque. – Close the STO circuit. – Reset any active faults. Restart the drive and check that the motor runs normally. 	<input type="checkbox"/>
Document and sign the acceptance test which verifies that the safety function is safe and accepted for operation in the machine log book.	<input type="checkbox"/>

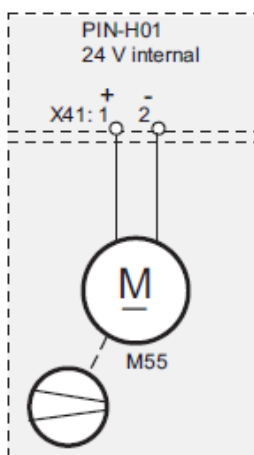
Service

Exchange cooling fan size H1 (one fan)



Before the work is started, disconnect the thyristor power controller completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Unit sizes DCS880-S0b-0045-dd ...
DCS880-S0b-0100-dd using one 24 V_{DC} fan.

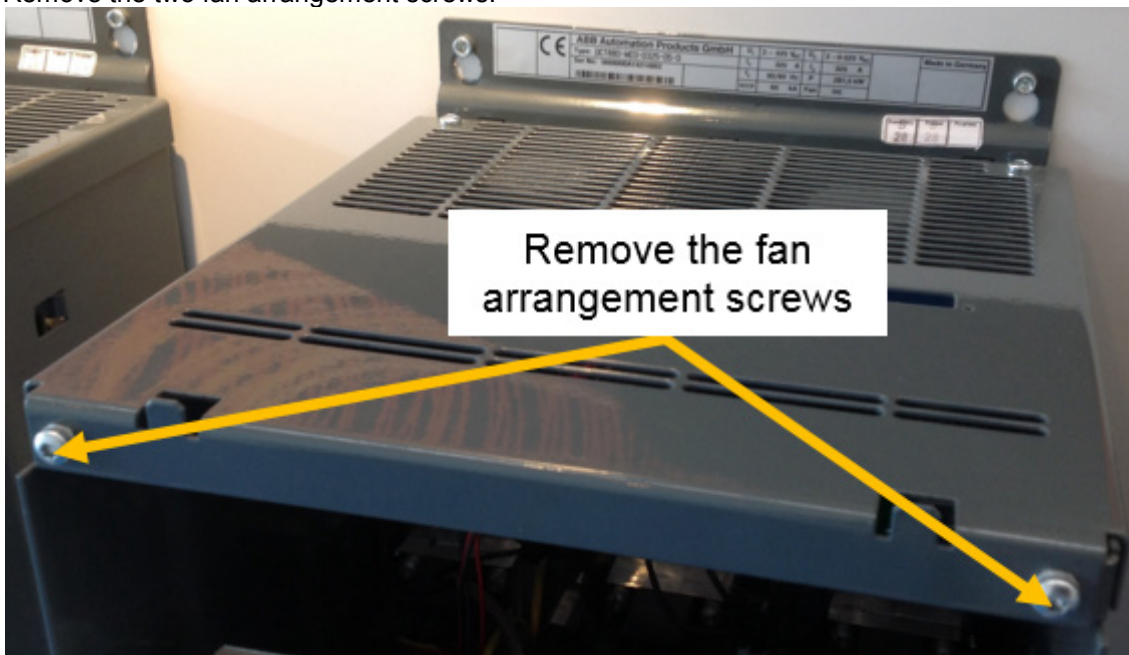


Removing the converter fan

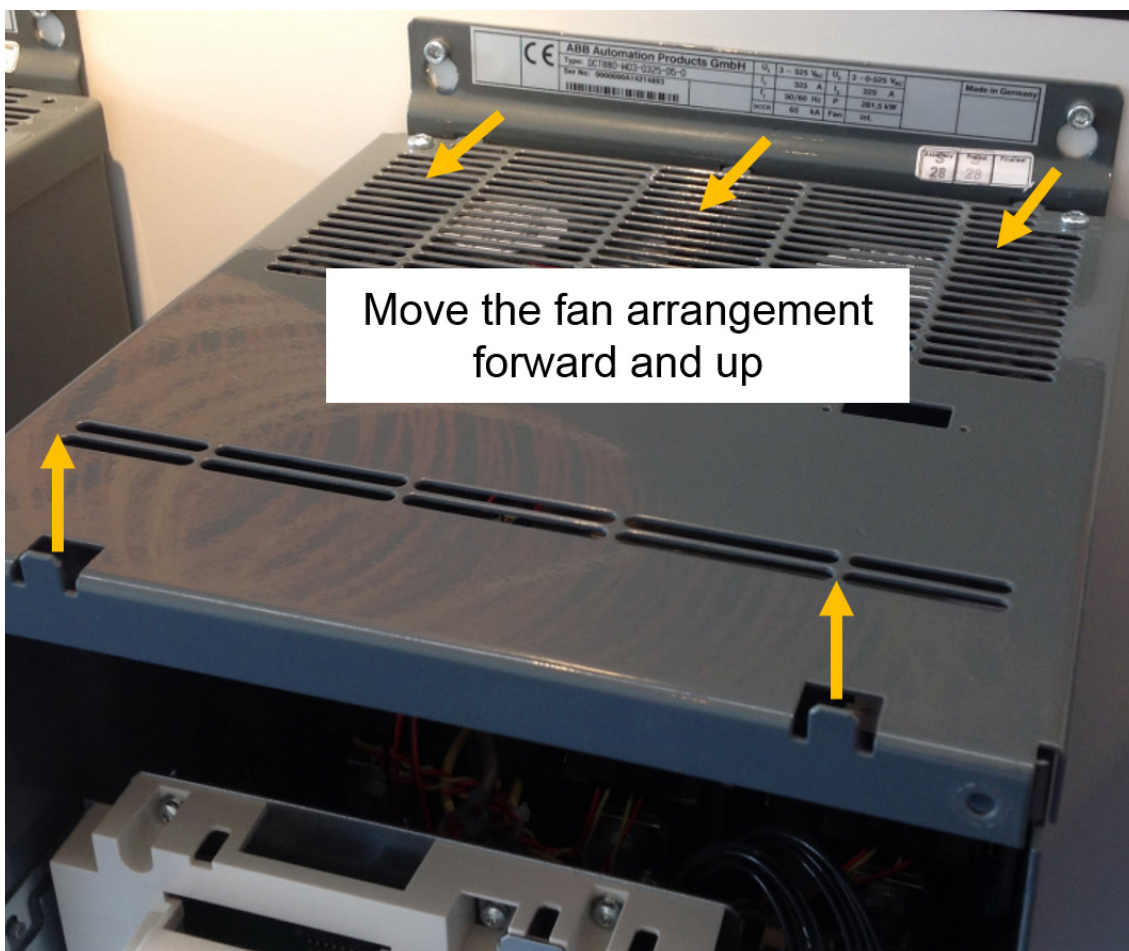
1. Remove the control panel and the design cover.



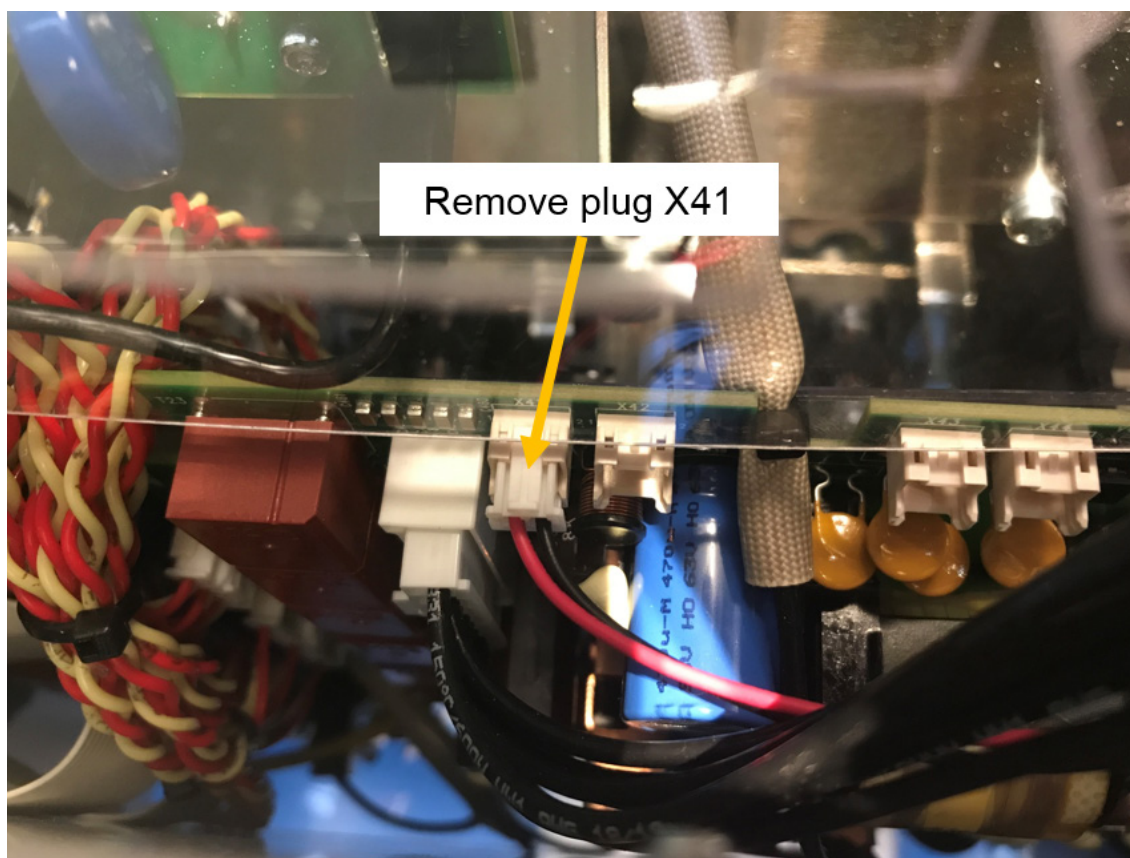
2. Remove the two fan arrangement screws.



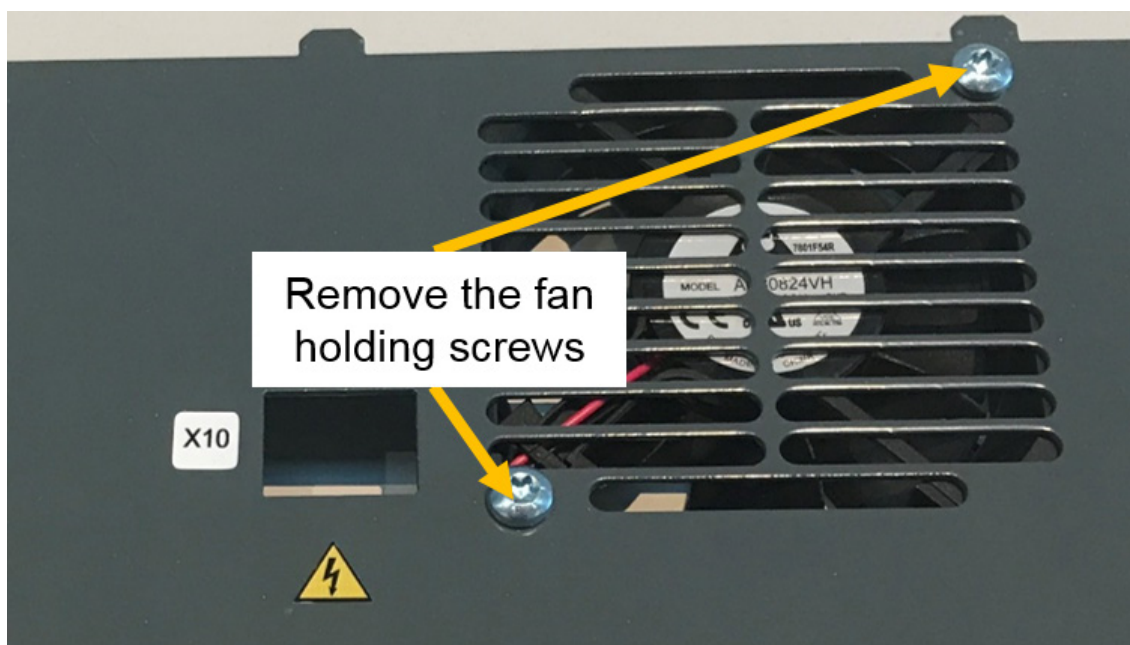
3. Move the fan arrangement forward and up.



4. Remove plug X41 on the SDCS-PIN-H01.



5. Remove the fan holding screws of the broken fan.



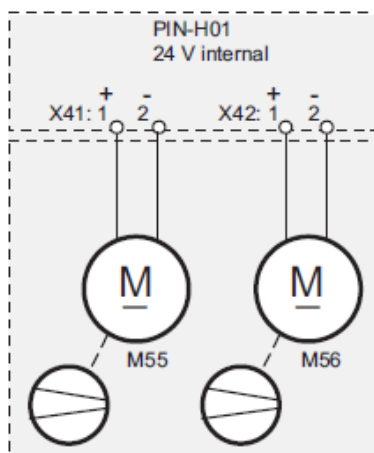
6. Attach the new fan, reassemble everything and check for correct blow direction the fan. The air should be sucked out of the module.

Exchange cooling fan sizes H2 ... H3 (two fans)



Before the work is started, disconnect the thyristor power controller completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Unit sizes DCS880-S0b-0135-dd ...
DCS880-S0b-0450-dd and using two 24 V_{DC}
fans.

