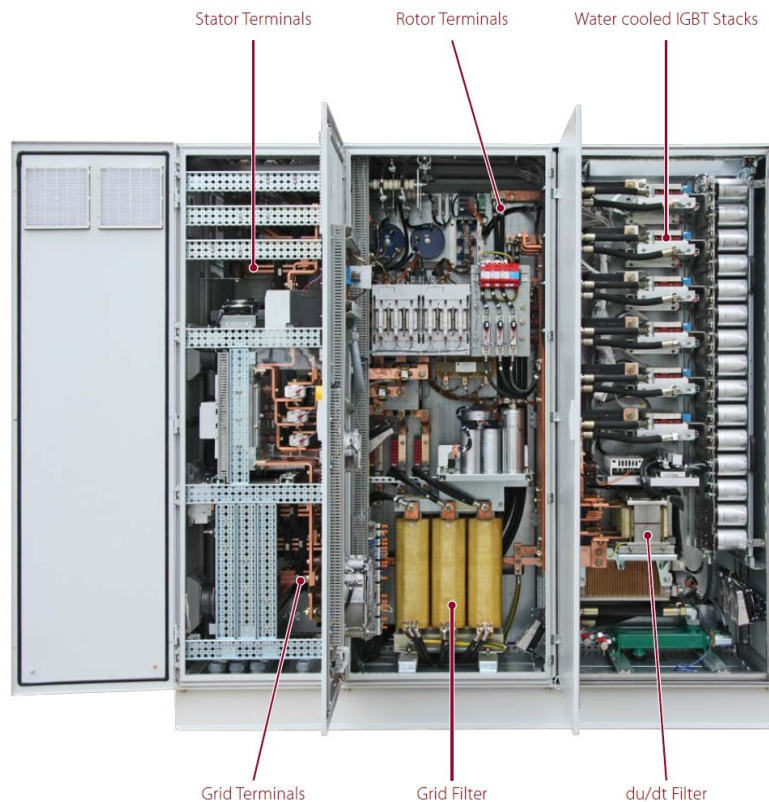




(Exemplary view)

Maintenance Manual NGx

KP-40642gb_td_maintenance_manual_ngx_rev.H

ConverterTec reserves the right to update any portion of this publication at any time. Information provided by ConverterTec is believed to be correct and reliable. However, ConverterTec assumes no responsibility unless otherwise expressly undertaken.

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1. Preliminary remarks

This maintenance manual is valid exclusively in conjunction with CONCYCLE® Wind Frequency Converter Systems from the company ConverterTec. ConverterTec reserves the right to deviate from this maintenance manual through the separate publication of special, type-based instructions.

**NOTE!**

Maintenance work on CONCYCLE® Wind Frequency Converters must only be carried out by ConverterTec personnel or by electrical specialists correspondingly trained by ConverterTec and authorized at the time of the performance of the maintenance!

Maintenance work on converters with a nominal operating voltage above 1000 V must only be carried out by correspondingly trained personnel who can demonstrate the necessary authorization for work on the converters.

Electrical measurements must not be carried out by persons who, on the basis of their training or previous work experience, are not classified as electrical specialists as defined by the BGFE (employers' liability insurance association).

It is an explicit requirement that such persons must only perform maintenance work under the supervision of an electrical specialist and with the switching system free of voltage.

Maintenance personnel who have acquired the qualification to carry out work on electrical systems and operating resources abroad and who perform work there, must adhere to the statutory provisions on accident prevention applicable in the respective country.

**DANGER!**

For safety reasons, electrical measurements must not be carried out with the converter cabinet open and while the system is running.

The converter must only be opened when switched off and free of voltage, and subject to adherence to the applicable safety regulations.

When performing maintenance work on the CONCYCLE® Wind Frequency Converter System, please observe all instructions in this manual and on the product itself.

Before starting work, the switching system must be free of voltage and this status ensured during the work.
(As per EN 50 110-1, DIN VDE 0105-100 and BGV-A3).

Adherence to national accident prevention regulations is imperative. In Germany as per BGV-A3.

The following relevant standard must be adhered for North America:
Canadian Electrical Codes Statement – Electrical installation must be in accordance with the current CSA 22.1. Canadian Electrical Codes Part 1 and/or local codes.

US Electrical Code Statement – All electrical installations shall be performed in accordance to the Local and National Electrical Codes (ANSI/NEMA 70)

In any case, the 5 safety rules must be applied. The access to the switchgear is not permitted to any other person.

**NOTE!**

Any contractually agreed warranty (liability for material defects) does not release the customer or operator of ConverterTec CONCYCLE® Wind Frequency Converters from the necessity of and obligation to carry out the contractually agreed servicing and maintenance work as a preventative measure as from the initial commissioning.

Exclusively components used and approved by ConverterTec (see parts list in the appendix to the ConverterTec Switching System Plan) are permitted! The ConverterTec Service Department will be pleased to answer any further questions that you may have.

Please note:

- The provision of spare parts must be planned in sufficient time.
- All maintenance work must be carried out in accordance with the pre-determined intervals.
- The performance of maintenance work must be documented in the WPP logbook.
- Defects detected during maintenance must be removed immediately or reported to ConverterTec Service if necessary.
- ConverterTec will only recognize maintenance carried out on the basis of a fully completed and returned maintenance report.
- Maintenance must be carried out exclusively by personnel trained and authorized by ConverterTec.

Information concerning liability and warranty

All information and instructions concerning operation of the systems are provided on the basis of our previous experience, findings and to the best of our knowledge. This manual describes standard modules of the NGx frequency converter. Minor deviations are not taken into account or are taken into account through special information sheets in the appendix.

The technical information and data contained in this manual reflect the status at the time of going to print. We reserve the right to make technical alterations within the framework of further development. No claims can be derived from the information and descriptions contained in this manual.

The information provided in text and drawings does not always conform to the scope of delivery or of any order for spare parts. The drawings and graphics are not on a scale of 1:1. We assume no liability for damage and operational disturbances resulting from operating errors, failure to observe this manual or from incorrect repairs.

ConverterTec original spare parts and ConverterTec accessories have been chosen, constructed and tested specially for ConverterTec switchboard systems. We recommend procuring spare parts and accessories exclusively from ConverterTec. We draw explicit attention to the fact that spare parts and accessories not supplied by us must be approved by ConverterTec. In certain circumstances, the installation and use of third-party products can cause negative changes to prescribed structural characteristics of the switching system and impede the safety of persons, devices or other material items. All liability of ConverterTec for damage resulting from the use of spare parts and accessories not approved by ConverterTec is excluded.

All arbitrary conversions or alterations to the switching systems are prohibited for safety reasons and exclude liability of ConverterTec for resulting damages.

The above instructions do not extend the terms and conditions of warranty and liability as per the General Terms and Conditions of Business of ConverterTec.

2. Identification of documents

Name of the document:

"Maintenance Manual CONCYCLE Wind Frequency Converter NGx"

Article designation source file Revision [WW-Article-No.-type designation_rev]

Original: KP-40976_td_maintenance_manual_concycle_wind_frequency_converter_ngx_rev.new_gb

Date of issue of the Revision [NEW]: November 2009

Valid for ConverterTec items nos.:

624245W0	ab Rev. 0
624245W1	ab Rev. 100
624245W2	ab Rev. 1
624245W3	ab Rev. 100
62426BY1	ab Rev. 1
62426BY2	ab Rev. 1
62426BY3	ab Rev. 1
62426BY4	ab Rev. 1
62428AW1	ab Rev. 1
62428AW2	ab Rev. 1
62428AW3	ab Rev. 1
6242AAW0	ab Rev. 1
6242AAW2	ab Rev. 1

62423GW1	ab Rev. 1
624185U0	ab Rev. 100
624F6BY1	ab Rev. 1
624247W1	ab Rev. 100
624247W2	ab Rev. 100
624F3AW1	ab Rev. 1
624F3VZ0	ab Rev. 0
624F3VZ1	ab Rev. 1
62424JW1	ab Rev. 1
62423VV1	ab Rev. 1
62423VV2	ab Rev. 1
62423VV3	ab Rev. 1
62423VV4	ab Rev. 1
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62423VZ1	ab Rev. 1
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62424JW2	ab Rev. 1
62422BP6	ab Rev. 100
62428AW3	ab Rev. 100
624245W5	ab Rev. 100
62426BY5	ab Rev. 100
6242AB21	ab Rev. 100
624247W2	ab Rev. 1

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FTC-624245W1	ab Rev. 1
TJ-62423GW1	ab Rev. 2
TJ-62423GW3	ab Rev. 1
TJ-62423GW4	ab Rev. 100
TJ-62423GW5	ab Rev. 1

KRK-624F3AW1	ab Rev. 1
KRK-624F3AW0	ab Rev. 1
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KRK-62426BY2	ab Rev. 0
KRK-624245W4	ab Rev. 1
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KMP-62423AW3	ab Rev. 1
KMP-62423AW4	ab Rev. 1
KMP-62423AW5	ab Rev. 1
KMP-624245W5	ab Rev. 100
ENG-624245W4	ab Rev. 1
KRK-62423AW4	ab Rev. 1
KRK-62423AW5	ab Rev. 1
ENG-62428AW3	ab Rev. 1
ENG-62428AW4	ab Rev. 1
KMP-62428AW4	ab Rev. 1
ENG-62428AW5	ab Rev. 1
KMP-62428AW5	ab Rev. 1
KMP-62428AW6	ab Rev. 1
KMP-624F3AW2	ab Rev. 1
KMP-624F6BY5	ab Rev. 1
ENG-624F6BY5	ab Rev. 1
KMP-6242AAW1	ab Rev. 100
ENG-6242AAW1	ab Rev. 100
KMP-624247W3	ab Rev. New
ENG-6242AAW2	ab Rev. 1
KMP-6242AAW2	ab Rev. 1
ENG-624247W3	ab Rev. 1

This manual replace version
KP-40642gb_td_maintenance_manual_ngx_rev.F



NOTE!

Concerning the ConverterTec system of document revision:

- Revision is an ongoing process
- The first condition, approved for delivery, is defined by the revision code "New" or from June 2017 with "-".
- All further revisions are alphabetical from "A" to "Z"

3. Marking on systems and devices

3.1 Warning signs

Electrostatic sensitive devices (ESD)



Warning of electrical power



3.2 Prohibition signs

Access by unauthorized persons prohibited



Do not switch on!



Prohibited for persons with heart pacemakers



3.3 Instruction signs

Wear protective helmet



Wear hand protection



Attach safety harness



Wear ear protection



These system and device markings must be observed when working on the converter/in its vicinity.

Additional instruction and prohibition signs attached by the constructor of the wind power plant must be observed. The signs shown here are a selection of the signs on the WPP; their requirements - including any farther reaching requirements - must be known and observed.

4 Maintenance work

4.1 Data backup prior to maintenance

When backing up data, the following system information must be backed up or recorded with the help of the CONCYCLE® System Tool.

1. Backup of all data triggers of the preceding month present in the disturbance memory
DR_XXX.dsb
2. Formatting of the disturbance data memory
3. Generation and backup of a trigger in parallel mains operation with power
DR_XXX.dsb
4. Back-up of event and operating hours counter
Counter_1.txt (event counter prior to maintenance)
OperatingHours_1.txt (operating hours counter prior to maintenance)
5. Recording the operating cycles of the circuit breaker
6. Backup of the event lists
Event_1.evt (event list prior to maintenance)



NOTE!

If there is no wind, the last trigger during which the system was connected to the mains is sufficient. Disturbance recordings are also permitted.

4.2 Checking of the documentation

When checking the documentation, attention must be paid to ensuring that all documents required for maintenance are available on site in paper form.

The following documents must always be present directly on the system and must also be left on the system following the maintenance work.

1. Delivery documentation supplied with the system (compare the system resource number on the type plate with that on the cover sheet of the switching system documentation).
This includes:
 - cover sheet (general information on the switching system)
 - project overview
 - site overview
 - system parts list
 - electrical connection diagram
 - terminal plan
 - settings list
 - mechanical structure and construction drawings
2. Description "Operating instructions"
3. Declaration of conformity
4. Manuals
On systems with integrated section switch, the manual for the switch is mandatory. These manuals can be seen from the system documentation which is available separately from ConverterTec upon request.

4.3 Safety isolation of the system – 5 safety rules

Prior to carrying out work on the converter's electrical system, the converter must be switched free of voltage. For this, the system must be disconnected taking account of the applicable safety rules.

5 Safety Rules

- 1 Isolate from power supply
- 2 Protect against reclosing
- 3 Verify the safe isolation from supply
- 4 Connect to earth and short circuit
- 5 Provide neighbouring parts under voltage with barriers

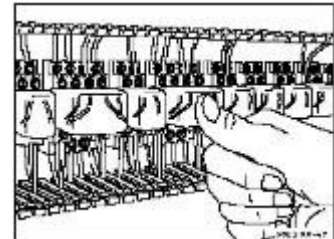
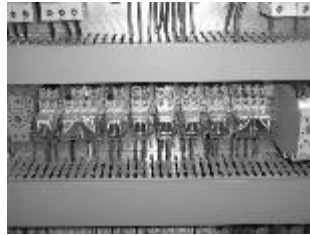
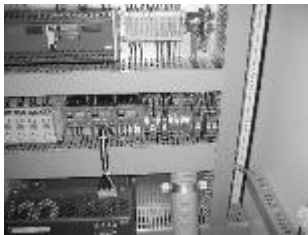
Protection against accidental contact

If access is necessary, the protection against accidental contact must be removed.

4.4 Switching elements and fuse units

4.4.1 Relay, contactor

Control relay and contactor must be checked for firm seat of the contacts and connections during all maintenance work.



The illustrations show examples of subassemblies/components on which the work described must be carried out.

Contactors with defective housing or contact must be replaced immediately.

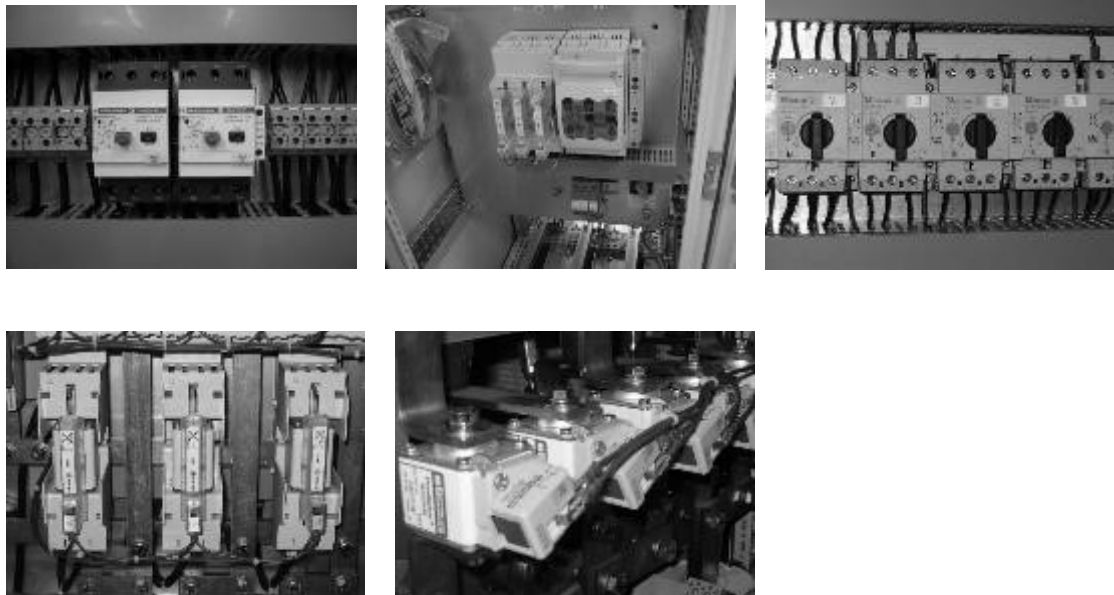


NOTE!

Checking the condition, operating cycles and corresponding operating hours can be seen from the respective device manuals. Following completion of the operating period, the operating resources must be replaced.

4.4.2 Alarm contacts

The alarm contacts must be activated individually. When so doing, the function of the signal chain is tested with a continuity checker in voltage-free condition.



The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.4.3 Checking the setting values

Fuses, motor protection and time lag relay

The settings of protection and function devices are checked using the settings list in the connection diagram appendix or parts list.

Check the firm seat of the fuses in the low-voltage high-performance fuse strips; if necessary, press the fuses back in.



NOTE!

When using low-voltage high-performance fuses, attention must be paid to the correct voltage category 500V fuses are not permitted with 660V/690V/950V mains!

4.4.4 Circuit breaker

Maintenance of the circuit breakers is carried out in accordance with the manufacturer's instructions. The latest maintenance instructions of the switch manufacturer are applicable in all cases. For circuit breakers with integrated operating cycle counter the number of operating cycles must be entered in the maintenance report.



The illustrations show examples of subassemblies/components on which the work described must be carried out.



DANGER!

Depending on the respective operating conditions, the explosion chambers and the contact system must be inspected. Particularly following short circuit switching off, their condition must be checked prior to switching back on. Depending on the condition, at the latest, however, after the number of switchings recommended by the switch manufacturer, the explosion chambers and the contact system must be replaced.

4.5 Insulation resistance

General

The insulation resistance is measured as dc resistance. It is determined mainly by the insulation material and less by the thickness of the insulation layer. As a result of its dependence on length, the insulation resistance falls with increasing cable length.

The insulation measuring devices used should satisfy the requirements of IEC 61557-1. As already required under the DIN-VDE standards previously applicable, measurement of the insulation resistance must likewise only be carried out with direct current in future. The level of the measuring voltage has not changed following publication of IEC 60364-6-61. 500 V measuring direct current is required for voltages up to and including 500 V. In systems with nominal voltages above 500 V, measuring must be carried out using a testing direct current of 1000 V.

The procedure for systems with low-voltage generators ($U_n < 1000V$) is as follows:

If present, the fuses of the overvoltage protection dischargers and stator filters must be removed. Switch off the fuse protection for the measurement of the generator voltage. Otherwise, please disconnect all poles of the stator cables in the converter cabinet and measure the insulation resistance of the stator path.

As per VDE, 1000 Ohm per volt can be taken as an approximate value. Precise values can be seen from the manual of the generator manufacturer. In the event of lower values to ground resulting, path and stator must be measured separately.

If lower values are ascertained on the stator connecting terminals, please contact the generator manufacturer and repair if necessary.

The fuses of the overvoltage protection dischargers must be removed. Please disconnect all poles of the rotor cables in the converter cabinet and measure the insulation resistance of the rotor path. 10MOhm can be taken as an approximate value. Precise values can be seen from the manual of the generator manufacturer.

If the value of the entire path is less than 10MOhm to ground, rotor and cable/busbar system must be measured separately.

If values of less than 10MOhm are ascertained on the rotor connecting terminals, it is normally necessary to check the brush area and to clean or repair it if necessary.



NOTE!

Excessively low insulation values can provoke flashovers. This can result in damage to the converter system.

Values $> 10MOhm$ can normally also be expected on the rotor cable stretch (busbar system). Deviating measured values indicate a creeping insulation fault.

Following the measurement, the fuses of the overvoltage protection dischargers must be re-inserted.

Optical control of the rear sides of the stator contactor and main switch. Remove loose cable remains.

Valid for CW2000XY: Check the correct position of the copper adapters at the main switch. These must not be installed offset to the busbar.

4.6 Electrical plug-in and terminal connections

4.6.1 Electrical plug-in and optical wave guide plug

The plug-in connections must be checked for correct seat. The correct seat is restored by pressing on the plug. Defective plug-in connections must be replaced immediately!



The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.6.2 Electrical terminal connections

The terminal connections of all clamping points on devices and terminal blocks as well as the terminal connections of the copper busbar system and the converter are designed maintenance-free ex-works. Depending on the conditions of use (vibrations at the place of setting up) of the CONCYCLE® Converter, the operator should carry out regular random checks. The starting torques for **loose screw** connections can be seen from the information on the devices in the system documentation.

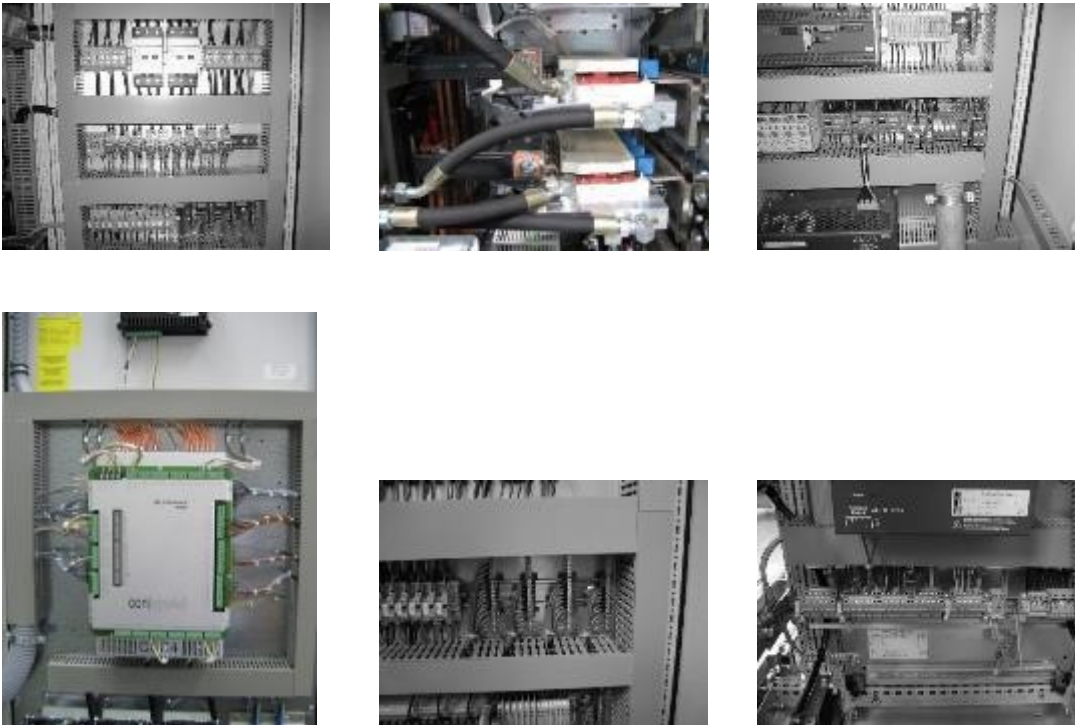
Depending on the situation/results during the random checks (e.g. in the event of thermal discoloration), the operator should order ConverterTec to check all clamping points.

We recommend not reusing but replacing **spring washers** that have become loose.

Checked screw connections should be marked by the operator in order to exclude multiple checking.

The starting torques stated here are valid for non-greased screw connections. If a connection of the copper busbar system is to be checked or loosened, it must first be cleaned in order to remove grease residue and dirt.

The starting torques for copper connections can be seen under point 4.6.3 of the table.



The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.6.3 Details of torques for cable connection and bus bar connection as per DIN 43673

Under ISO 898-1, the property class of the screws and nuts used by ConverterTec is 8.8 and higher. Values for non-greased/dry screw connections can be derived from this.

Bus Bar Connections / Cable Connection / Dry	
Thread	Tightening Torque [Nm]
M 4	2,3
M 5	4,6
M 6	7,9
M 8	19
M 10	38
M 12	66
M 16	162

The bus bar connections must be designed with two conical spring washers (opposite).

Cable lug connections must be designed with plain washer and spring lock washer.

The screw connection with a fixed upper torque must be marked with a waterproof felt pen following assembly.

This information is not applicable for connections to operating resources (please observe the manufacturer's instructions for these).

Appendix: "Customer-specific characteristics"

4.7 Capacitors

4.7.1 Filter capacitors

Amongst other things, the purpose of the capacitors is to filter the harmonic reactive power of the CONCYCLE® Wind Frequency Converter.