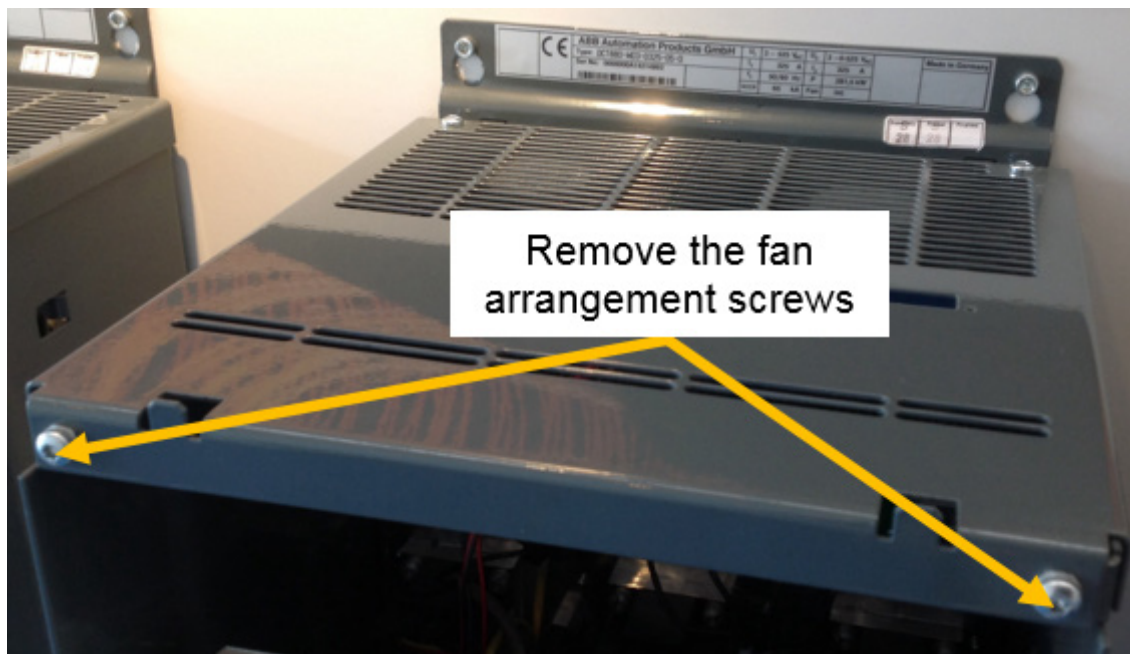


Removing the converter fan

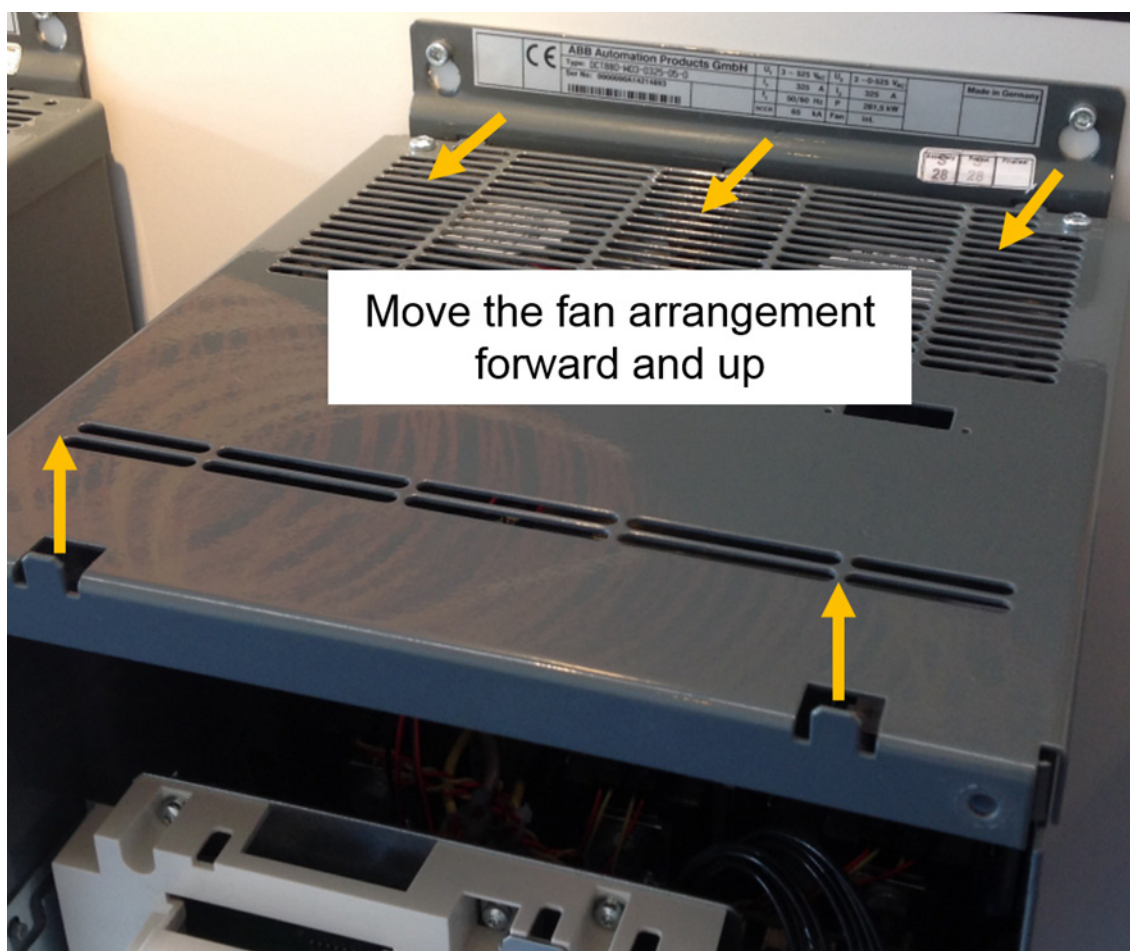
1. Remove the control panel and the design cover.



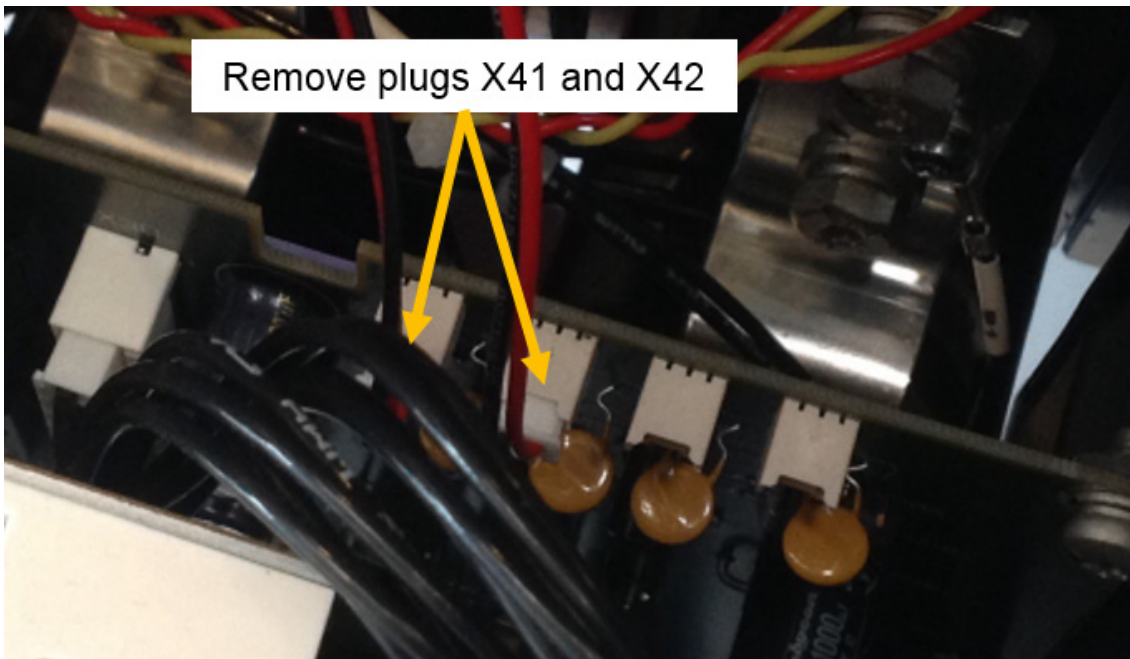
2. Remove the two fan arrangement screws.



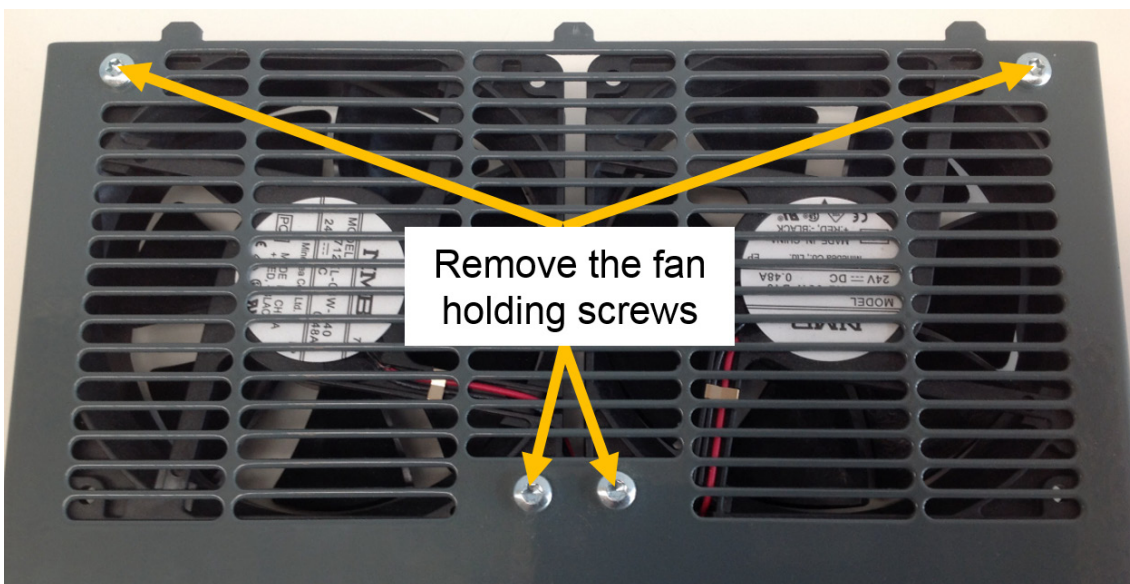
3. Move the fan arrangement forward and up.



4. Remove plugs X41 and X42 on the SDCS-PIN-H01.



5. Remove the fan holding screws of the broken fan.



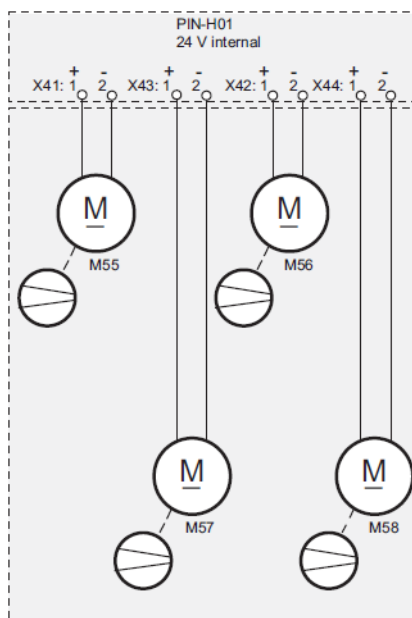
6. Attach the new fan, reassemble everything and check for correct blow direction of each fan. The air should be sucked out of the module.

Exchange cooling fan size H3 (four fans)



Before the work is started, disconnect the thyristor power controller completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Unit sizes DCS880-S0b-0470-dd ...
DCS880-S0b-0520-dd and using four 24 V_{DC} fans.

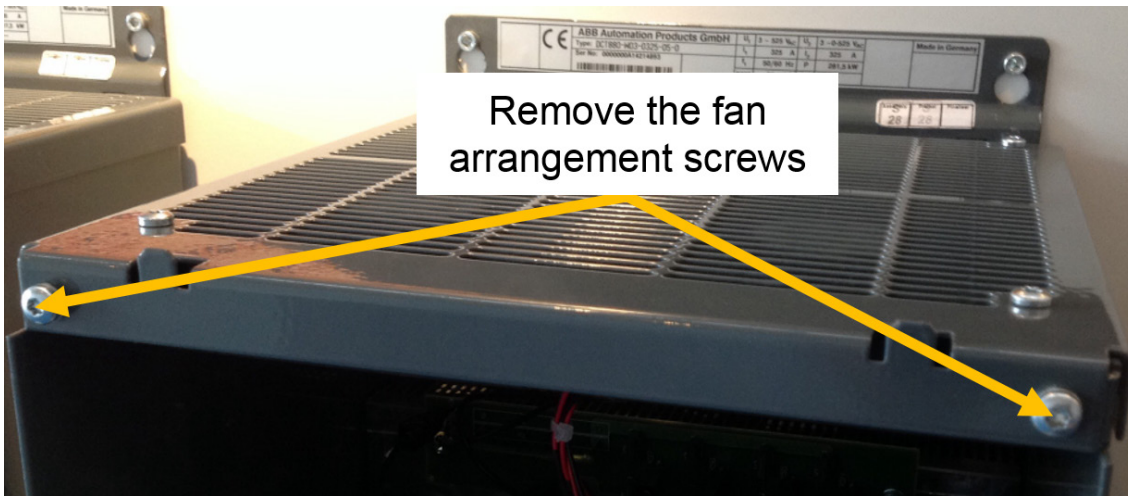


Removing the converter fan

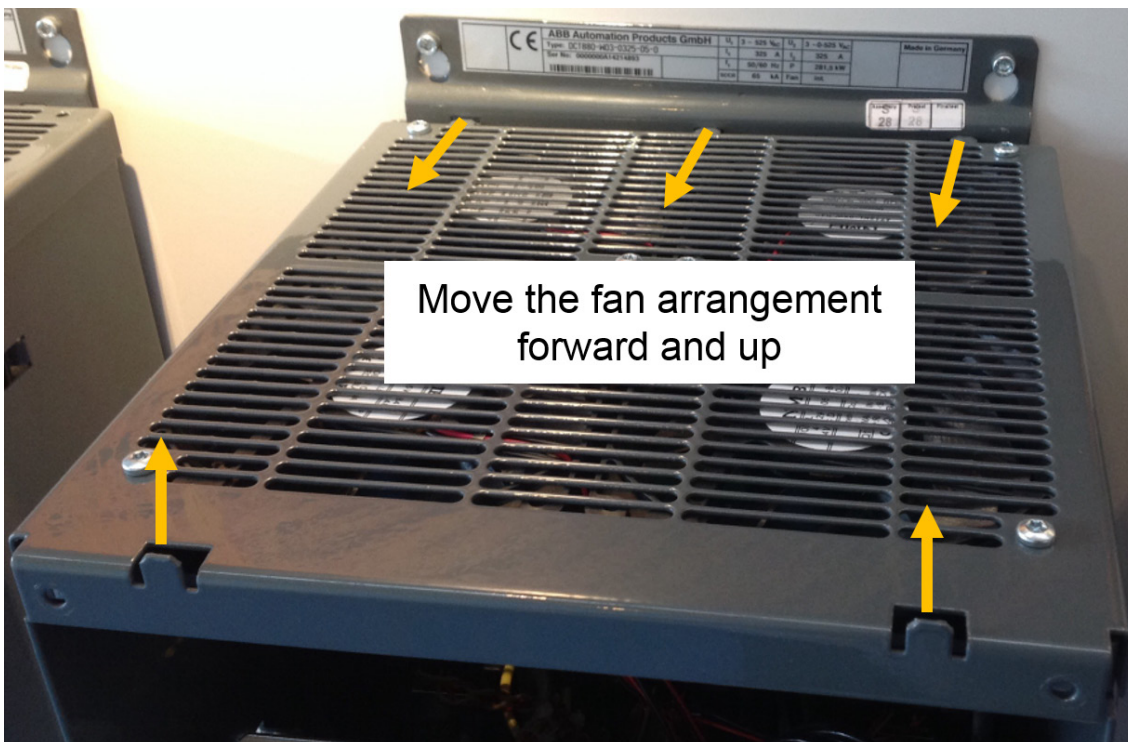
1. Remove the control panel and the design cover.



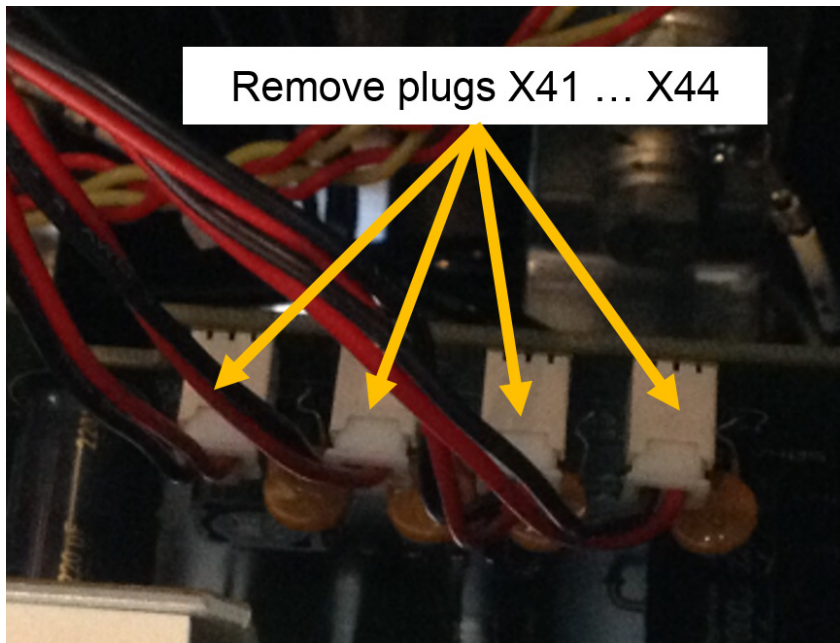
2. Remove the two fan arrangement screws.



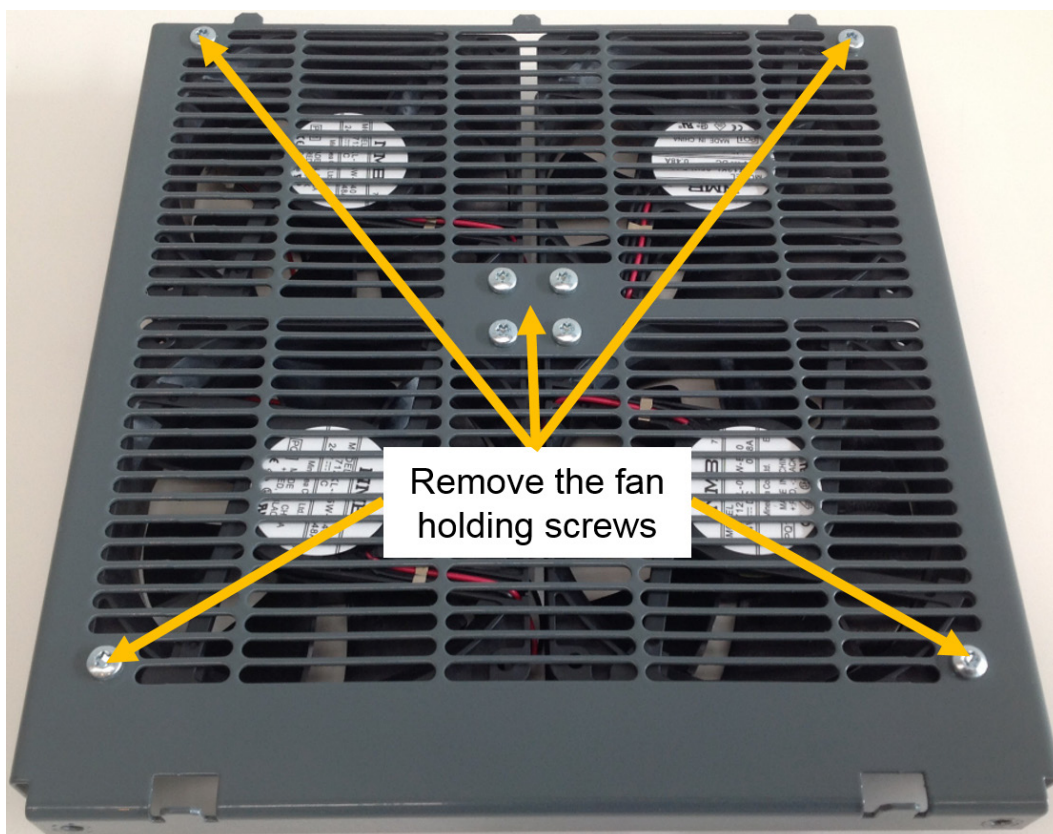
3. Move the fan arrangement forward and up.



4. Remove plugs X41 ... X44 on the SDCS-PIN-H01.



5. Remove the fan holding screws of the broken fan.



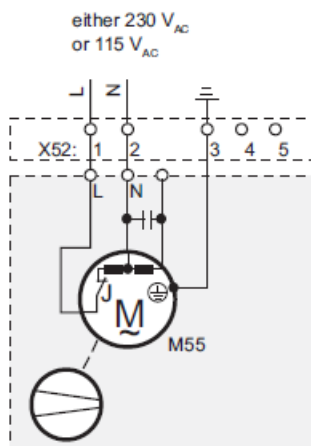
6. Attach the new fan, reassemble everything and check for correct blow direction of each fan. The air should be sucked out of the module.

Exchange cooling fan size H4



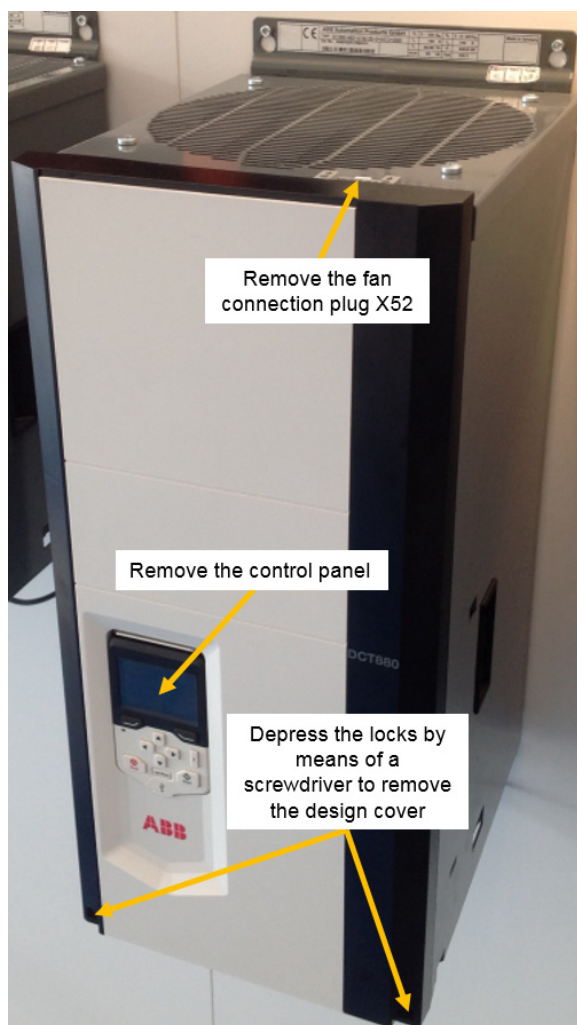
Before the work is started, disconnect the thyristor power controller completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Unit sizes DCS880-S0b-0610-dd ...
DCS880-S0b-1000-dd using either one 230 V_{AC} or one 115 V_{AC} fan.



Removing the converter fan

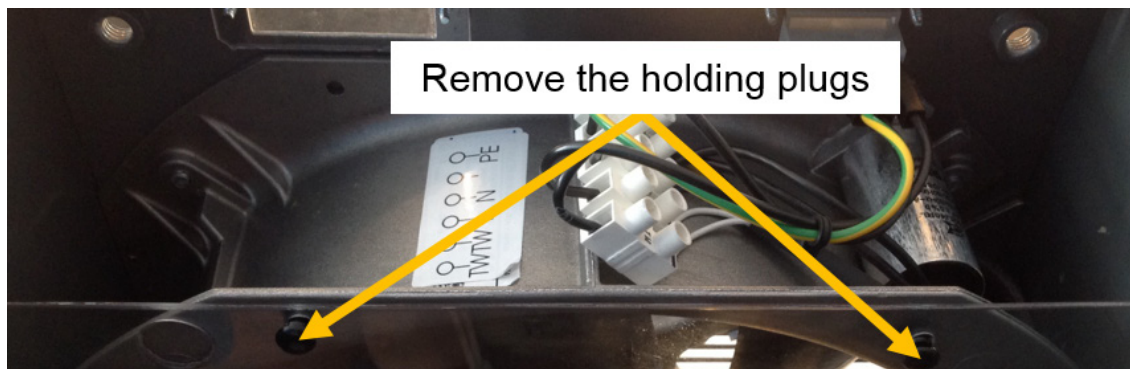
1. Remove the control panel, the design cover and the fan connection plug X52 on the top of the converter housing.



2. Remove the two fan arrangement screws.



3. Remove the holding plugs by pulling out the head (use a flat screwdriver).



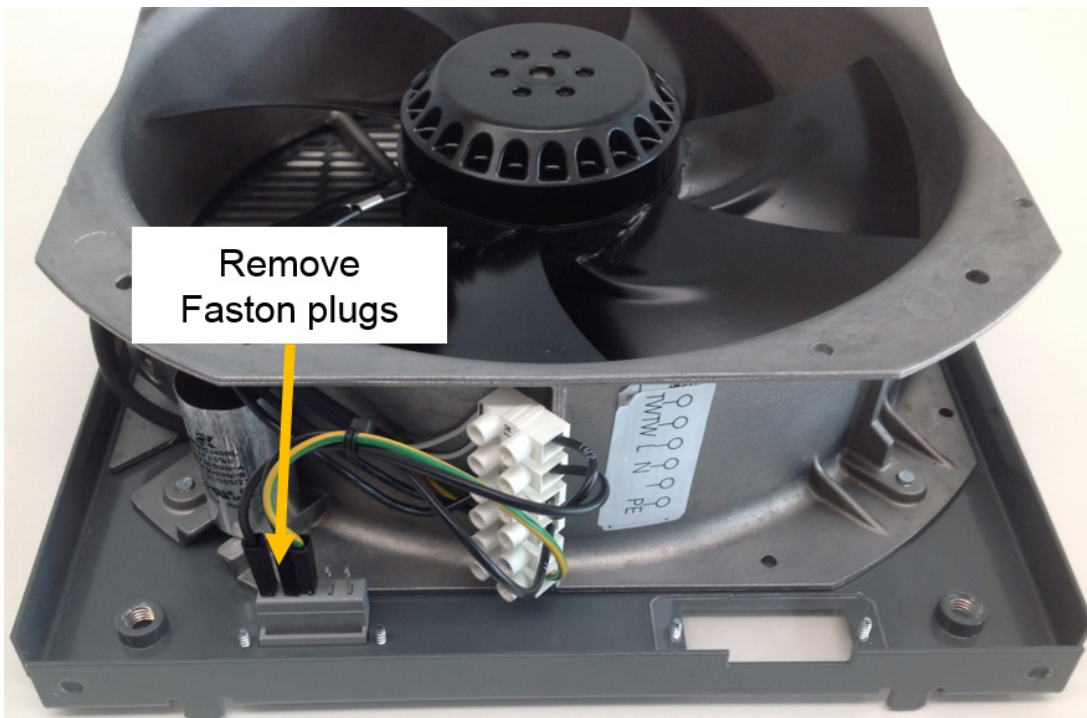
4. Move the fan arrangement forward and up.



5. Remove the fan holding screws.



6. Remove the Faston plugs from X52 and the broken fan.



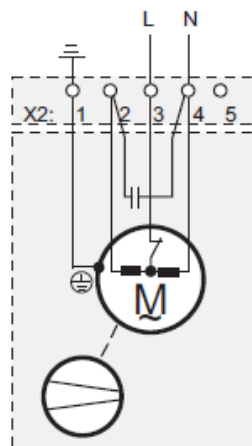
7. Attach the new fan, reassemble everything and check for correct blow direction of each fan. The air should be sucked out of the module.

Exchange cooling fan size H5

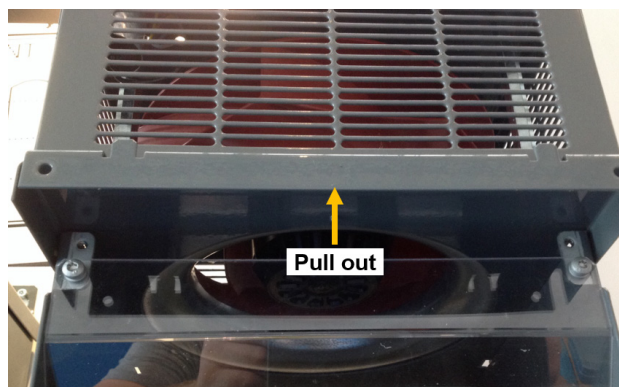
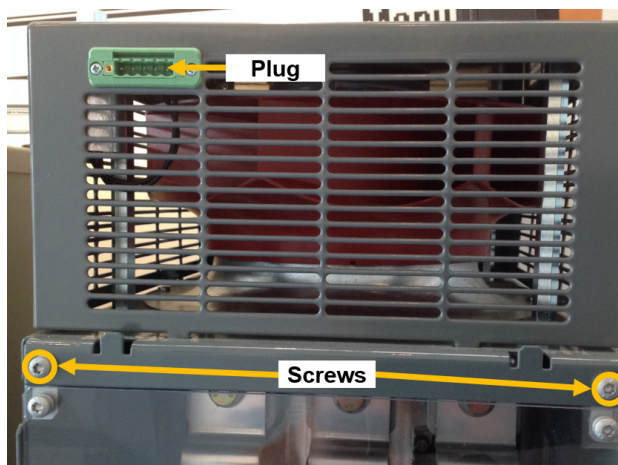


Before the work is started, disconnect the thyristor power controller completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Unit sizes DCS880-S0b-1190-dd using one 230 V_{AC} fan.



1. Remove both screws at the bottom of the fan arrangement.
2. Disconnect the plug.
3. Now the fan arrangement can be pulled out.

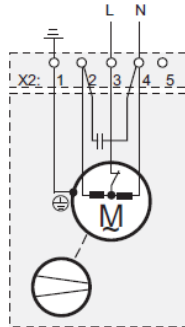


Exchange cooling fan size H6

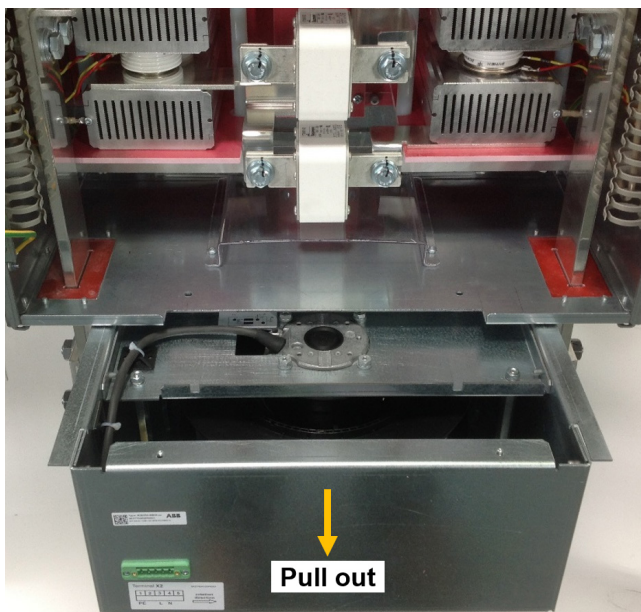
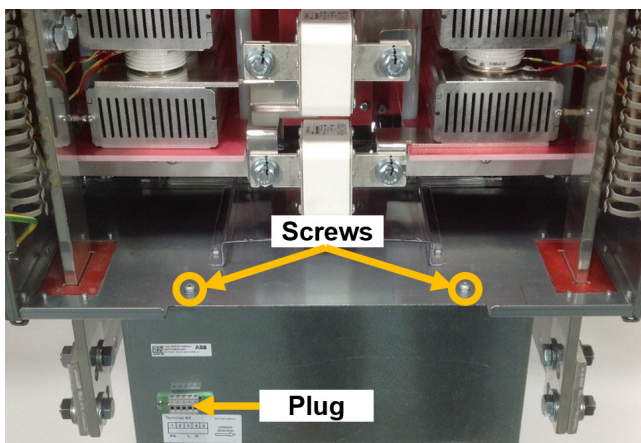


Before the work is started, disconnect the thyristor power controller completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Unit sizes DCS880-S0b-0900-dd ...
DCS880-S0b-2000-dd using one 230 V_{AC} fan.