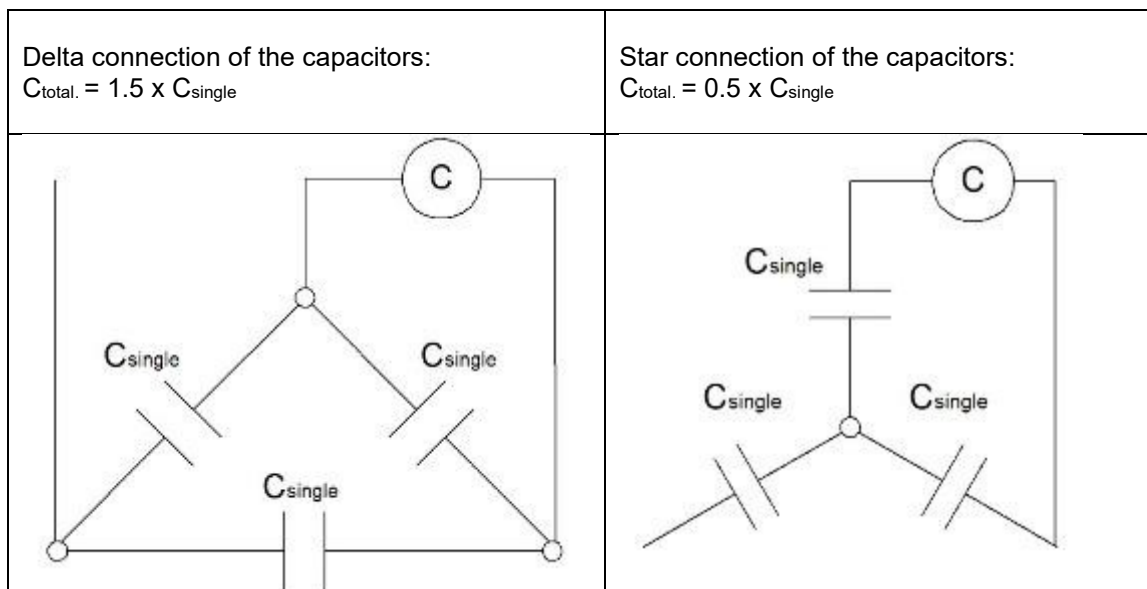
DANGER!

When checking capacitors, adherence to the following measures is mandatory:

- Observe the 5 safety rules for the operation of electrical systems (BGV-A3)
- When working on capacitors the required auxiliary safety materials must be used.
- When the converter is active, presence in the gondola or on the ladder of the WPP must be prohibited, unless sufficient escape facilities have been provided.
- The converter must only be activated with the doors closed.
- The converter must only be opened when switched off and free of voltage and subject to adherence to the applicable safety regulations.
- For safety reasons, the capacitor must be dumped using a suitable discharging device.

The following checks must be carried out:

1. Check the safe isolation from supply, see 4.7.3 – discharging time $t > 3$ min.
2. Check the capacitor cans for warpage or damage.
3. Check the overpressure valve/opening in the vicinity of the connecting terminals.
4. Check the capacity of each individual capacitor (all phases are measured and recorded against each other) A capacitor with a capacity outside the stated tolerance for the nominal capacity must be replaced. ConverterTec recommends replacement if the variance is more than 5%.



If one of points 1-3 (see above) is found to apply during a check, the capacitor must be replaced immediately and under no circumstances used again.

Mixed use of capacitors from various manufacturers on one fuse strip is not allowed unless this has been designed, checked and approved by ConverterTec.

4.7.2 DC-link capacitors

Optical check of the DC-link capacitors.

The following points should be observed:

- Ripped cladding
- Noticeable discoloration in the area of the connections to the IGBT models (soot blackening)
- Damage to the intermediate circuit connections
- Soiling
- Dampness

Dirt must be removed immediately. In the event of damage to the power capacitors, the capacitor affected must be replaced immediately following consultation with the ConverterTec Service Department.

Discharging time $t > 10$ min. Freedom from voltage



NOTE!

DC voltage up to 1100 V possible.



The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.7.3 Checking the discharging device



The illustrations show examples of subassemblies/components on which the work described must be carried out.



DANGER!

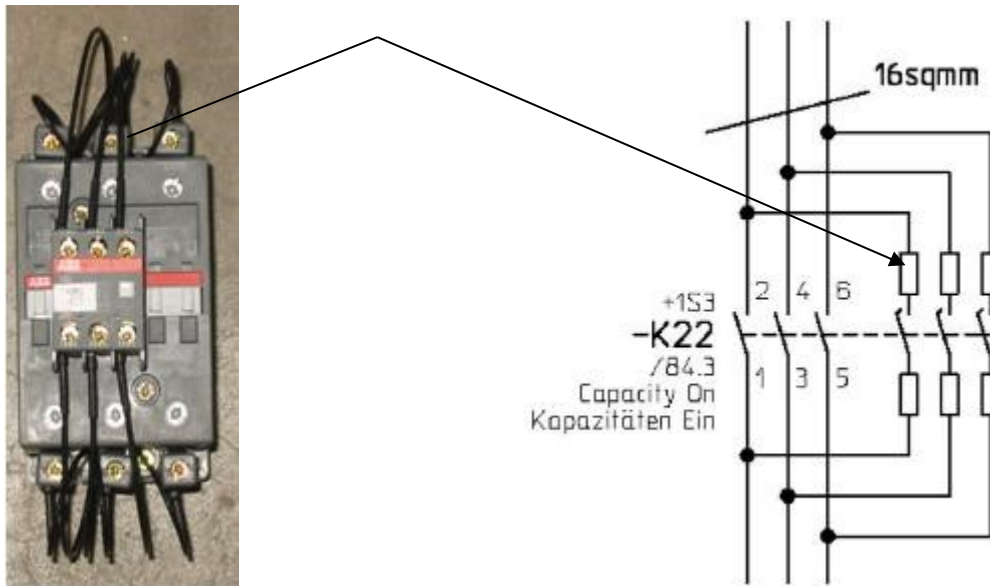
Defective discharging devices are not necessarily optically recognizable. Nevertheless, a charged capacitor represents a potential risk to life!

Trials and accidents have shown that, when discharging a capacitor over the human body, severe shock must be reckoned with upwards of an energy content of 0.25 Ws and a risk to life upwards of just 10 Ws. Given a voltage of 690 V and a delta connected capacitor with an individual capacity of 55.7 μF, the energy content is as follows:

$$W = \frac{1}{2} \cdot C \cdot U^2 = 0,5 \cdot 1,5 \cdot 55,7 \cdot 10^{-6} \frac{As}{V} \cdot (690 V)^2 = 19,88 Ws !$$

Once you have ensured that the capacitor connected has been dumped, the discharging device is checked with a multimeter. Typical values are in the range around 4kOhm (+/- 2kOhm). In the event of a deviating value being ascertained, the discharging device must be replaced.

4.7.4 Checking the capacitor contactors/ inrush current limiter



Example of a capacitor contactor

The illustrations show examples of subassemblies/components on which the work described must be carried out.

The surge current at make limiter consists of resistance wiring which connects the capacitor to voltage via an advance make contact. As a result, the otherwise high current at make of the capacitors is reduced.

When checking the capacitor contactor, attention must be paid to burnt contacts or defective, bent resistance cables. Values in a single-figure Ohm range are measured per resistance wire with a multimeter.

Defective contactors must be replaced. Defective capacitors can also be an indication of a damaged contactor.



NOTE!

Advice for disposing batteries, accumulators, capacitor, electrical components and circuit boards see 4.19.2.

4.8 Mechanical connections and vibration damage

4.8.1 Mechanical connections

Mechanical connection points, in particular door hinges and locks, are subject to increased wear and tear and therefore require regular maintenance. Doors, roofing sheets and walls must close perfectly. Defective or missing screws must be replaced.



The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.8.2 Vibration damage

**NOTE!**

Vibration damage can occur at all points of the switching cabinet under unfavorable operating conditions. Any such damage must be removed immediately. The functionality of the converter must be restored during the maintenance work.

The following points must be checked in particular and repaired or replaced if necessary:

External area:

- Cabinet fastening on the machine carrier/carrier construction, stability
- Fastening of the side panels/tops (IP degree of protection must be given)
- Tighten loose screws, replace missing screws
- Fastening of the operating resources

Inner area:

- Mountings and fastening of the operating resources
- Strain reliefs of the cables
- All clamp and screw connections
- Seals of the cabinet doors
- Door hinges
- Cable/wire insulation (abrasion points)



The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.9 Overvoltage protection – type 2 arrester

When the overvoltage surge arresters are triggered, the internal resistance with reference to the earth potential becomes low Ohm and diverts the overvoltage to the earth.

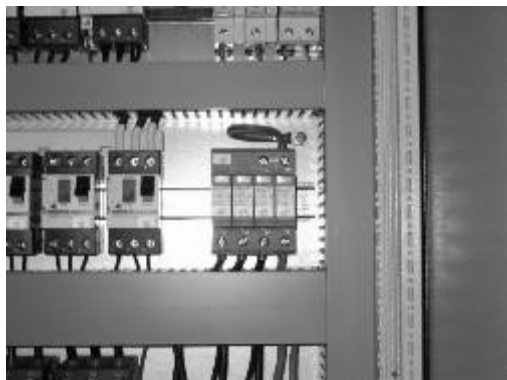
If an overvoltage surge arrester has been overloaded and has reached the end of its lifespan, this is displayed in the control window by a change of color (e.g. through color signal – yellow, red).

The overvoltage discharger must be replaced immediately following a change of color (yellow, red).

**NOTE!**

In some system types, the functionality of the overvoltage surge arrester is monitored via signal contacts.

Overvoltage surge arrester:



The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.10 Overvoltage protection – type 1 - lightning stroke current arrester

In general, lightning stroke current arrester have no function control. They must be checked at the prescribed time intervals in accordance with the manufacturer's instructions.

Example: DEHNgap B/n (resistance > 500kOhm -> arrester ok)

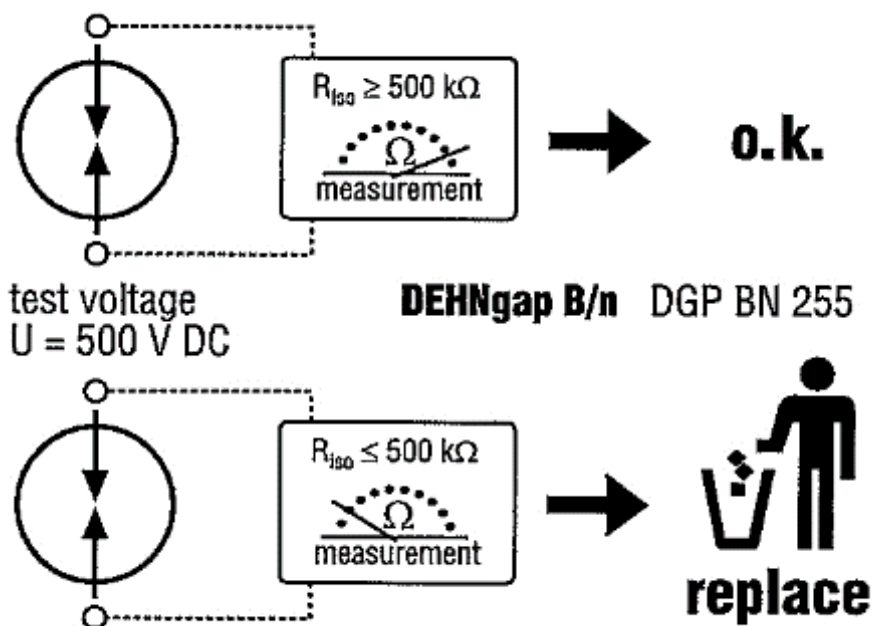
Lightning arrester and overvoltage surge arrester are classified into device categories (SPD – Surge Protection Device). Lightning arresters are classified under SPD type 1 and overvoltage arrester under types 2 and 3. Since, as a rule, air gaps are used for lightning arrester and these arrester have no signals, they must be checked during the maintenance work.

The check applies only for type 1 arrester. With type 2 arrester the indicating pins and transmission contacts must be evaluated.

Work during the check:

- 1) Disconnection of the system/ observe 5 safety rules
- 2) Disconnection of the type 1 arrester through removal of the fuses
- 3) Measurement and assessment of the arrester in accordance with the chart
- 4) Re-connection of the fuses

A measurement of the arrester must be carried out with the help of an insulation resistance measuring device (setting 500 V). The measured result must be in the range >500kOhm .