1. Remove both screws at the top of the pull out box.
2. Disconnect the plug.
3. Now the fan box can be pulled out.

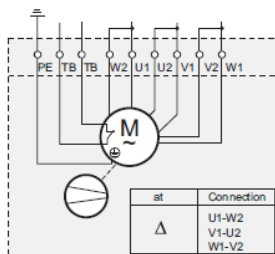


Exchange cooling fan size H7

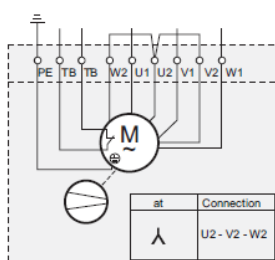


Before the work is started, disconnect the thyristor power controller completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Unit sizes DCS880-S0b-1900-d ...
DCS880-S0b-3000-dd using one fan in delta connection.
400 V_{AC}, 50 Hz or
460 V_{AC}, 60 Hz.



Unit sizes DCS880-S0b-1900-dd ...
DCS880-S0b-3000-dd using one fan in star connection.
500 V_{AC}, 50 Hz.



1. Disconnect the cables.
2. Remove the three screws at the top of the fan.
3. Lift the fan up and pull it out.

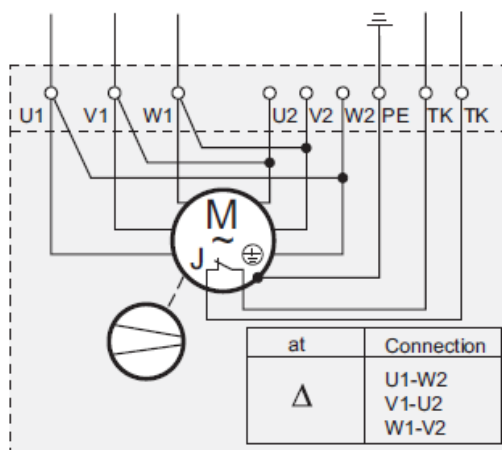


Exchange cooling fan size H8

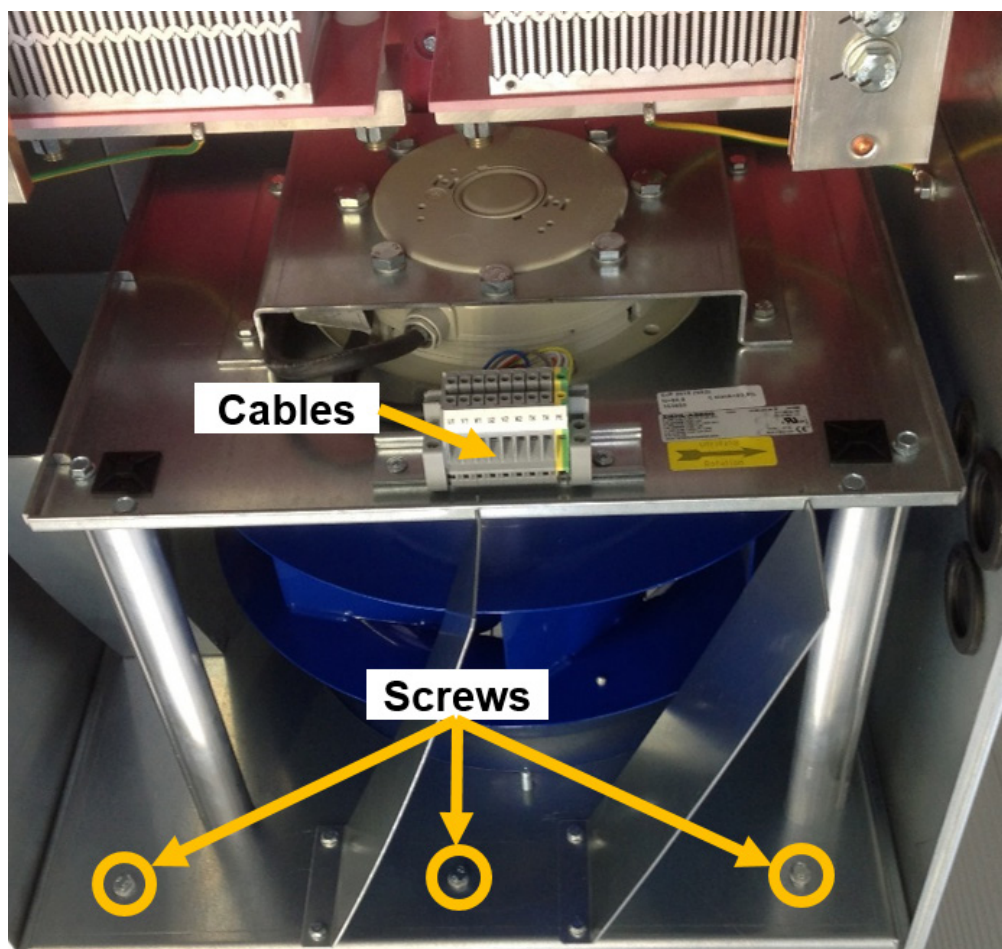


Before the work is started, disconnect the thyristor power controller completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

Unit sizes DCS880-S0b-2050-dd ...
DCS880-S0b-5200-dd using one fan.



1. Disconnect the cables.
2. Remove the three screws at the bottom of the fan.
3. Lift the fan up and pull it out.



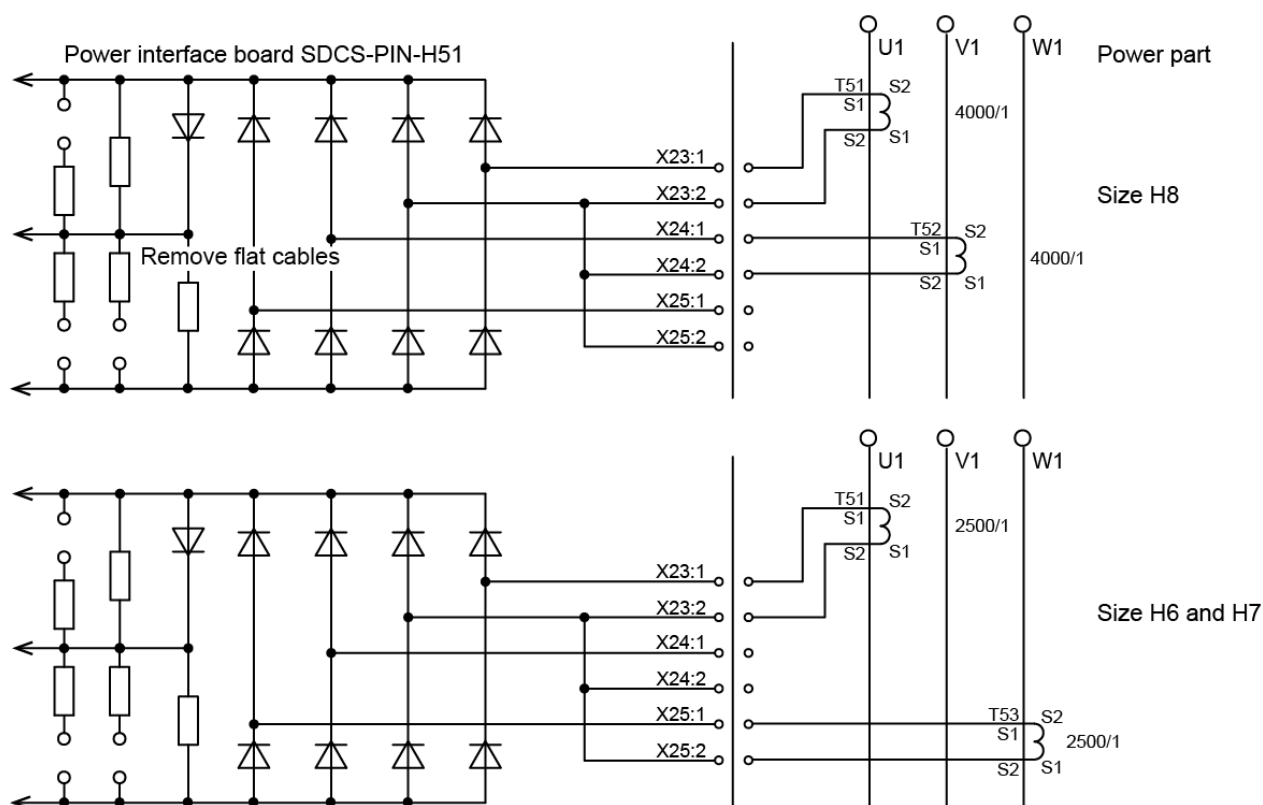
Exchange current transformers sizes H6 ... H8

Measuring the actual current

The control electronic of the drives is designed to use either 2 or 3 standard current transformers. They are located on the AC side of the bridge to measure the armature current.

Wiring

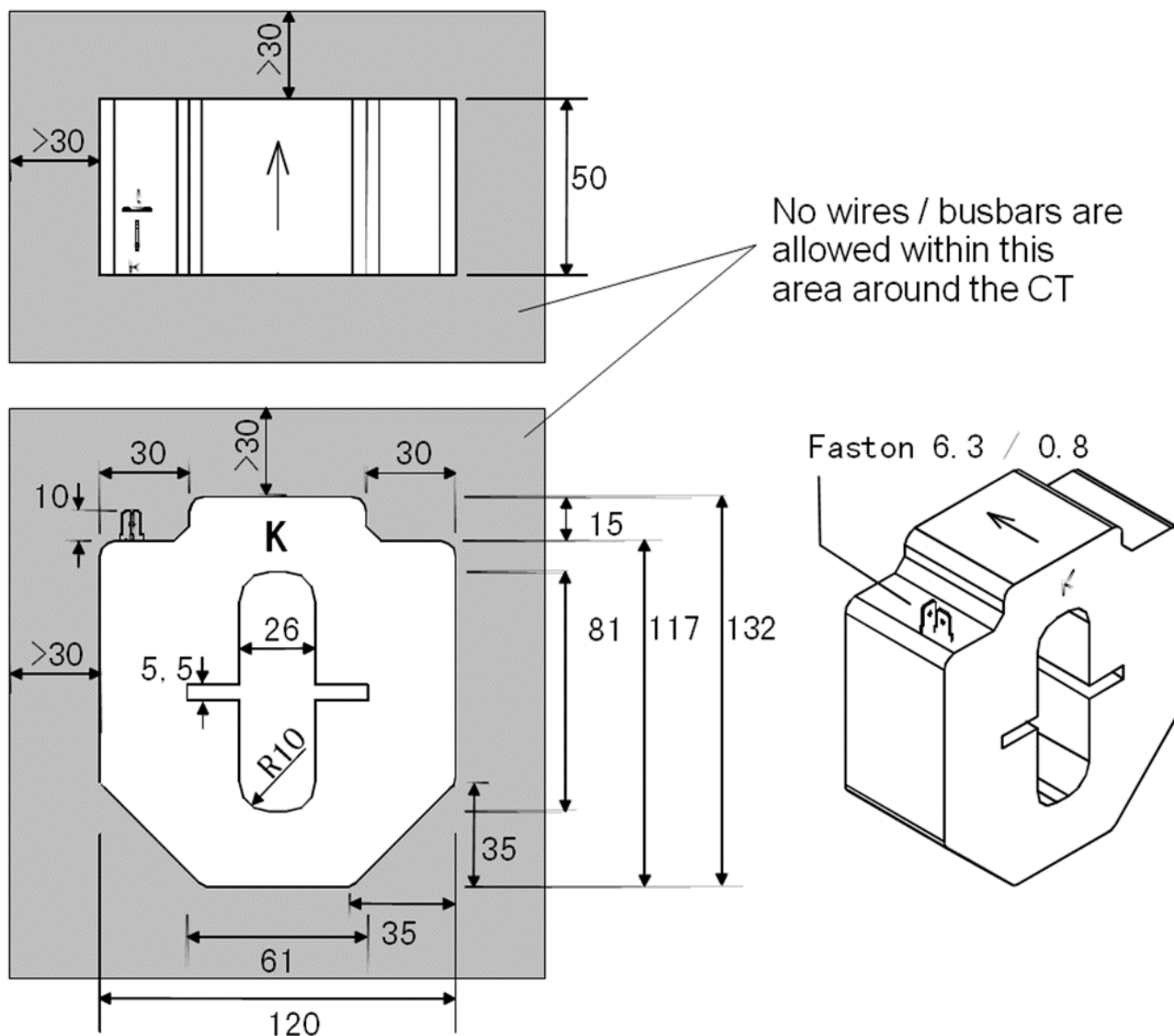
The wiring of the current transformers is basically identical for all drives. The figure below shows the most common configurations.



SF_880_031_PIN-H51_a.ai

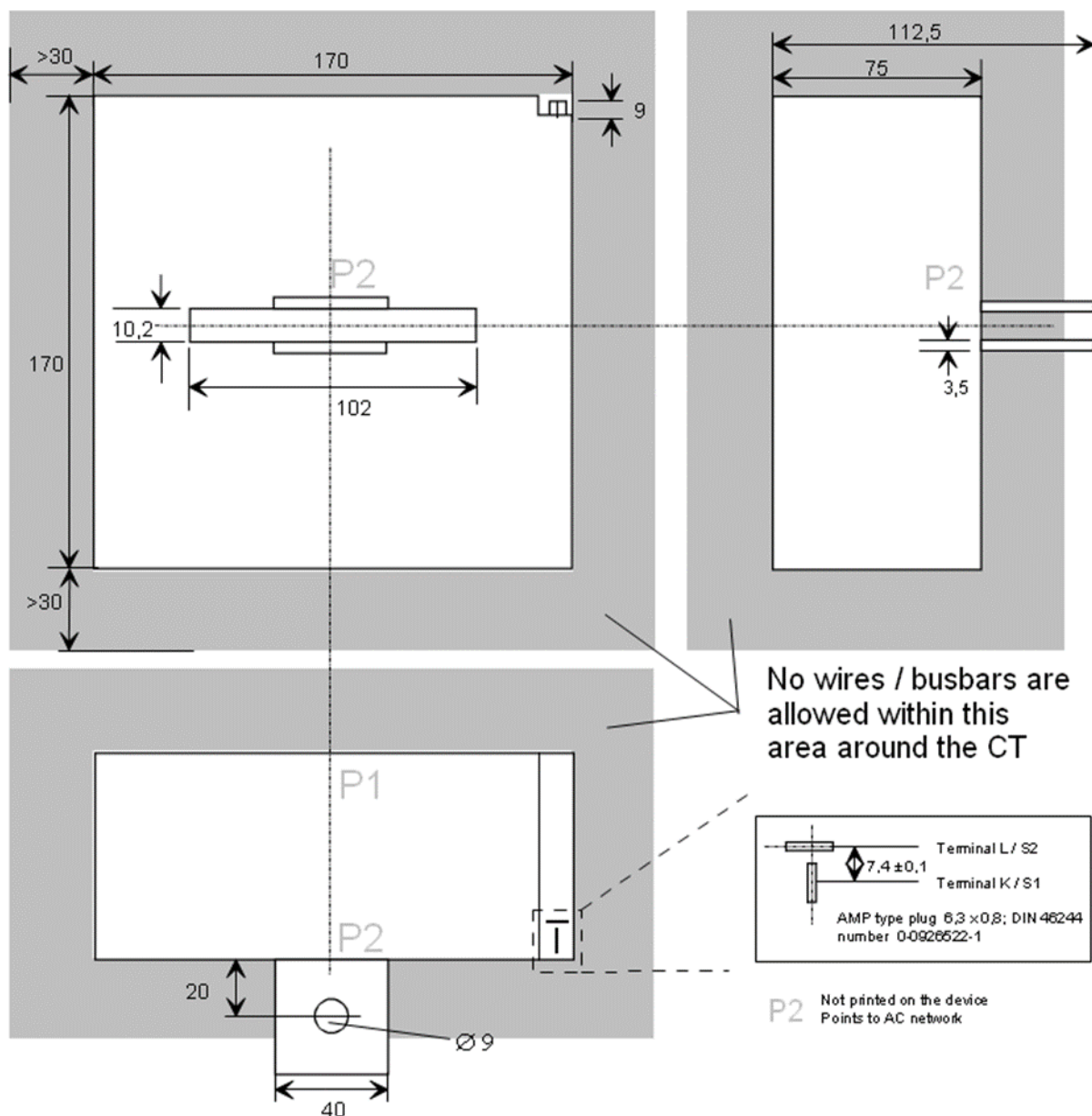
Current transformers for sizes H6 and H7

Type:	LT 2032.
Ordering number:	3ADT751010P0001.
Rated primary current:	3000 A _{AC} .
Rated secondary current:	1.2 A _{AC} .
Ratio:	2500 : 1.
Magnetic overload capacity for a short time:	3 times rated primary current.
Maximum rated voltage:	1500 V _{AC} .
Maximum test voltage:	5000 V _{AC} for less than 3 seconds.
Dimensions:	In mm, see figure below.
Weight:	1.7 kg.
Maximum ambient (e.g. cooling air) temperature at rated current:	55°C.
Maximum conductor (wire/busbar) temperature at rated current:	90°C.