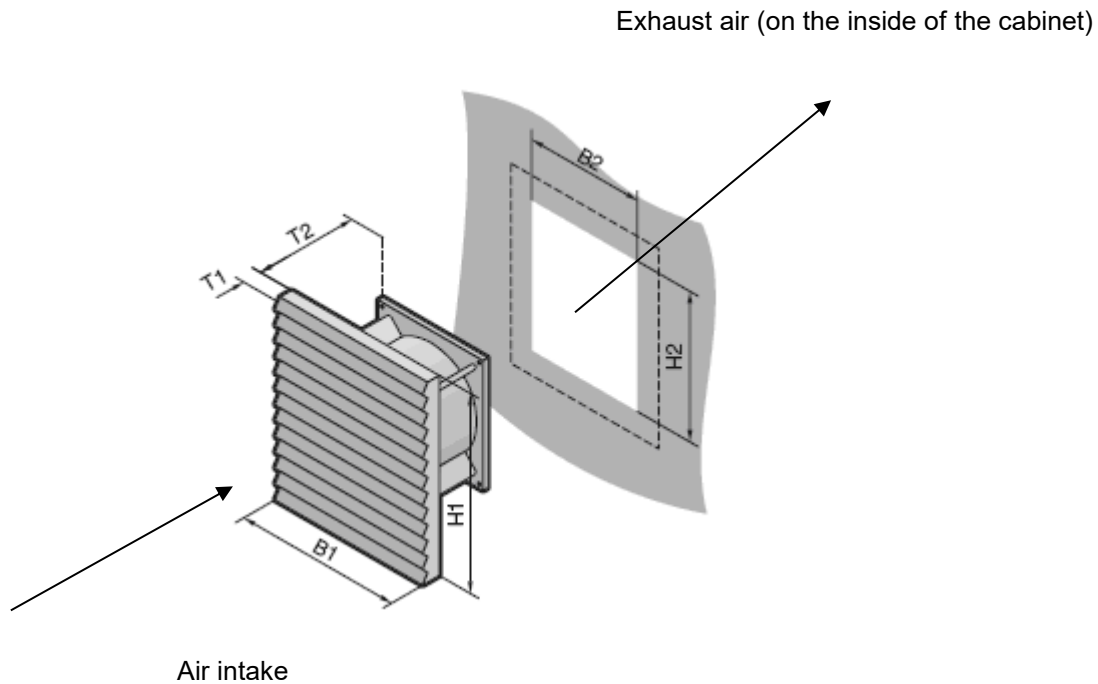


The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.11 Filter pads

The filter pads must be checked during all maintenance work and replaced if soiled or damaged.

The active fans push air into the cabinet resulting in an overpressure inside the system. This in turn minimizes the amount of dust particles entering the cabinet. The warm air is pushed out through the air vents at the top.



Filter pad / exhaust air grid



Exhaust escape grid

The illustrations show examples of subassemblies/components on which the work described must be carried out.

Attention must be paid to the correct installation direction:

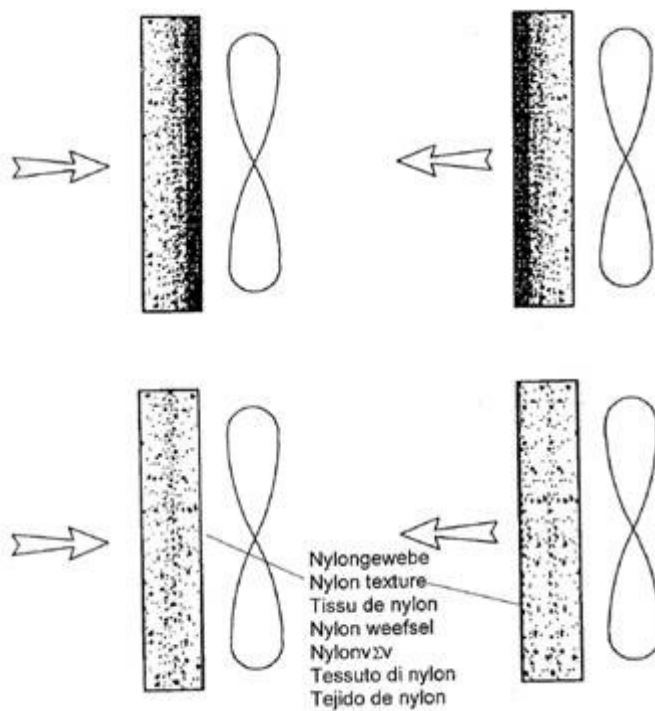
Air inlet (fan):

The fine side of the filter mat should be on the inside (i.e. facing the cabinet)

Exhaust air grid:

The rough side of the filter mat should be on the inside.

There are two types of filter mats:



The following filter mats must be used as a replacement for the respective air vents and fans. No distinction between fine and rough filter mats is made when replacing them. The filter mats listed are sufficient to fulfill IP54 standards.

COM- PONENT NUMBER	EXT. DESCRIPTION	MANUF. ITEM	REPLACE- MENT FILTER MAT Manuf. Item	REPLACEMENT FILTER MAT ConverterTec Item
KP-22347	AIR OUTLET FILTER, IP54, RAL7035	SK 3326.207, RAL7035	SK 3173.100	KP-31215
KP-22348	AIR OUTLET FILTER, IP54, RAL7035	SK 3325.207, RAL7035	SK 3172.100	KP-31214
KP-23083	AIR OUTLET FILTER, IP54, RAL7035	SK 3321.207, RAL7035	SK 3321.700	KP-31211
KP-27097	AIR OUTLET FILTER, IP54, RAL7035	SK 3323.207, RAL7035	SK 3171.100	KP-31213
KP-28384	AIR OUTLET FILTER, IP54, RAL7035	SK 3322.207, RAL7035	SK 3322.700	KP-31212
KP-23670 KP-44833*	FILTER VENTILATOR 230V, 50/60HZ, IP54, VENTILATION POWER: 700/720 CBM/H, RAL7035	SK 3327.107, RAL7035 SK3244.100* RAL7035	SK 3327.700 SK3242.200	KP-31216 KP-44860*
KP-22094 KP-44859*	FILTER VENTILATOR 230V, 50/60HZ, IP54, VENTILATION POWER: 500/560 CBM/H, RAL7035	SK 3326.107, RAL7035 SK 3243.100*	SK 3173.100 SK 3243.200*	KP-31215 KP-44860*
KP-22349	FILTER VENTILATOR 230V, 50/60HZ, 41W, IP54, VENTILATION POWER: 230/265 CBM/H, RAL7035	SK 3325.107, RAL7035	SK 3172.100	KP-31214
KP-22847	FILTER VENTILATOR 230V, 50/60HZ, 19W, IP54, VENTILATION POWER: 105/120 CBM/H, RAL7035	SK 3323.107, RAL7035	SK 3171.100	KP-31213
KP-31255	FILTER VENTILATOR 230V, 50/60HZ, 12.5W, IP54, VENTILATION POWER: 20/25 CBM/H, RAL7035	SK 3321.107, RAL7035	SK 3321.700	KP-31211
KP-39682	FILTER VENTILATOR 230V, 50/60HZ, 35W, IP54, VENTILATION POWER: 180/160 CBM/H, RAL7035	SK 3324.107, RAL7035	SK 3172.100	KP-31214
KP-39889	FILTER VENTILATOR 115V, 50/60HZ, 80W, IP54, VENTILATION POWER: 500/560 CBM/H, RAL7035	SK 3326.117, RAL7035	SK 3173.100	KP-31215

4.12 Rittal TopTherm filter air fan

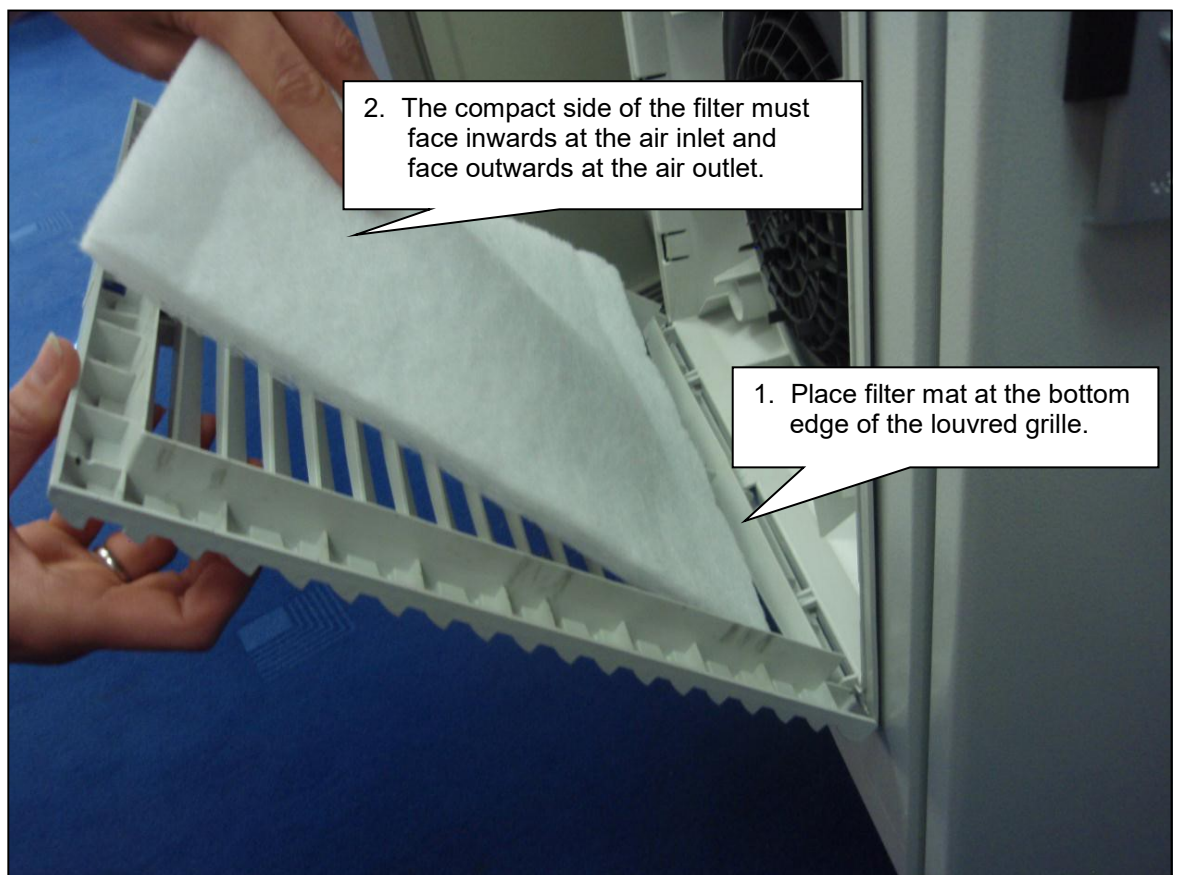
Scope: 3237.xxx, 3238.xxx (KP-44853
3239.xxx (KP-44854 / KP-44855)
3240.xxx (KP-44857)
3241.xxx (KP-44858)
3243.xxx (KP-44859 / KP-44860)
3244.xxx (KP-44833)
3245.xxx (KP-46206)