Current transformers for size H8

Ordering number:	3ADT751007P0001.
Rated primary current:	5000 A _{AC} .
Rated secondary current:	1.25 A _{AC} .
Ratio:	4000 : 1.
Magnetic overload capacity for a short time:	3 times rated primary current.
Maximum rated voltage:	1200 V _{AC} .
Maximum test voltage:	4000 V _{AC} for less than 60 seconds.
Dimensions:	In mm, see figure below.
Weight:	1.7 kg.
Maximum ambient (e.g. cooling air) temperature at rated current:	55°C.
Maximum conductor (wire/busbar) temperature at rated current:	90°C.



Exchange current transformers size H6



Before the work is started, disconnect the converter completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

If current transformers fail or need to be repaired, the following has to be considered:

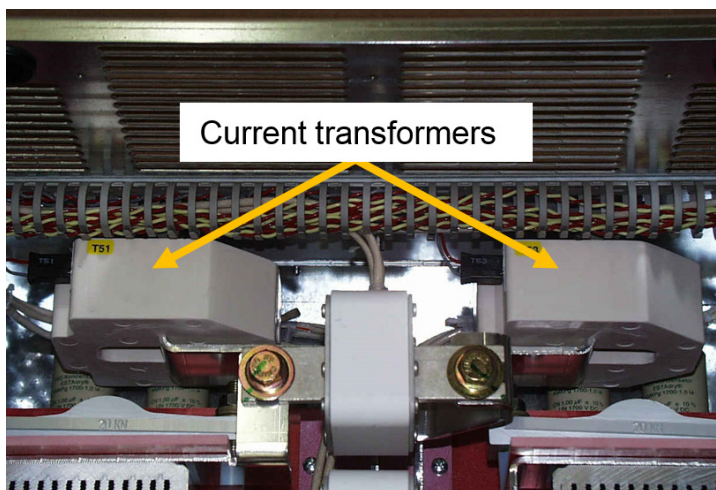
- It is important, that all current transformers are orientated and mounted in the same way on the busbars.
- Check the wiring of the old current transformers according the figure in chapter [Wiring](#). It is important, that all current transformers are wired in the same way. Take additional care in case the connection is not done by coded twisted pair cables.

Current transformer type

- The current transformers are located in the H6 module.
- AC busbars are routed through the current transformers. The current transformers are kept in place by design and need no further mounting.
- The connection to the electronics is done via twisted pair cables with coded faston plugs on both ends.

Exchange

- Disconnect the AC wires/busbars at the top of the drive.
- To get access to the current transformers remove the top panel of the converter's body.
- Now the old current transformers can be removed.
- Install the new current transformers with proper orientation. No extra mechanical mounting is necessary.
- Take care of proper electrical connections.
- Remount the top panel.
- Reconnect the AC wires/bus bars.



Exchange current transformers size H7



Before the work is started, disconnect the converter completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

If current transformers fail or need to be repaired, the following has to be considered:

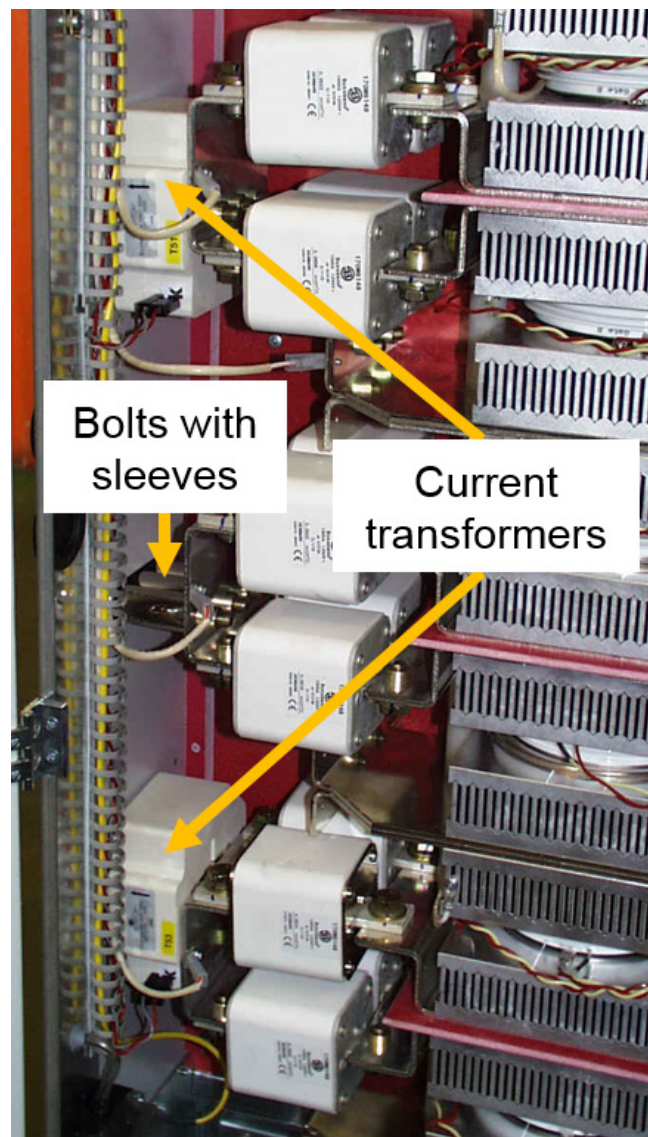
- It is important, that all current transformers are orientated and mounted in the same way on the busbars.
- Check the wiring of the old current transformers according the figure in chapter [Wiring](#). It is important, that all current transformers are wired in the same way. Take additional care in case the connection is not done by coded twisted pair cables.

Current transformer type

- The current transformers are located in the H7 module.
- AC busbars are routed through the current transformers. The current transformers are kept in place by design and need no further mounting.
- The connection to the electronics is done via twisted pair cables with coded faston plugs on both ends.

Exchange

- Remove the fuses connected to the busbars leading to the current transformers.
- To get access to the current transformers remove the bolts with sleeves from the AC busbars outside the converter.
- Make sure the current transformers are not falling down when removing the bolts and sleeves.
- Install the new current transformers with proper orientation. No extra mechanical mounting is necessary.
- Fasten the bolts including sleeves.
- Take care of proper electrical connections.
- Remount the fuses.



Exchange current transformers size H8



Before the work is started, disconnect the converter completely from the power supply, then check the voltage free condition and make sure, everything is located in an electrical and mechanical safe condition!

If current transformers fail or need to be repaired, the following has to be considered:

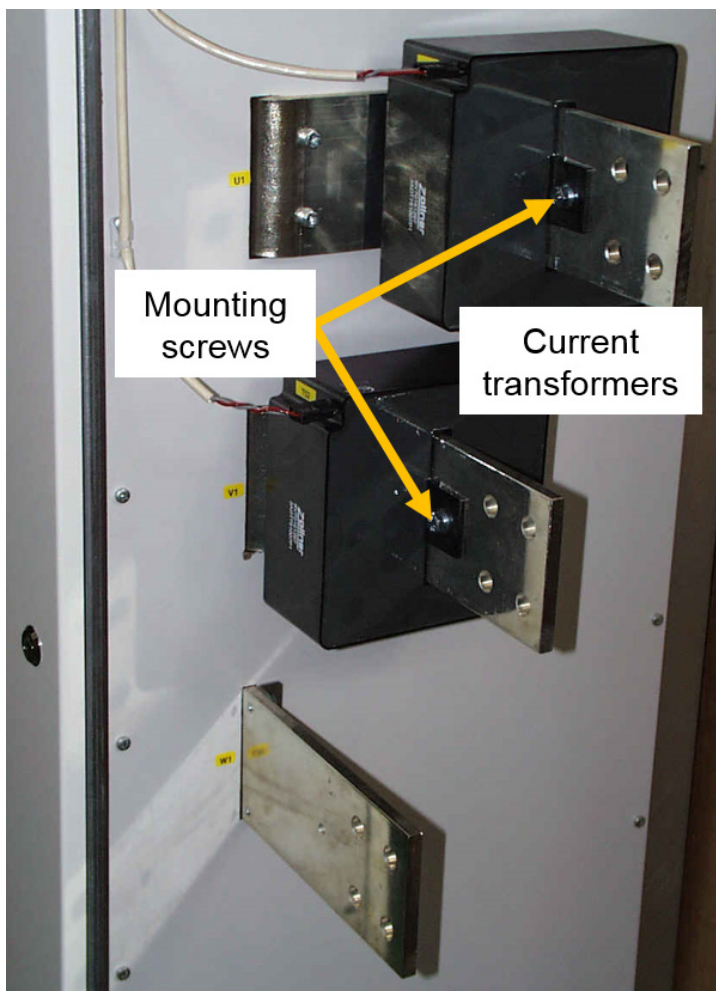
- It is important, that all current transformers are orientated and mounted in the same way on the busbars.
- Check the wiring of the old current transformers according the figure in chapter [Wiring](#). It is important, that all current transformers are wired in the same way. Take additional care in case the connection is not done by coded twisted pair cables.

Current transformer type

- The current transformers are located outside the H8 module.
- AC busbars are routed through the current transformers. The current transformers are mounted on the busbars by means of screws.
- The connection to the electronics is done via twisted pair cables with coded faston plugs on both ends.

Exchange

- Disconnect the AC wires / busbars at the side of the drive.
- Remove the mounting screws.
- Remove the old current transformers.
- Install the new current transformers with proper orientation.
- Fix the current transformers by means of the mounting screws.
- Take care of proper electrical connections.



DCS880 firmware download

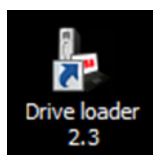
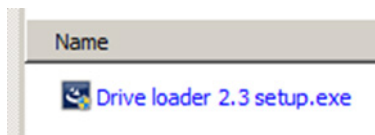
General

This file describes how to download firmware into the SDCS-CON-H01.

Download SDCS-CON-H01 firmware using the Drive loader 2.x

Installation

- Double click on *Drive loader 2.x setup.exe*.
- Follow the setup instructions.
- This installs the Drive loader 2.x.



Prepare firmware download

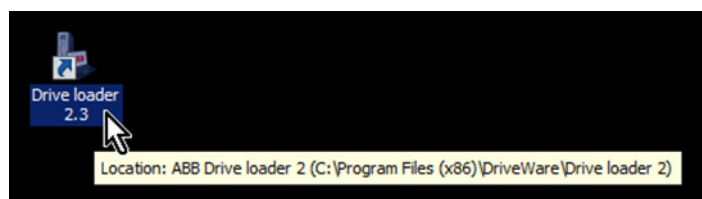
- The firmware download is setting all parameters back to default. Before starting, make a parameter backup using either the control panel or Drive composer.
- The firmware download deletes all application programs. Make sure that it is possible to re-load the application programs.
- The firmware download is done via a USB port and the control panel.



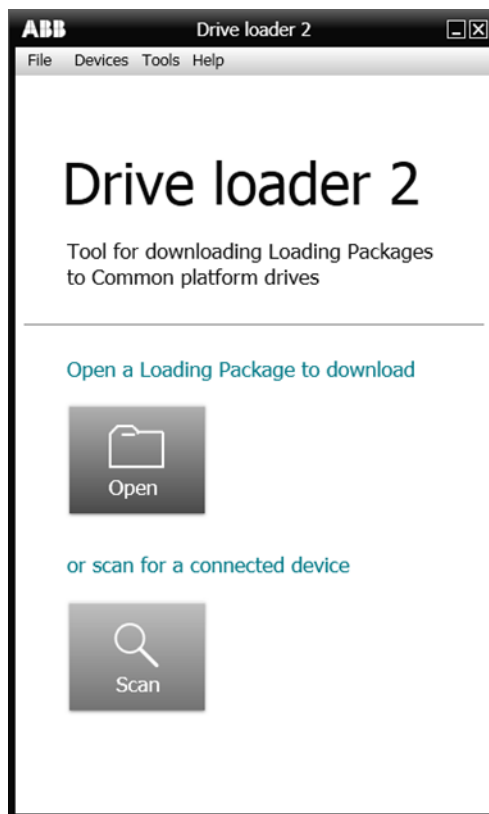
Firmware download

Make sure:

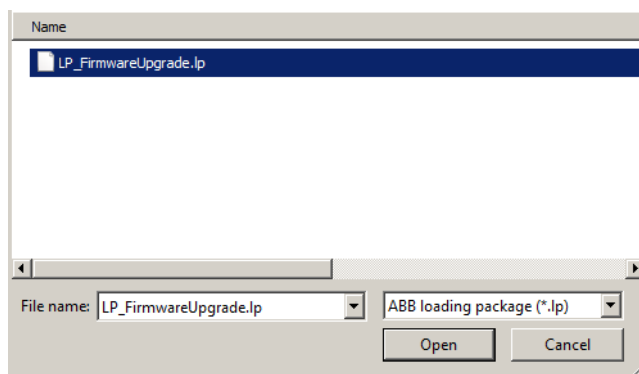
- The drive composer is closed.
- The DCS880 is done with booting (energized, auxiliary voltage is on).
- The control panel is only connected to **one** DCS880.
- Open the Drive loader 2.x by double click.



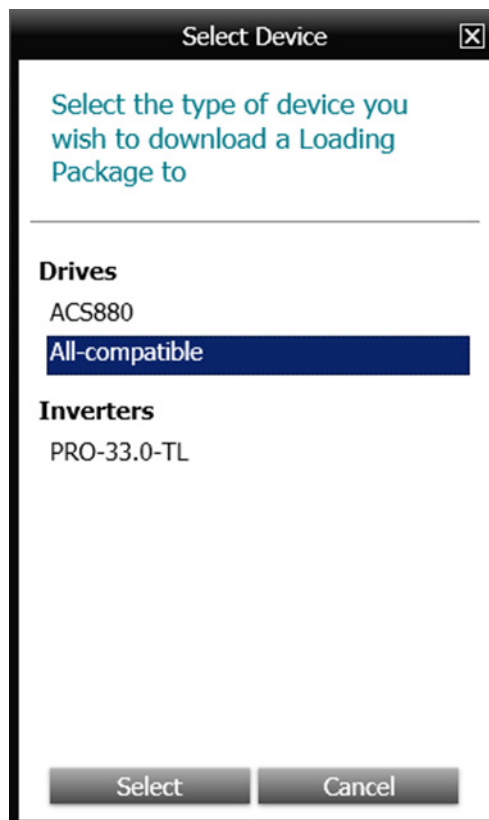
- Click *Open*.



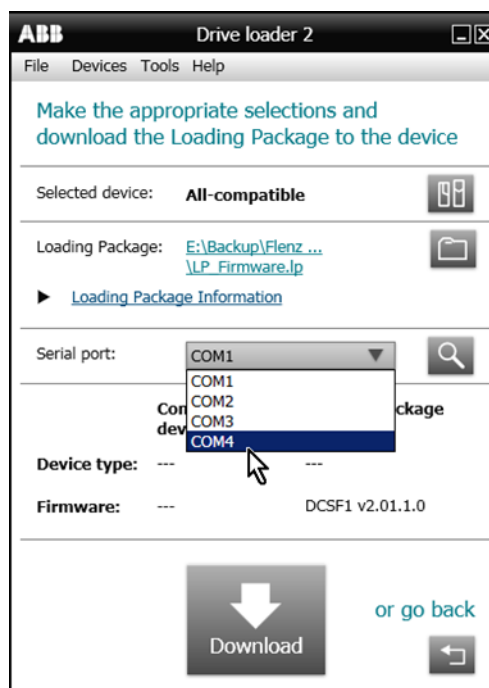
- Go to the folder containing the desired firmware file.
- Mark the desired firmware file and click *Open*.



- Mark *All compatible* and click *Select*.



- Choose the proper COM port, in this case COM4.
- How to find the proper COM port see below.

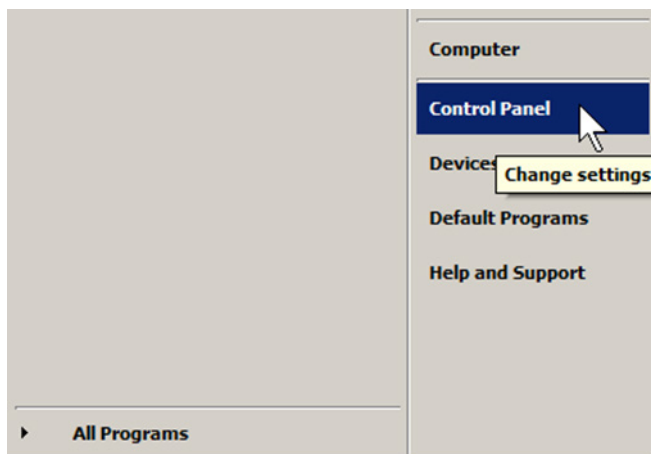


Find COM port

- To find the proper COM port click *Start*.



- Click *Control Panel*.



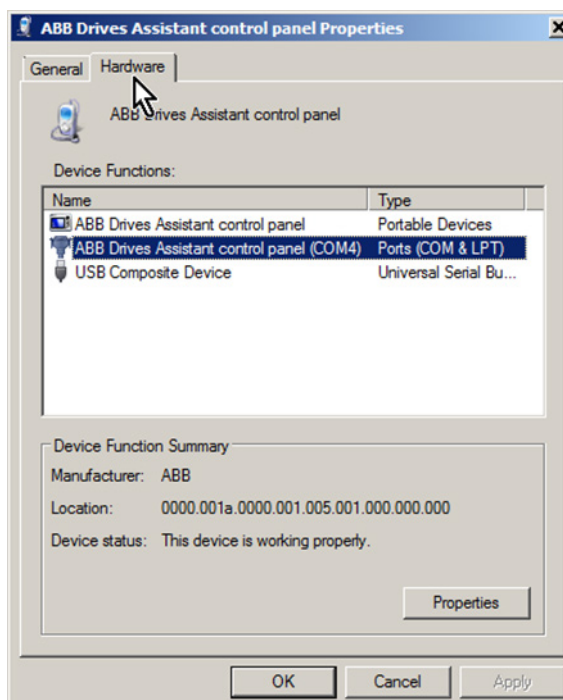
- Click *Devices and Printers*.



- Double click *ABB Drives Assistant control panel*.

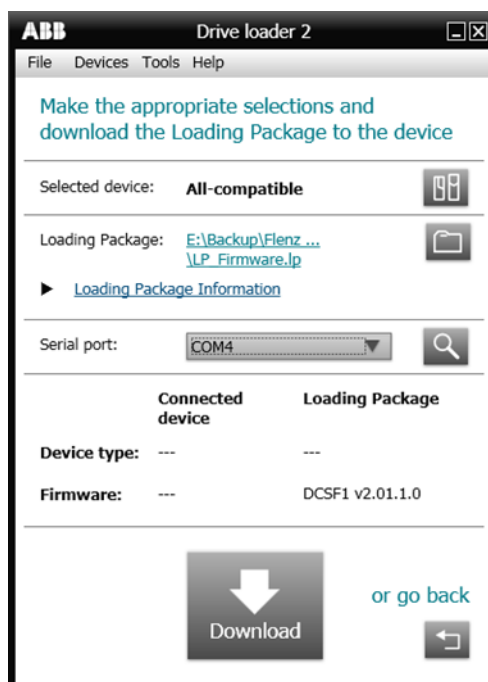


- Choose *Hardware*.
- The COM port can be found under *Device Functions*.
- Here COM5.

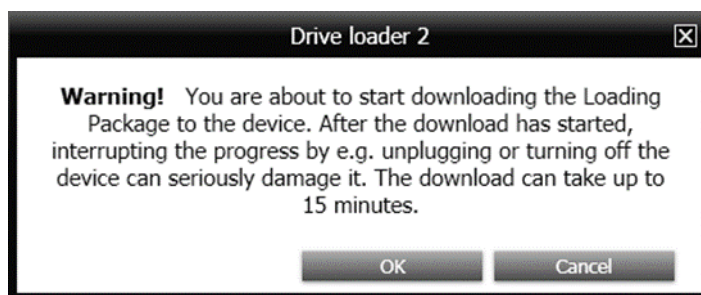


Continue firmware download

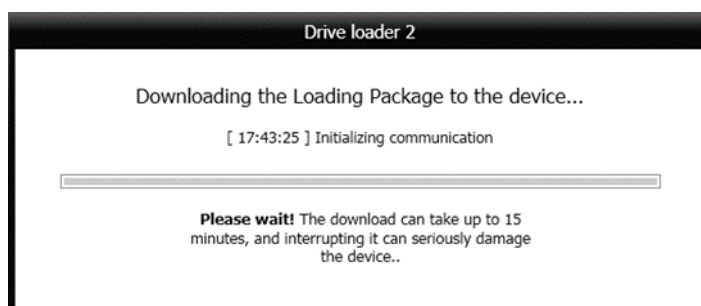
- Make sure the proper COM port (here COM4) is chosen.
- Click *Download*.



- Click *OK*.



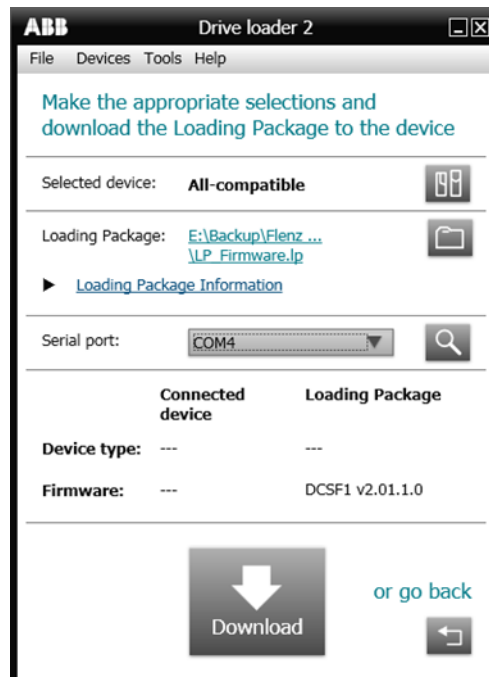
- Please wait and go for lunch!



- The firmware download is complete now.
- Click *OK*.



- Close the Drive loader 2.x.



- Check for proper firmware version in 07.05 Firmware ver.

Set type code

The type code - 95.25 Set: Type code - is preset in the factory and is write protected. It identifies the drives current-, voltage-, temperature measurement and its quadrant type. The type code can only be changed as whole or individually.

To change the type code as whole use the control panel and follow the instructions below:

- Un-protect the type code by means of 95.24 Service mode = Set: Type code.
- 95.25 Set: Type code = S01-0020-04 ... S02-5200-05 (details, see table below).

The drive's basic type code: DCS880-aab-cccc-ddef			
Product family:	DCS880		
Product type:	aa	= S0	Standard converter module
		= R0	Rebuild kit
		= E0	Panel solution
		= A0	Enclosed converter
Bridge type:	b	= 1	Single bridge (2-Q)
		= 2	2 anti-parallel bridges (4-Q)
Module type:	cccc	=	Rated DC current (IP00)
Rated AC voltage:	dd	= 04	100 V _{AC} ... 415 V _{AC}
		= 05	100 V _{AC} ... 525 V _{AC}
		= 06	270 V _{AC} ... 600 V _{AC}
		= 07	315 V _{AC} ... 690 V _{AC}
		= 08	360 V _{AC} ... 800 V _{AC}
		= 10	450 V _{AC} ... 990 V _{AC}
		= 12	540 V _{AC} ... 1200 V _{AC}
Power connection:	e	= X	Standard H1 ... H7
		= L	Left side H8
		= R	Right side H8
Revision code:	f	= 0	1 st generation

Attention: When using H1 ... H5 modules the current and voltage range of the type code setting is limited to max 1190 A_{DC} and max 600 V_{AC}.

- The change of the type code is immediately taken over and 95.24 Service mode is automatically set back to Normal mode.
- The new values can be seen in group 7:
 - 07.34 Drive block bridge 2 set.
 - 07.35 Drive DC current scaling set.
 - 07.37 Drive AC voltage scaling set.
 - 07.38 Drive max bridge temperature set.

To change the type code individually use the control panel and follow the instructions below:

- Un-protect the type code by means of 95.24 Service mode = Set: Type code.
- Set the type code individually by means of:
 - 95.26 Set: Drive block bridge 2.
 - 95.27 Set: Drive DC current scaling.
 - 95.28 Set: Drive AC voltage scaling.
 - 95.29 Set: Drive max bridge temperature.

The change of the type code is immediately taken over and 95.24 Service mode has to be set back to Normal mode by the user.

- The new values can be seen in group 7:
 - 07.34 Drive block bridge 2 set.
 - 07.35 Drive DC current scaling set.
 - 07.37 Drive AC voltage scaling set.
 - 07.38 Drive max bridge temperature set.

DC-Motor neutral zone adjustment

Types concerned

DC-Motors.

Summary

Procedure to adjust the neutral zone of a DC-motor.

General

- Loosen the bolts holding the brush bridge.
- Connect a scope or a voltmeter between two adjacent brush-holder assemblies (holders with different polarity).
- Set the scaling on the scope or voltmeter to mV AC.
- Disconnect the excitation cables and connect 110 ... 240 V_{AC} between F+ and F- (a normal extension cord is sufficient).
- Start moving the brush bridge slowly in one direction and watch the scope or voltmeter. If the voltage is increasing move the brush bridge in the other direction.
- Try to get the voltage down to less than 50 mV AC. The smaller the better.
- When this is achieved, start tightening the brush bridge bolts and watch the voltage. Sometimes you have to do a little offset to compensate for movements during tightening.
- Finally, mark the correct neutral zone position in case the motor will be taken apart in the future.

Preventive Maintenance

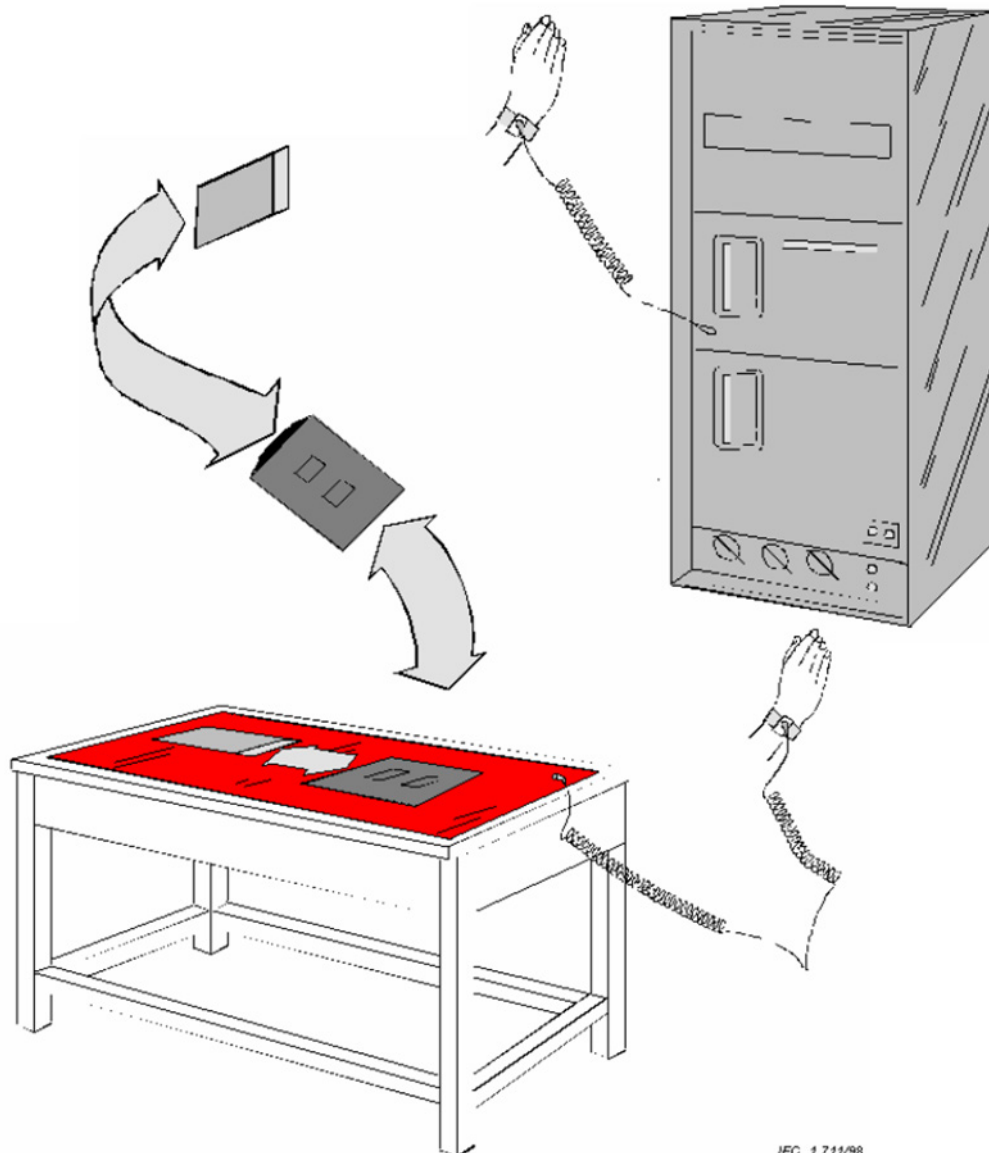


WARNING! Before performing any maintenance, the chapter [Safety Instructions](#) at the beginning of this manual must be followed. Negligence of these instructions can cause injury or death.