Exchange of filter mat

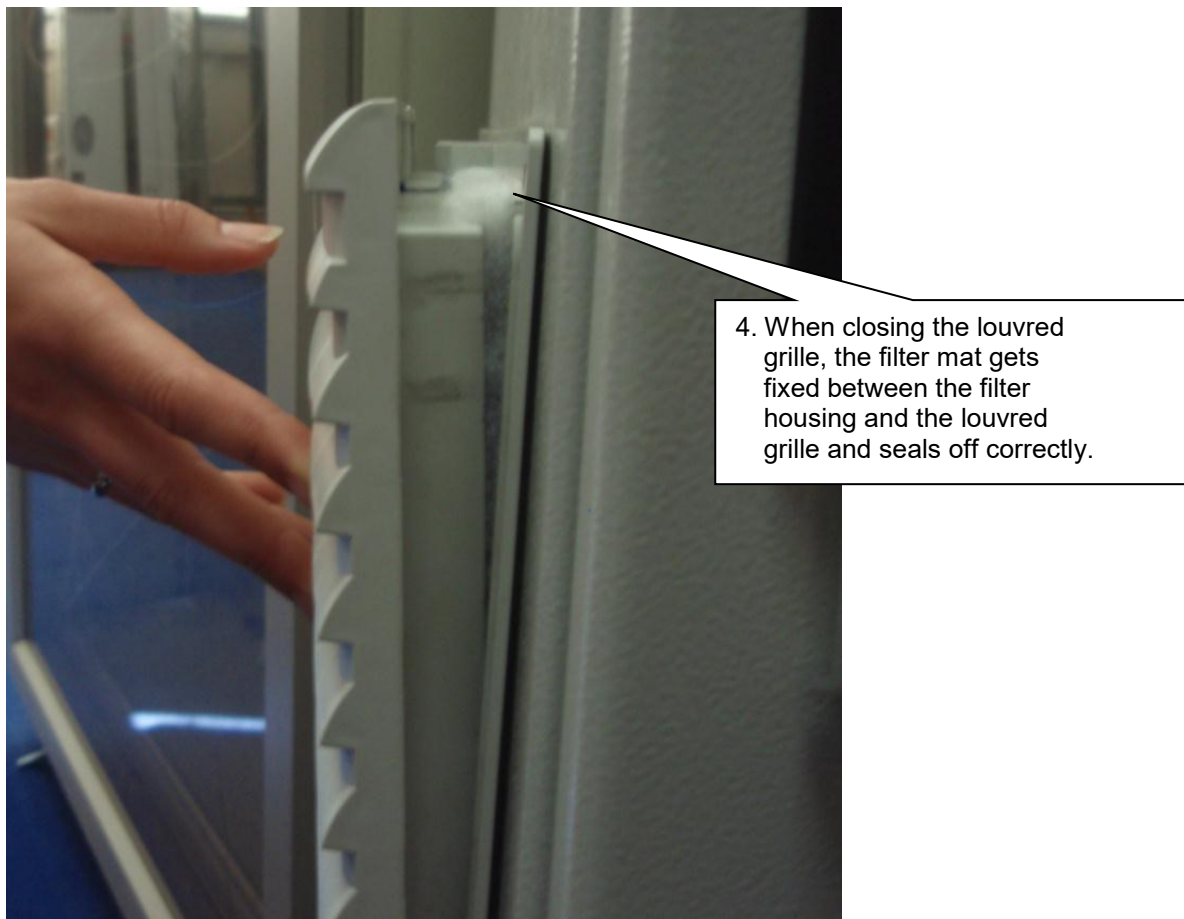
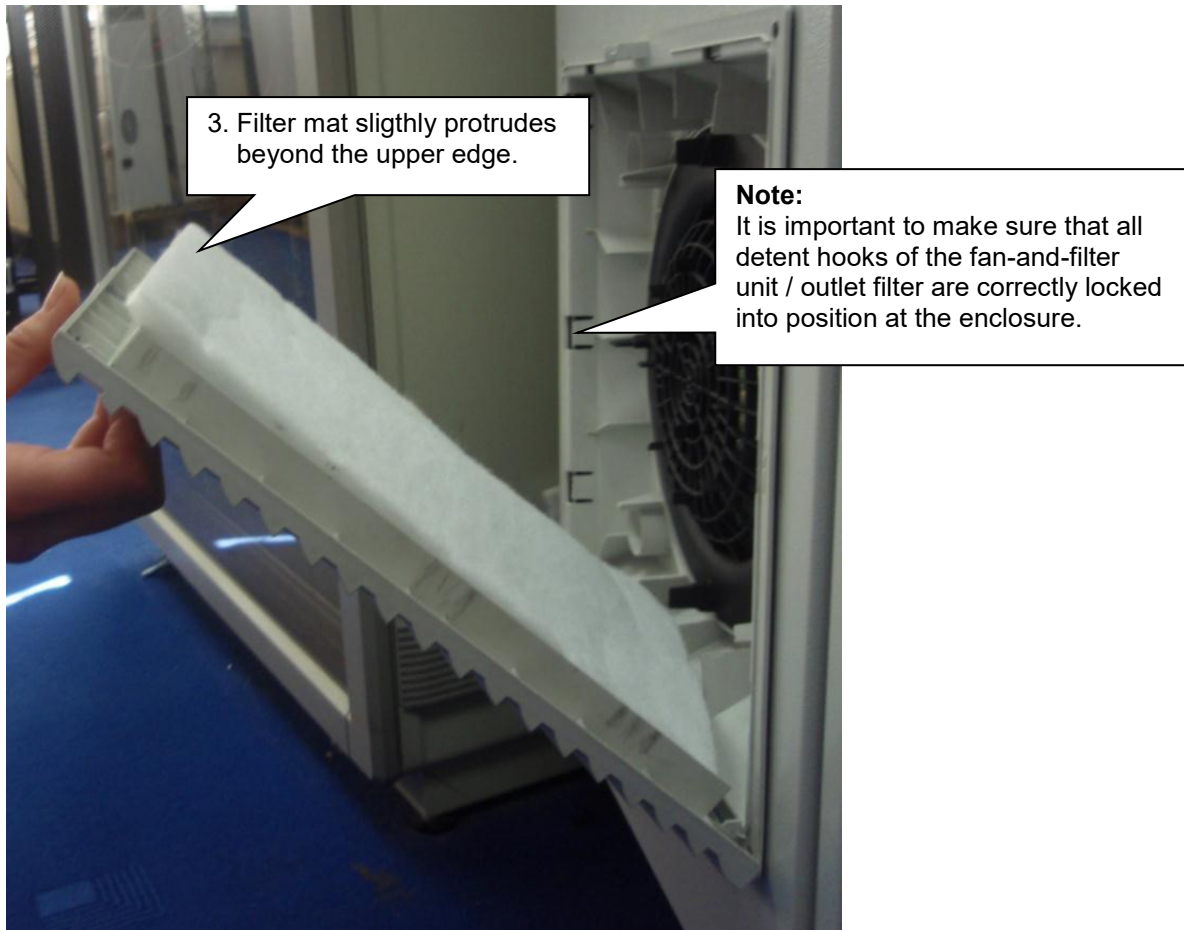


ATTENTION!

Only by use of the original Rittal filters mats, the protection category, performance data and approvals can be guaranteed.

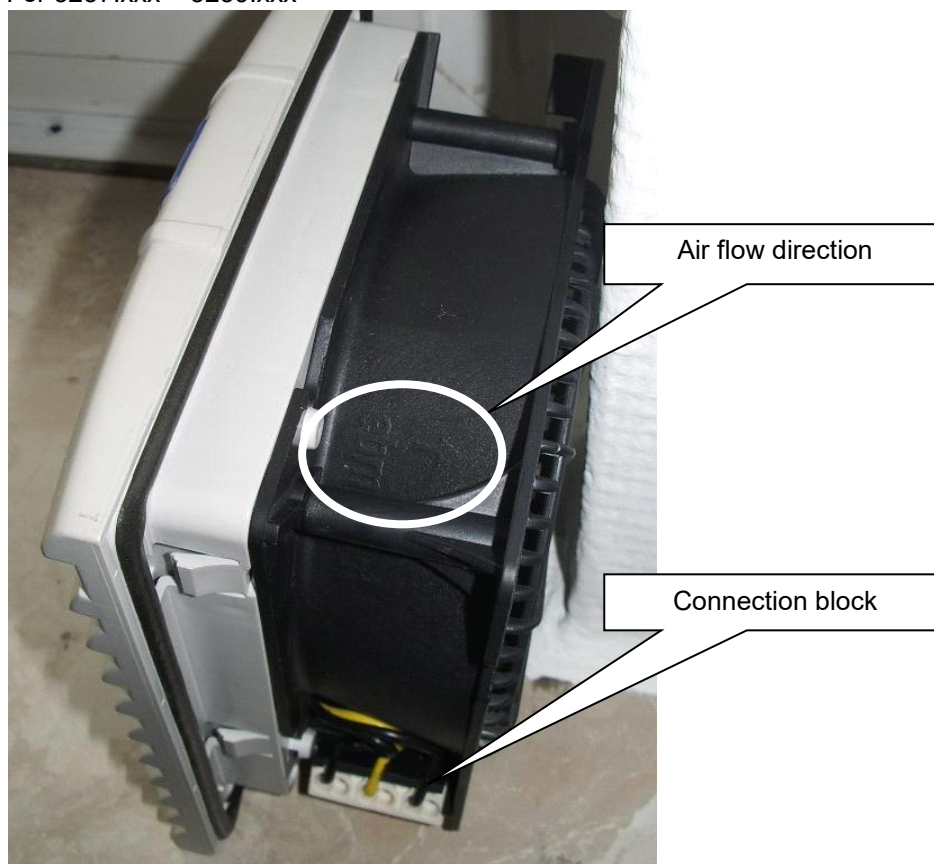


Notice: The fan is meant here as the air inlet

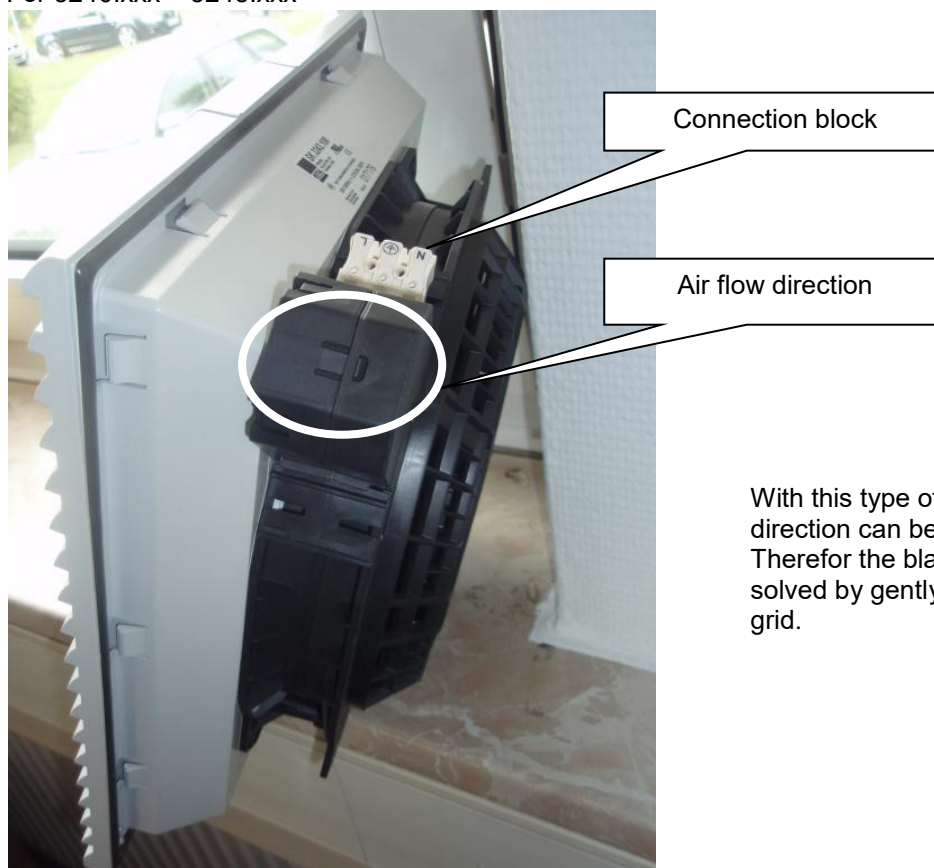


Indication of air flow direction:

For 3237.xxx – 3239.xxx



For 3240.xxx – 3245.xxx



With this type of fan, the conveying direction can be turned if necessary. Therefore the black housing can be solved by gently twisting against the grid.

4.13 Cleaning the system

Before re-connection, it must be cleaned using suitable tools (vacuum cleaner, cloths etc.).



Contact with electronic components, either by the hands or by other auxiliary materials, must be avoided during cleaning. Electrical discharges can result in the destruction of the components.

As a rule, these components bear the sign shown. As a general rule, the connections of the IGBT power parts must not be touched without ESD measures.

4.14 Safety devices, protection against accidental contact prior to electrical connection

Attention must be paid to ensuring that the safety devices (EMERGENCY STOP switch, safety locks, overcurrent protection relays etc.) are in a perfect and fully functional condition following maintenance work. You must also ensure that all components removed for the maintenance work (protection against accidental contact) have been re-attached and fulfill their function for compliance with BGV-A3.

4.15 Re-connection of the mains voltage

The mains voltage must be re-connected on subject to observance of the applicable safety measures.



DANGER!

As a fundamental rule, as already mentioned in the preliminary remarks and for safety reasons, electrical measurements and tests must not be carried out with the converter cabinet open and with operating resources carrying voltage. Work must only be carried out by correspondingly qualified specialist personnel in accordance with the applicable rules.

Consequently, all steps set out below must be performed exclusively by specialist personnel trained by ConverterTec and with the utmost caution.

Adherence to national accident prevention regulations is imperative. In Germany as per BGV-A3.

The following relevant standard must be adhered for North America: Canadian Electrical Codes Statement – Electrical installation must be in accordance with the current CSA 22.1. Canadian Electrical Codes Part 1 and/or local codes.

US Electrical Code Statement – All electrical installations shall be performed in accordance to the Local and National Electrical Codes (ANSI/NEMA 70)

4.16 Heating system

The function of the heating system must be checked by adjusting the hygrometers (moisture) and thermostats (temperature) (see connection diagram).

The thermostats and hygrometers must be checked on the basis of the settings list for compliance with the values stated therein. Any deviations should be corrected and ConverterTec informed.

The thermostats and hygrometers are normally locked in their setting range. Please consult the device documentation as regards cancellation and re-setting of these locks.

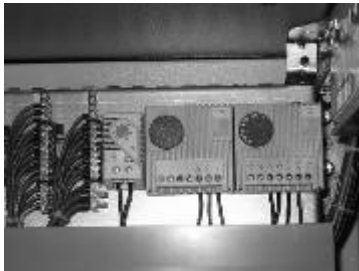
Inaccessible radiators must also be checked through suitable measures (e.g. measuring the temperature).

- Is the fan running?
- Is the heater working?
- Is voltage available on the terminals (230VAC)?
- Check circuits and components (relays) according to the circuit diagram.
- Replace the components if the heater or the fan is defective.
- If dirty, then clean the heater fan with a vacuum cleaner or with compressed air.
- Reset the thermostat from the target value (consult the list with the settings in the circuit diagram) after the test.



DANGER!

The function of all heating systems must be checked in the switching cabinet. When so doing, direct contact with the radiators must be avoided. **RISK OF BURNING!**



The illustrations show examples of subassemblies/components on which the work described must be carried out.

Operation of the heating system – Quick user guide

After the operating voltage (mains voltage) has returned:

If the humidity has exceeded the set value of the hygrometer or the temperature set on the thermostat has been exceeded, the supply voltage of the battery charger will not be connected and the heating operation activated. This heating operation ends when the delay time set on the time lag relay has expired, temperature and humidity are again within the limits set. Following ending, the supply voltage of the battery charger will be connected.

4.17 Cooling system

4.17.1 Control cabinet fan

If the components are visibly dirty, clean them with a vacuum cleaner or with compressed air. (If compressed air is used, a vacuum cleaner should also be used to vacuum up directly the dissolved dirt particles)

Persistent dirt soaked with oil can be removed with non-flammable cleaner, e.g. cleaning solvent.

Sequence of maintenance work:

- Check the extent of dirt.
- Filter pollution? Replace filter.
- Are the fan blades dirty? Clean it.
- Is the fan running? The fan blades must rotate freely. If this is not possible, then test the electric function.
- Is voltage available on the terminals (230VAC)?
- Inspect the noise development (grinding, clicking) of the fans and replace as needed.
- Clean the fan blades, motor and housing with compressed air.

4.17.2 IGBT cooling water system

Inspect the cooling tubes, heat sinks, hoses and connection points of the cooling loop for their leak-tightness and corrosion (see Section "Visual inspection of the cooling system's screw connections and pipes"). If there are leaks or corroded connection points, repair them immediately (see Section "Replacement of components"). If in the area of electrical components traces of moisture or wetness occur, then the entire system must be switched voltage free.

Components must be cleaned with dry cloths and perhaps with water or cleaner to remove any coolant residues. If there is standing water on electrical components, then these components must be replaced to avoid any consequential damages.

If electrical components are moist or wet such as chokes, then these must be cleaned and dried (with a heater or with a dryer, etc.). In this context, pay particular attention to the maximum temperature of the components.

After cleaning or after any repair work, the cooling water system must be operated for at least 8 hours in heating operation. Any moisture, which may have gotten into the IGBT module, will be dried with the help of the heating operation in the cooling loop. It is imperative to ensure that the doors to the switchgear are completely closed.

Optional cooling units

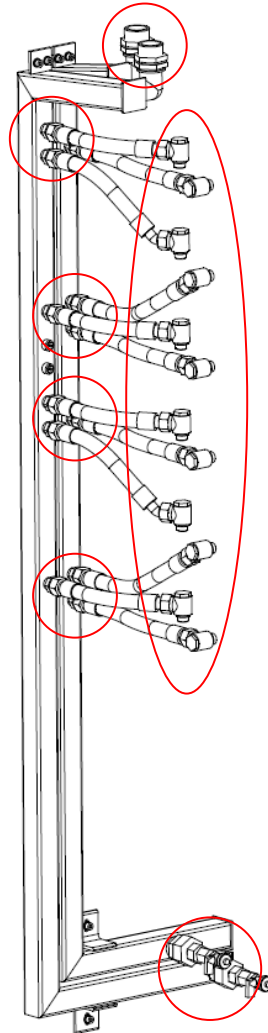
Please use the data of the corresponding manufacturer.

4.17.3 Visual inspection of the cooling system's screw connections and pipes

Visually inspect the connections (fittings, cap nuts) and their tube compressions shown in the picture below.

- Are there any signs of leaks on the connections?
- Are there significant signs of corrosion on the connections, which point to any liquid, which may have leaked earlier?

- Are there any visible residues of leaks of moisture?
- Are the drain valves leaking?
- Is it possible to identify signs of liquid (wet or dried) on the components?
- Welds of coolant tubes must be inspected for cracks, corrosion.

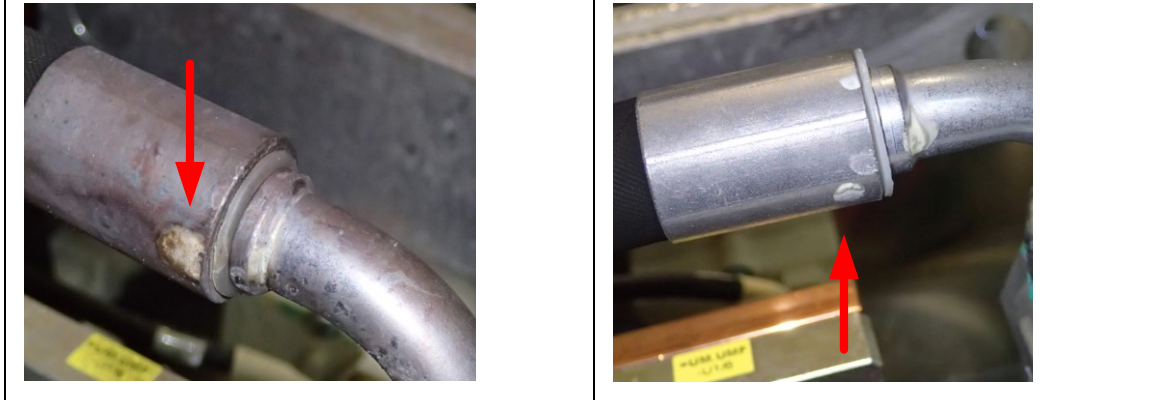


Exemplary illustration of an NGx cooling tube including tubing.

Examples of leaking fittings or pressings

Exemplary illustration of an NGx cooling tube including tubing.

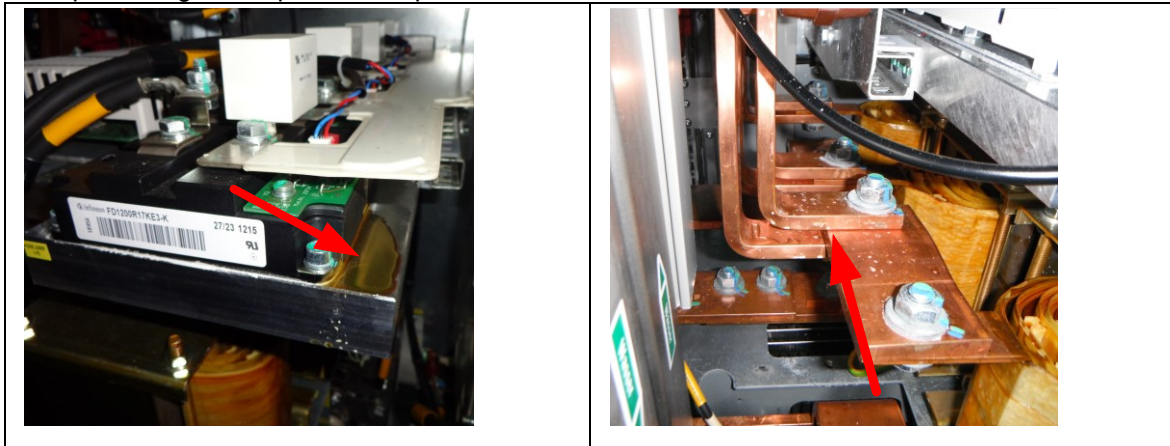
Examples of leaking fittings or pressings



Examples of leaking valves

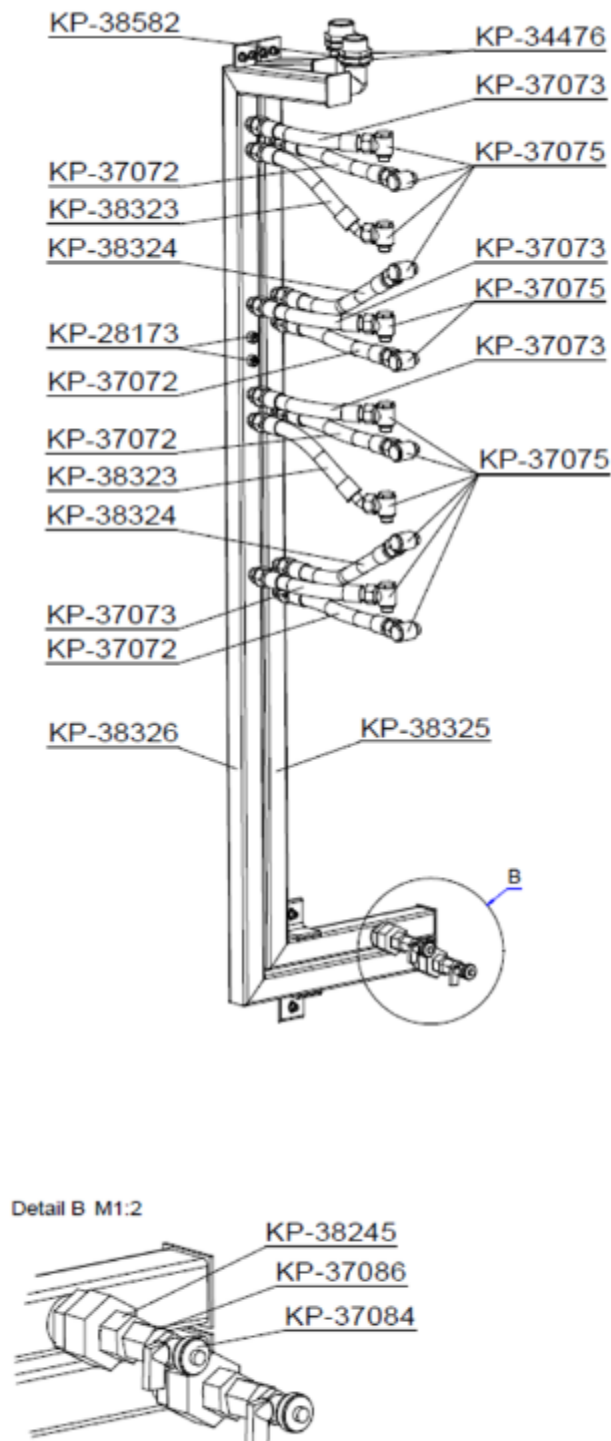


Examples of signs of liquid on components



4.17.4 Exchange of components

If faulty components were identified, these must be replaced. Article numbers of spare parts can be determined through ConverterTec Service based on the switchgear's series number. Use new seals (KP-46655) at the side of the IGBT connections.



Exemplary illustration of an NGx cooling tube including tubing.

4.17.5 Installation information

- Suitable tools (open-end wrench 27, 30, 32, 50 mm) must be used during the disassembly and assembly of the cooling system or its components.
- Connection tubes must first be disconnected on the riser and then on the IGBT.

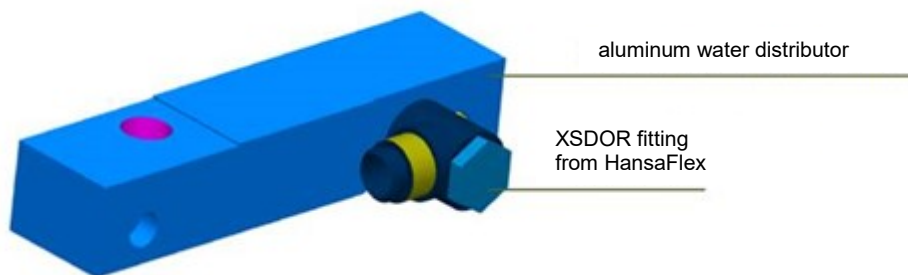


During the installation of **aluminum screw connections on the IGBT cooling body**, **particular attention must be paid** to ensure that the selected seal is not overstressed while it receives sufficient pressure to seal it.