WARNING! The printed circuit boards contain components sensitive to electrostatic discharge. Use an [ESD-field service kit](#) when handling the boards. Do not touch the boards unnecessarily.

Handling the boards:



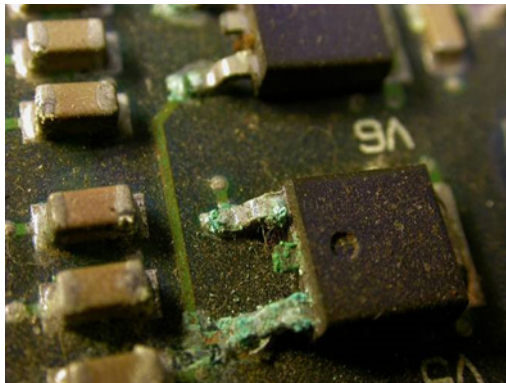
IEC 1711/98

When ESD sensitive boards are removed from the drive and transferred to a temporary work surface, they should be placed in a protective packaging.
Handle unprotected ESD sensitive boards only when connected to the system and always place them in a protective package that is sealed.
It is easiest to use the spare parts ESD package. Place the protective package on the ESD mat before opening.

Recommended regular maintenance

The DCS requires very little maintenance if installed in an appropriate environment. Regular inspection according to the maintenance schedule is strongly recommended. Preventive maintenance prevents unexpected production stop and production loss. It also increases availability of the drive.

The environmental and operating conditions of the drive are also to be considered.



A harsh environment, such as high ambient temperature, humidity, dust and cyclic heavy load, not only shortens the components lifetime but also the preventive maintenance and replacement intervals.

Maintenance schedule

	Years from start-up																					
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Start-up	P																					
Cooling																						
Air Cooled Unit:																						
Cooling fan DCS800 H7, H8		I	I	R	I	I	R	I	I	R	I	I	R	I	I	R	I	I	R	I	I	R
Cooling fan DCS800 H1 (> 25 A) ... H6		I	I	I	I	I	R	I	I	I	I	I	R	I	I	I	I	I	R	I	I	I
Aging																						
DCS800 Power interface board SDCS-PIN-H01							(R)			R			(R)						R			
DCS800 Power supply board SDCS-POW-H01							(R)			R			(R)						R			
Snubber Capacitor H8 (990 V _{AC} , 1190 V _{AC})										R									R			
Connections & Surroundings																						
Flat cables							(R)			R			(R)						R			
Tightness of terminals				I			I			I			I			I			I			I
Tightness of terminals, heatsink H8		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Door filters		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Condition of contactors				I			I			I			I			I			I			I
Fiber optic cables (connections)				I			I			I			I			I			I			I
Dustiness, corrosion and temperature		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Quality of supply voltage		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Improvements																						
Based on product notes		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Measurements																						
Basic measurements with supply voltage		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Spare Parts																						
Spare Parts		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

The service intervals and component replacements are based on the operational environment specified by ABB.

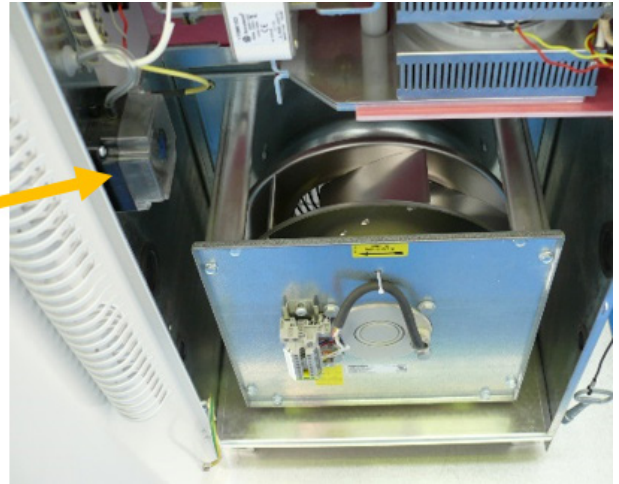
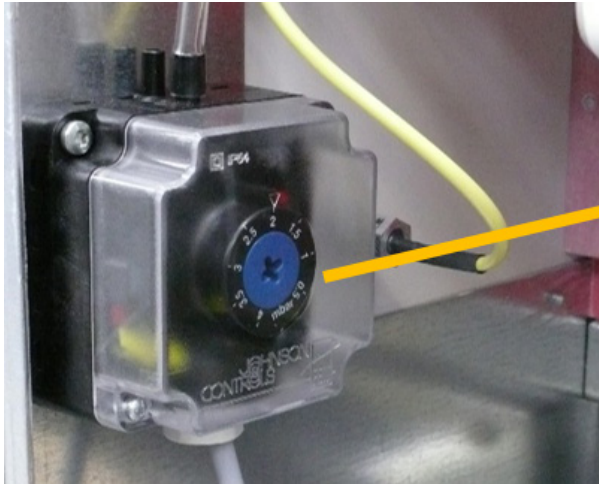
Legend:

- R = Replacement of component
- I = Inspection (visual inspection, correction and replacement if needed)
- P = Performance of on-site work (commissioning, tests, measurements, etc.)
- (R) = Replacement if high ambient temperature or cyclic heavy duty

Annual preventive maintenance

The following actions have to take place:

- Check the cooling fans of units H1 ... H8.
The lifetime of the cooling fan is about 30,000 ... 100,000 hours depending on the converter type, the usage of the DCS and the environmental conditions (e.g. temperature). Fan failure can be predicted by means of increasing noise from its bearings and a gradual rise of the heatsink temperature. If the DCS operates in a critical part of the process it is recommended to replace the fan once the above mentioned symptoms appear.
- Check the cooling air pressure switch of units H7 and H8.



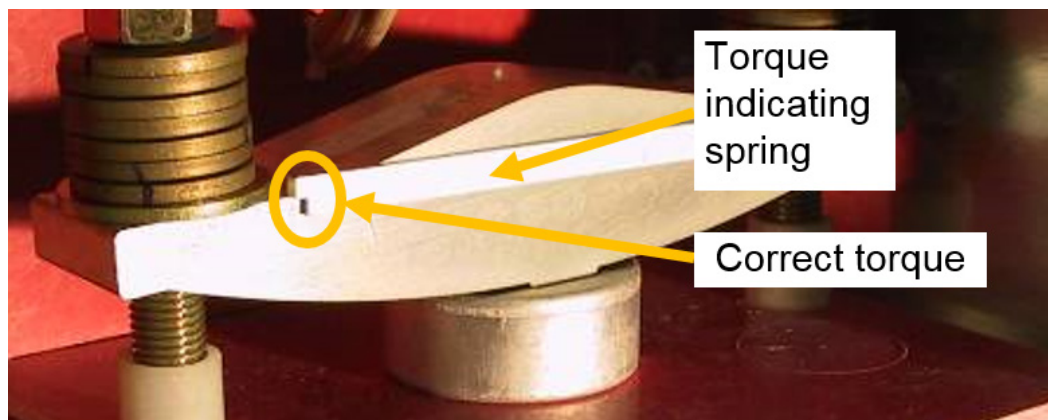
Actions:

- Make sure electrical safety is performed.
- Open the module's door and hold it in position to prevent any movement.
- Repeat it with the cabinet's door.
- Start the drive.
- The air pressure switch is ok when the converter is either switched off by 5080 Drive fan acknowledge or shows warning A518 Drive fan acknowledge - see 20.38 Drive fan acknowledge source. Crosscheck this result with the module's door closed.

Attention:

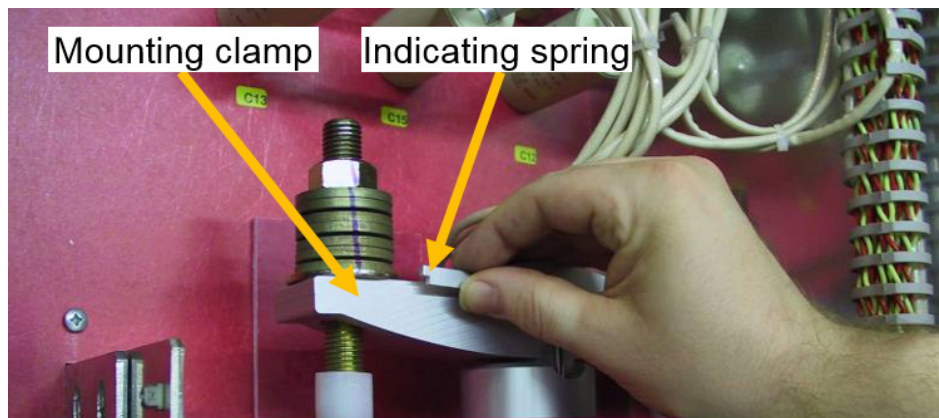
Do not reach into the fan. Negligence to this warning can cause injury.

- Check for tightness of unit stacks H6 ... H8.
The thyristors together with the heatsinks are stacked. The proper stack torque is shown by the torque indication spring:

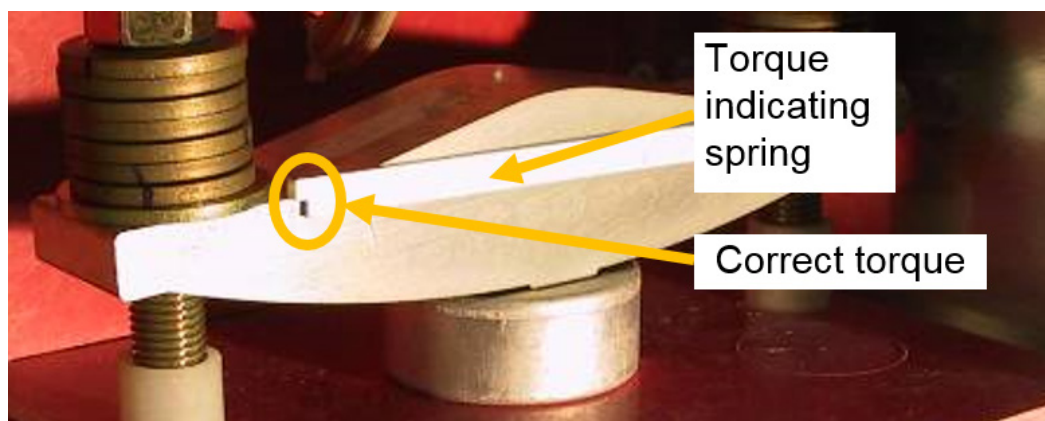


The correct torque has to be checked the following way:

- Make sure all supply voltages are switched off, most important the supply for the power part (armature), for the drive electronics (SDCS-POW-H01), for the converter fan and for other auxiliaries!
- Open the cabinet's and module's door; if needed secure them.
- Pull the torque indication spring a little bit out:



- Release the torque indication spring. It has to snap back into position "correct torque":



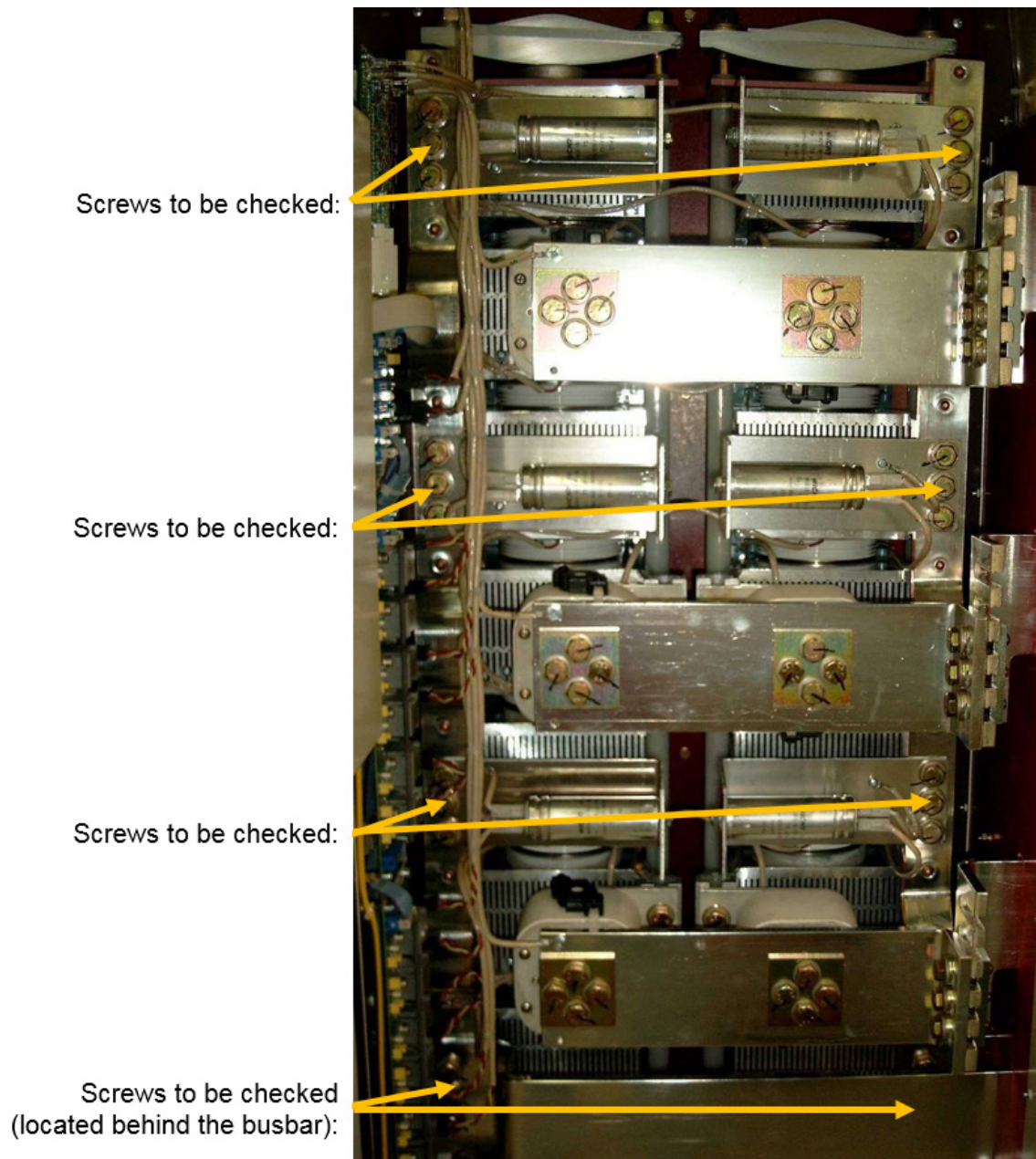
- If the torque indicating spring does not snap back into position "correct torque" the stack has to be retorqued otherwise everything is fine.
- Tighten each nut in turn, half a turn at a time with the help of a ring spanner until the indicating spring clicks into position "correct torque". Do not tighten the screws any further.