Particular attention must be given to the cleanliness of sealing surfaces.

Installation of the XSDOR adjustable elbow joint on the cooling body.
Open-end wrench 27 or 30 mm.

Tightening torque: 75 Nm.



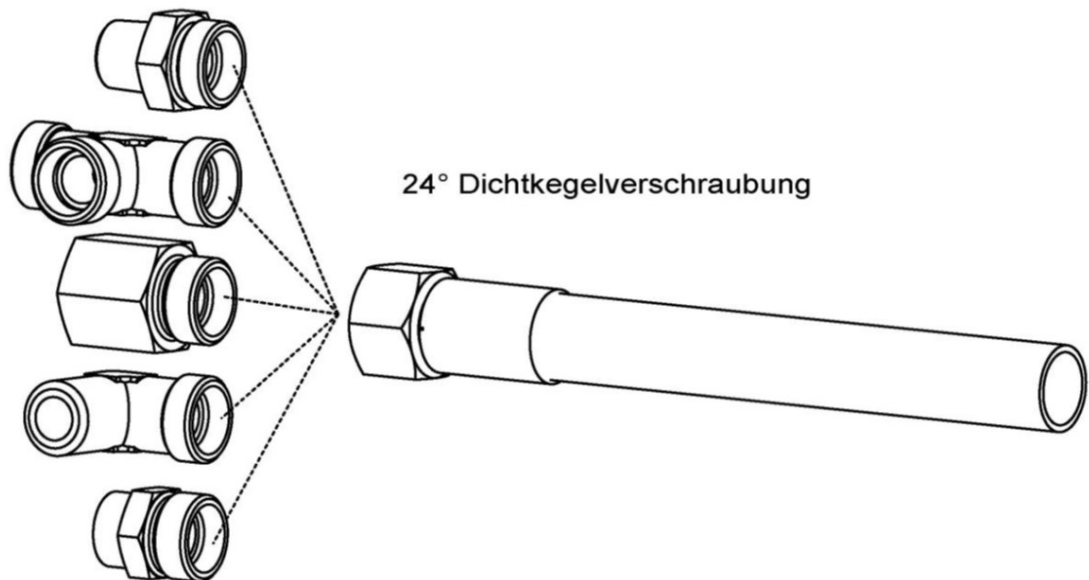
Installation of 24° taper couplings (AOL/AOS)
(Source: technical documentation HansaFlex)

- Slightly oil (oil, lubricant (WD-40)) the threads and cone of the screw and the threads of the cap nut.
- Place the screw body (taper coupling) straight onto the screw connection.
- Tighten the cap nut of the taper coupling on the screw body until force increases* significantly.
- Continue to tighten the cap nut of the taper coupling or tube with a screwdriver approx. 30° and 60° but no more than ¼ of a turn (tightening/sealing).

*Definition "clearly increased force": tighten the cap nut to the point, at which the cap nut is significantly more difficult to turn.

In this situation e.g. minor damages on the threads noticeable if the cap nut catches slightly, must be overcome.

In tapered screw connections with O-ring (AOL/AOS), preload of the O-ring must be bypassed and the metallic part of the taper coupling must be placed on the cone of the HL/HS connection.



Exemplary illustration of an NGx cooling tube including tubing

4.18 Batteries (accumulators) – internal power supply

Batteries are subject to a limited warranty. The lifespan can vary greatly depending on the form of use and the ambient conditions.

Only battery chargers/no-break power supply specified by ConverterTec (see connection diagram/parts list) must be used for charging the batteries. Only these devices ensure the charging of correctly functioning batteries.

4.18.1 24 V buffer battery (2x12V)

The role of these batteries is to provide the control device (CSC) with 24 V supply voltage for at least 3 minutes in the event of failure of the mains voltage. The disturbance recordings triggered are backed up within this period. Protective devices such as the crowbar are only in a position to protect the converter in the event of a mains failure if provided with this supply voltage.

Special treatment regulations apply for the batteries:



The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.18.2 Checking the condition of the battery

- Checking the charging voltage on the battery charger
The value should be around 27.5V. The precise setting can be seen from the corresponding settings list.

The output voltage can be set on the battery charger (see device manual)



NOTE!

Optical condition of the batteries. Pay attention to damaged housing, firm seat of the plug connections (AMP plugs) or charred contacts.

- Endurance test:
With the converter ready for operation (at standstill), switch off the -F8 fuse. The voltage must be measured directly on the battery terminals. At least 22V must be maintained for 3 minutes at an ambient temperature of 10°C to 40°C.



The illustrations show examples of subassemblies/components on which the work described must be carried out.

4.18.3 Exchange

To avoid premature failure, the batteries should be replaced every 2 years (within the maintenance intervals) as a precautionary measure.

If exchange is necessary, the batteries must never be replaced individually but always as a complete set. When replacing the batteries, always use the article as per the WW parts list!

An exception is the UPS power supply. If lead-gel batteries CTV 7-12 (KP-36185) are used for the UPS-DC, they must be exchanged against KP-40588 (Jovyatlas) and for UL-certified plants against KP-42551 (Panasonic).

With lead-gel batteries (KP-36185) always ensure a horizontal installation position.
For lead-fleece (AGM) batteries installation position is optionally.



NOTE!

Upon receipt of the batteries they must be unpacked carefully and cleaned if necessary. During installation, the blocks must be checked for pole direction and connection. Information on this is contained in the current connection diagram. The batteries must be connected correctly poled and free from current (i.e. switch off the charger and consumers) to the DC supply (positive + pole to positive + connection terminal). Switch on charger and start charging.

4.18.4 Storage

All batteries are delivered charged. If batteries are not installed immediately, they must be stored in a cool, frost-free and clean place. Ideally, the battery blocks are stored at conservation charge. The batteries must be charged up at the latest every 6 months. With systems that are not operated for more than 6 months, it is advisable to remove the batteries and not to re-insert them until commissioning - re-charged.

4.19 UPS unit (if UPS scope of delivery)

The UPS unit is checked as follows:

- 1) Connect available load – up to maximum nominal load - to the output of the UPS unit by connecting the consumers of the WPP operating management
- 2) Switch off input voltage of the UPS unit (switch off the upstream safety cutout as per connection diagram)
- 3) The UPS unit must switch to battery operation and supply the consumers for at least 7 minutes
- 4) After 7 minutes the input voltage must be reconnected.
- 5) The UPS unit reverts from battery operation back to mains operation.

If the UPS supply unit switches off during the test, proceed in accordance with the error code of the UPS unit. If the battery is run down proceed as per section 4.19.2.

Special instructions for different types of UPS units:

- **Effekta** recommends replacing the ventilators after an operating period of 3 years.
- **Jovyatlas** recommends replacing the ventilators after an operating period of 2 years.

Please consider the respective manufacturer information from the manuals.

If the load test under nominal conditions is not achieved within the prescribed time (usually 7 minutes), all batteries of the UPS unit must be checked and/or replaced.

4.19.1 Storage of the Uninterruptable Power Supply unit without internal batteries

Please consider the respective manufacturer information about special storage conditions from the manuals.

4.19.2 Advice for disposing batteries, accumulators, capacitor, electrical components and circuit boards



The frequency converter contains batteries, capacitors, electronic components and circuit boards which must be disposed in accordance with local requirements for hazardous waste.

All components with the sign of the crossed out wheeled bin are recyclable assets and must be fed to the recycling process after exchange.

5. Change IGBT-Modul

This chapter describes how to remove and reinstall an IGBT module.
Pictures are examples. The actual structure and configuration may differ.

5.1 Required special tools

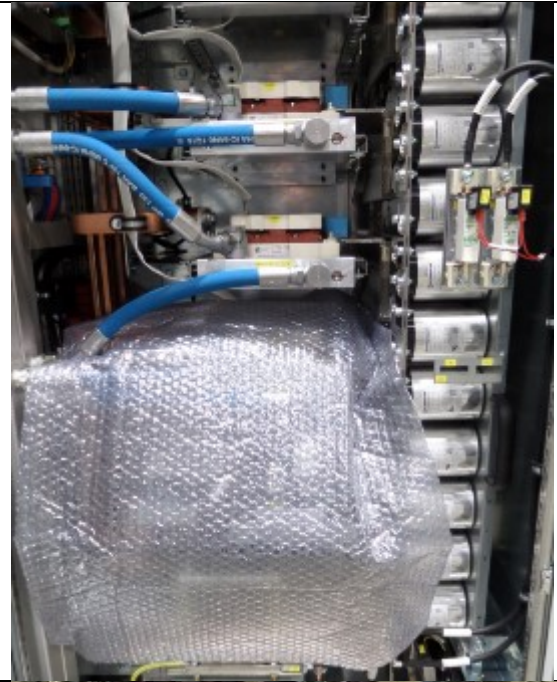
Hand pump with manometer or electrical pump	
1x Ratchet 1x Torque spanner 3-140Nm 2x extensions 1x extension short (50-60mm) 1x 6mm hexagon 1x 25 Torx wrench 1x 25 Torx screwdriver 1x 8 mm spanner 2x 10 mm spanner 2x 17 mm spanner 27 mm spanner	
1x Collection Container 25 l + volume of the cooling system (if a shut-off valve was not installed between the cooling system and the converter) 1x Funnel	

5.2 Removal and reinstallation of the IGBT modul

• Stop the coolant supply to the inverter through a valve on the external cooling system.	
• Connect ½ inch hose at the lower connections. Stop the coolant supply to the inverter through a valve on the external cooling system. • Open the ball valves. • Use the pump if needed to pump out the coolant • Waiting until coolant liquid stops to flow. The cooling system has a volume from approx. 18-20 L without recoler. • Close ball valve and repeat at the second connection. • Now, the pressure in the cooling system should have subsided (visually inspect the manometer).	
Leave ball valve open and don't un-screw the hose. Additional coolant can leak (approx. 2 l to 5 l) if the tube connections are later opened on the riser.	 Example of manual pump
First, remove the ribbon cable of the defective IGBT module.	

ATTENTION

Before loosening the tube connection, the components underneath must be covered with an anti-static (ESD) film and they must be protected against any potential leak or dripping coolant.



Tube connections are always uninstalled starting at the coolant distributor (riser).

ATTENTION

Opening the connections at the back of the cabinet is prohibited to prevent cooling liquid from dripping onto the electronics of the IGBTs below.



Use a suitable spanner to open the hose connection to the cooling system (37mm). Open the connection slowly to avoid dripping coolant liquid.

Have cloth/floor nearby to pick up and wipe off rest coolant liquid.

Disconnect tubes at the distributing pipe. Use a bucket to collect the coolant.



Loosen and remove the connection screws to the DC intermediate circuit layer.