- Check for tightness of heatsink terminals of units H8.
The thyristors together with the heatsinks are stacked. Every single thyristor is connected to the DC+ and DC- busbars via flexible copper busbars. These busbars consist of 10 layers of pre-shaped sheet copper. This construction is able to compensate for small changes in length caused by temperature rise when current is flowing. The screw fixings between heatsink and flexible copper busbar have to withstand different types of mechanical stress.

Therefore each fixing needs to be checked for correct torque.

Actions:

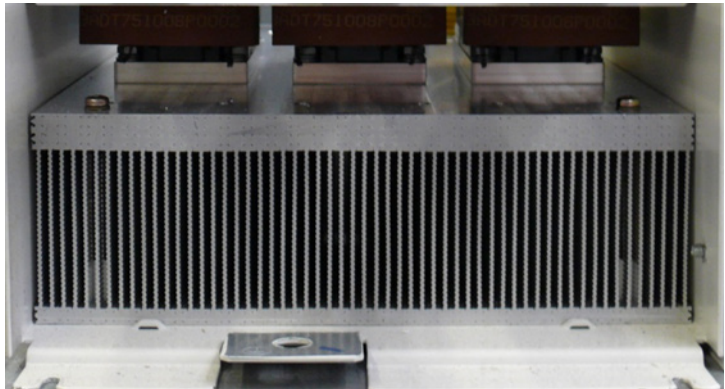
- Make sure all supply voltages are switched off, most important the supply for the power part (armature), for the drive electronics (SDCS-POW-H01), for the converter fan and for other auxiliaries!
- Open the cabinet's and module's door; if needed secure them.
- Set a latching torque spanner to 25 Nm (18 lb-ft). A 17 mm nut is needed too.
- Check the torque of the screws marked within the next figure.
- Apply the torque spanner to the screw and turn right until the right torque is indicated.
- Don't loosen the screws by a left hand turn!
- Put on a new marking, if appropriate.



- Check the door air filters.
- Clogged up filters prevent proper cooling of the drive. Wash dirty filters with water (60°C) and detergent.



- Check for dust, corrosion and temperature inside the module/cabinet. The DCS will run into overtemperature faults if the heatsinks are not clean.
- Pre-clean the heatsinks using an [ESD vacuum cleaner](#) then use compressed air to remove the dust from the heatsinks (the airflow must be from bottom to top). Fan rotation caused by the compressed air must be stopped in order to prevent damage.
- Use an [ESD vacuum cleaner](#) to clean the dust from the air inlet, air outlet, the interior of the cabinet and the electronic boards.
- Any signs of corrosion, especially at ground components, must be removed.



- Check the quality of the supply voltage (e.g. deviation from nominal voltage value, ...).

3 years preventive maintenance

Following additional actions have to take place:

- Replace the cooling fans of units H7 and H8:

- [Exchange cooling fan size H7.](#)

- [Exchange cooling fan size H8.](#)

The manufacturer's estimation for the operational time of the cooling fans is:

- GR28C-2DK 30,000 hours at 40°C.

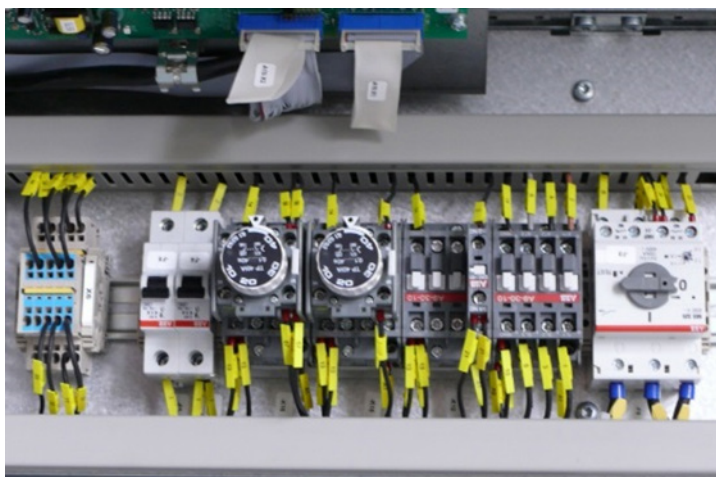
- GR35C-2DD 30,000 hours at 40°C.

The mayor problem is the failure of the bearings. The cooling fans are used in:

DCS880-S0b-1900-dd ... DCS880-S0b-3000-dd	H7	GR28C-2DK 400 V / 500 V
DCS880-S0b-2050-dd ... DCS880-S0b-5200-dd	H8	GR35C-2DD 400 V

Aging of the components result in:

- Increased vibration due to the imbalance of the cooling fan (can last for several months).
- Increased temperature due to the stopped cooling fan (drive trips with overtemperature).
- Check the tightness of all terminals.
- All connections should be inspected and checked for tightness.
- Check the condition of the contactors and relays.
- Contactors and relays should be checked for proper function.
- Check the fiber optic cables and their connections.



6 years preventive maintenance

Following additional actions have to take place:

- Replace the cooling fans of units H5 and H6:

- [Exchange cooling fan size H5.](#)

- [Exchange cooling fan size H6.](#)

The manufacturer's estimation for the operational time of the cooling fans is:

- R2E250-RB 40,000 hours at 40°C.

The mayor problem is the failure of the bearings. The cooling fans are used in:

DCS880-S0b-1190-dd	H5	R2E250-RB
DCS880-S0b-0900-dd ...	H6	230 V
DCS880-S0b-2000-dd		

Aging of the components result in:

- Increased vibration due to the imbalance of the cooling fan (can last for several months).
- Increased temperature due to the stopped cooling fan (drive trips with overtemperature).

- Replace the cooling fans of units H1 ... H4.

- [Exchange the cooling fan size H1 \(one fan\).](#)

- [Exchange the cooling fan sizes H2 ... H3 \(two fans\).](#)

- [Exchange the cooling fan size H3 \(four fans\).](#)

- [Exchange the cooling fan size H4.](#)

The manufacturer's estimation for the operational time of the classic cooling fans is:

- 3110UL: 70,000 hours at 25°.
- AFB122: 100,000 hours at 25°.
- W2E200: 45,000 hours at 60°C.
- W2E250: 40,000 hours.

The mayor problem is the failure of the bearings. The cooling fans are used in:

DCS880-S0b-0045-dd ... DCS880-S0b-00100-dd	H1	1 x 3110UL 24 V internal
DCS880-S0b-0135-dd ... DCS880-S0b-0300-dd	H2	2 x AFB122 24 V internal
DCS880-S0b-0315-dd ... DCS880-S0b-0450-dd	H3	2 x 3110UL 2 x AFB122 24 V internal
DCS880-S0b-0610-dd ... DCS880-S0b-0820-dd	H4	1 x W2E200 230 V
		1 x W2E200 115 V (plus code E171)
DCS880-S0b-0900-dd ... DCS880-S0b-1000-dd		1 x W2E250 230 V
		1 x W2E250 115 V (plus code E171)

Aging of the components result in:

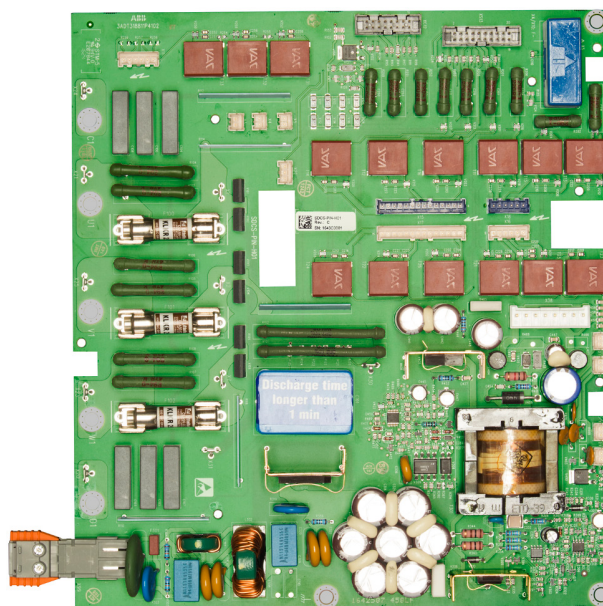
- Increased vibration due to the imbalance of the cooling fan (can last for several months).
- Increased temperature due to the stopped cooling fan (drive trips with overtemperature).

- Check the flat cables and their connections.

9 years preventive maintenance

Following additional actions have to take place:

- Replace the power interface board SDCS-PIN-H01 of units H1 ... H5 (DCS880-S0b-0020-dd ... DCS880-S0b-1190-dd).
- The SDCS-PIN-H01 is located between the heat sink and the electronic tray. It operates continuously, because it supplies the drive electronics even when the armature current is switched-off. Therefore, all its components are exposed to hot conditions.
- Additionally the electrolytic capacitors on the SDCS-PIN-H01 are aging. The SDCS-PIN-H01 also is equipped with several capacitors, which are sensitive to high ambient temperature.
- Aging of the components result in:
 - Damage other devices.
 - Trip the drive and cause breakdown time.

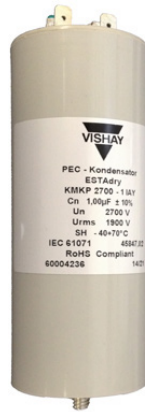


- Replace the power supply board SDCS-POW-H01 of units H6 ... H8 (DCS880-S0b-0900-dd ... DCS880-S0b-5200-dd) and DCS880-R (Rebuild- and Upgrade Kits).
- The SDCS-POW-H01 is located between the module door on the electronic tray. It operates continuously, because it supplies the drive electronics even when the armature current is switched-off. Therefore all its components are exposed to hot conditions.
- Additionally the electrolytic capacitors on the SDCS-POW-H01 are aging. The SDCS-POW-H01 also is equipped with several capacitors which are sensitive to high ambient temperature.
- Aging of the electronic card result in:
 - Damage other devices.
 - Trip the drive and cause unexpected shutdown.



- Replace the flat cables of all units H1 ... H8. Environmental conditions, especially temperature and humidity could cause corrosion on the contact surfaces and embitterment of the insulation.
- Aging of the flat cables result in:
 - Contact problems.
 - Flat cable insulation breaks.

- Replace the snubber capacitors of units H8. 990 V_{AC} and 1190 V_{AC} only.



Preventive maintenance checklist for DCS880

Type of drive:		Frame size:	
Serial number:		Year of initial startup:	
Last inspection:		Drive name:	

	Inspection cycle	H1	H2	H3	H4
1. Environment					
1.1 Checking the environment.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.2 Documentation checked and available.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.3 Checking the spare parts.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Maintenance with no voltage applied					
2.1 Cleaning with ESD vacuum cleaner and/or soft brushes:					
Converter and cabinet.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Air inlet and outlet filters (replace/clean if IP54 or if needed).	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fins of fan.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heat sinks.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2 Relays & connections:					
Inspect relays/contacts for proper functionality.	3 years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inspect electrical connections for tightness.	3 years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inspect for proper grounding.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inspect for corrosion.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inspect tightness of stacks (torque indicating spring).	yearly		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inspect tightness of heatsink terminals (25 Nm required).	yearly				<input type="checkbox"/>
Inspect connection of fiber optical cables.	3 years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inspect connection of flat cables.	6 years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Maintenance with main supply voltage applied					
Create parameter backup.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Test cooling air pressure switch.	yearly			<input type="checkbox"/>	<input type="checkbox"/>
Check level of all connected voltages.	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inspect condition of fans (check that all fans are operational).	yearly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Inspection cycle	H1 ...H5	H6	H7	H8
4. Preventive Replacements					
4.1 Flat cables:					
SDCS-CON-H01 ... SDCS-PIN-H01 (XC12, XS13, X38).	9 years	<input type="checkbox"/>			
SDCS-CON-H01 ... SDCS-PIN-H51 (XC12).	9 years		<input type="checkbox"/>		
SDCS-CON-H01 ... SDCS-PIN-H41 (XS13).	9 years		<input type="checkbox"/>		
SDCS-PIN-H41 ... SDCS-PIN-H41 (XS23 ... XS13).	9 years		<input type="checkbox"/>		
SDCS-CON-H01 ... SDCS-POW-H01 (X38).	9 years		<input type="checkbox"/>		
SDCS-OPL-H01 ... SDCS-PIN-H51 (XC12).	9 years			<input type="checkbox"/>	<input type="checkbox"/>
SDCS-OPL-H01 ... SDCS-PIN-H41 (XS13).	9 years			<input type="checkbox"/>	<input type="checkbox"/>
SDCS-PIN-H41 ... SDCS-PIN-H41 (XS23 ... XS13).	9 years			<input type="checkbox"/>	<input type="checkbox"/>
SDCS-OPL-H01 ... SDCS-POW-H01 (X38).	9 years			<input type="checkbox"/>	<input type="checkbox"/>
4.2 Boards and other parts:					
SDCS-PIN-H01.	9 years	<input type="checkbox"/>			
SDCS-POW-H01.	9 years		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Snubber capacitors frame size H8. 990 V _{AC} and 1190 V _{AC} only.	9 years				<input type="checkbox"/>
4.3 Fans:					
Cooling fan frame size H1 ... H6.	6 years	<input type="checkbox"/>	<input type="checkbox"/>		
Cooling fan frame size H7, H8.	3 years			<input type="checkbox"/>	<input type="checkbox"/>

Inspect = visual inspection, correction and replacement if needed.

Remarks:

Date of inspection:

Name of field service engineer:

Appendix: Spare Parts List

[illegible]

DCS Family



DCS550-S modules The compact drive for machinery application

20 ... 1,000 A_{DC}
0 ... 610 V_{DC}
230 ... 525 V_{AC}
IP00

- Compact
- Robust design
- Adaptive and winder program
- High field exciter current



DCS880 modules For safe productivity

20 ... 5,200 A_{DC}
0 ... 1,600 V_{DC}
230 ... 1,000 V_{AC}
IP00

- Safe torque off (STO) built in as standard
- Compact and robust
- Single drives, 20 A to 5,200 A, up to 1,600 V_{DC}
- IEC 61131 programmable
- Intuitive control panel and PC tool with USB connection and start up assistant
- Wide range of options to serve any DC motor application



DCS800-A enclosed converters Complete drive solutions

20 ... 20,000 A_{DC}
0 ... 1,500 V_{DC}
230 ... 1,200 V_{AC}
IP21 – IP54

- Individually adaptable to customer requirements
- User-defined accessories like external PLC or automation systems can be included
- High power solutions in 6- and 12-pulse up to 20,000 A, 1,500 V
- In accordance to usual standards
- Individually factory load tested
- Detailed documentation



DCT880 modules Thyristor controller

16 ... 4,200 A_{DC}
110 ... 190 V_{DC}
IP00

- Precise power control in industrial heating applications
- Two or three phase devices
- Power optimizer for peak load reduction
- Built on ABB's all-compatible drives architecture
- Intuitive control panel and PC tool with USB connection and start up assistant
- Application control programs and drive application programming with IEC 61131-3 programming



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