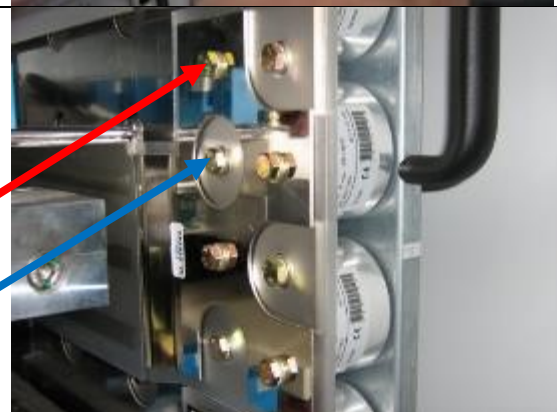
ATTENTION

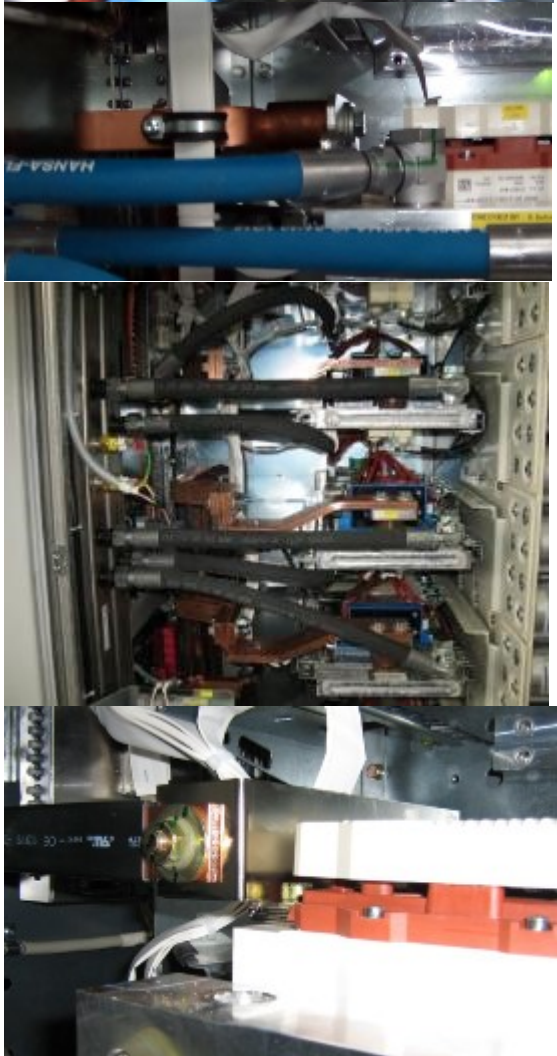
Screws have different length

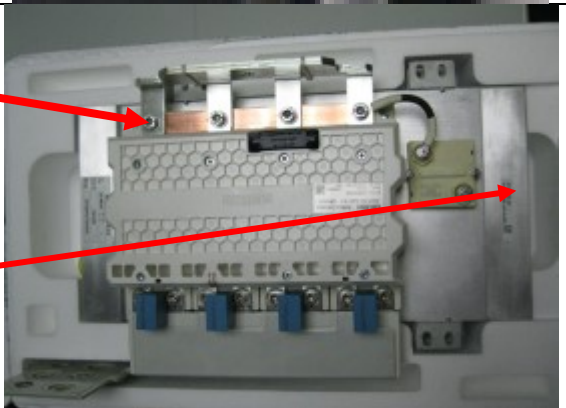
Wrench 10mm

Long screw 4x 6mm x 20mm

Short screw 4x 6mm x 16mm

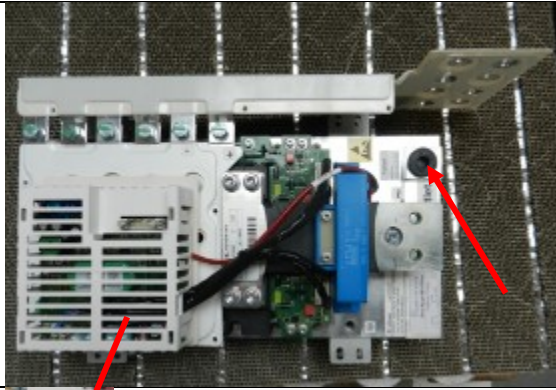


Remove fixation bolt from the guiding rail. Use suitable Torx with ratchet. Torx size: 5,5 x 13mm	
Remove AC bus bar from IGBT module. When loosening the connection screw, hold against it with a second wrench. The connection layer on the IGBT module may not deform. <u>The AC connection is constructed differently depending on the inverter system.</u> <u>Open-end wrench 17 mm or 19 mm.</u>	

Remove fixation of the heat sink to the rear wall using ratchet with two long extensions and 6mm Allen screwdriver. Now pull out the IGBT module approx. 10cm. Hexagon socket 6mm	
Before the IGBT module can be pulled from the rack, the cables must be disconnected at the power resistor. (use an open-end wrench no. 10). Then, pull out the IGBT module. ATTENTION Use a second wrench to hold against the connection. The connections can break!	
New IGBT Module The IGBT modules of the MSC and LSC are designed with coder pins to prevent any mix-up. In this example – LSC is coded here.	
Example Semikron Skiip 4: The 4 screws toward the AC connection side must only be screwed-in hand-tight in spare part deliveries in order to be able to account for smaller tolerances. A torque of 15 Nm must be used. The coolant connections are located behind at the bottom and on the front.	

Example Infineon stack:

The coolant connections are located behind at the bottom and on the front.



Rückseite

Remove adapter and tubes from the old IGBT module and install them on the new module.

Notice the mounting direction of the O-rings when you change them.

KP-37075

KP-28211



Flache Seite nach unten!

ATTENTION

O-rings must be replaced! KP-46655

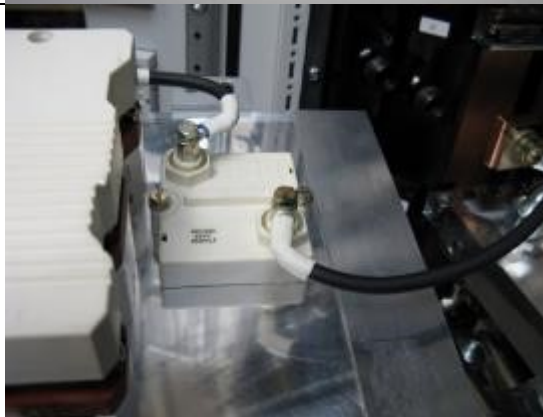


Connect the cables to the power resistor.

ATTENTION

Use a second wrench no. 10 (mm) to hold against the connection.
The connections can break!

Torque: 3 Nm



Place the new IGBT in the cabinet and fasten it on the assembly panel with Allen screws. Use a ratchet with two extensions and a 6-mm Allen wrench attachment.

Torque: 11 Nm



Screw in the fixation screw of the guide rail hand-tight.

Use fitting Torx with ratchet.

Torx size: 5,5 x 13mm

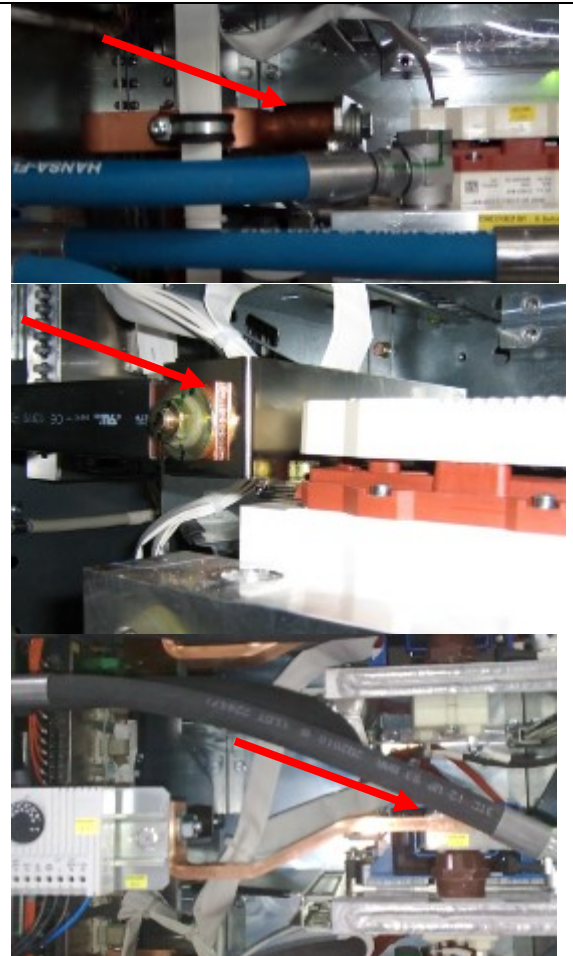


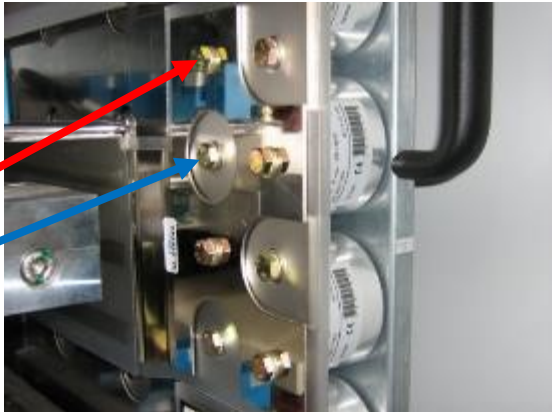
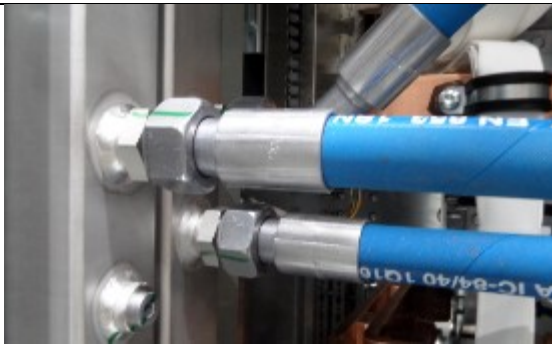
Screw the AC power rail together with the IGBT module. When tightening the connection screw, hold against it with a second wrench. The connection layer on the IGBT module may not deform.

The AC connection is constructed differently depending on the inverter system.

Torque: M10 = 38Nm

M12 = 66Nm



Screw the IGBT module together with the DC interim circuit layer. ATTENTION The screws come in different lengths. During tightening, use the wrench or the attachment to hold against it. The isolation of the DC interim circuit layer may not be damaged. Long screw 4x 6mm x 20mm Short screw 4x 6mm x 16mm <u>10mm spanner size</u> <u>Torque: 7,9 Nm</u>	
Connect any tubes on the risers. <u>Use a 27-mm or 30-mm wrench depending on the design.</u> Torque: see Section "Installation information"	
Connect the ribbon wire with the IGBT module. Secure the plug again with cable ties!	

Refill coolant with manual pump or with an electrical pump. The indicated coolant pressure should conform to a nominal pressure of 2.5 bar.



To ventilate the IGBT cooling system, use the automatic ventilation (if available).

If the heat exchanger is connected above the inverter, then the ventilation is installed there.

After ventilation, recheck the coolant pressure and refill any coolant as needed.

Turn on the cooling system pump, let it run and recheck the pressure.
(Reference value: 30 min.)



6. Data backup and control following maintenance

The following checks must be carried out following conclusion of the maintenance work. This information can be called up with the help of the *CONCYCLE*® System Tool.

1. Using the *CONCYCLE*® System Tool, check whether the parallel mains trigger generated before the maintenance work is still present in the disturbance memory. If this is not the case, please contact the ConverterTec Service Department.
2. Generation and backup of a trigger in parallel mains operation with power

When backing up data, the following system information must be backed up or recorded with the help of the *CONCYCLE*® System Tool.

1. Generation and backup of a trigger in parallel mains operation with power DR_xxx.dsb
2. Back up of the event and operating hours counter

OperatingHours_2.txt (operating hours counter after maintenance)

Counter_2.txt (event counter after maintenance)



NOTE!

If there is no wind, the parallel mains trigger can be generated at a later time when the system is again connected to the mains, if necessary also via remote dial-in.

Checking the parallel mains trigger DR_xxx.dsb after maintenance:

A check must be carried out as to whether all measurements are present in all phases and no vibration occurs in the intermediate circuit voltage and in the revolutions signal. If this is not the case, please contact the ConverterTec Service Department.

7. Dealing with the data and the maintenance report

Complete the next 4 pages in full and return to the ConverterTec Service Department within two weeks by fax or e-mail.

Please also forward the data described in section 4.1 /4.19 in full to the ConverterTec Service Department within 2 weeks by e-mail, indicating the location of the system and the series number of the converter system. The maintenance report together with the data described in section 4.1/4.19 are a precondition for the agreed continued validity of the system warranty.

E-mail: service-kempen@convertertec.com

Fax: +49 (0)2152 145-631

7.1 Maintenance report



NOTE!

This maintenance protocol is provisional. It is subject to permanent further processing without prior notification.

System type:	Series number (WW job no.):		Location:
	Implementation/ result		Remarks/explanations
	OK/ finished	Not OK/ not finished	
Data backup before maintenance			
Checking of the docu- mentation			
Isolation of the system			
Free of voltage – after isolation			
Check of relays and con- tactors			
Check of signal contacts			
Check of setting values			
Check of circuit breakers			Number of switching cycles acc. to CB indica- tion
Insulation resistances of the stator			Values:
Insulation resistances of the rotor			Values:
Electrical plug-in and ter- minal connections			
Filter capacitors			Values:
DC capacitors			
Discharging device			Values:

Check of capacitor con- tactor/Inrush current lim- iter			Values:
Check of mechanical connections			
Check for vibration dam- age			
Check of overvoltage protection – type 2			
Check of overvoltage protection – type 1			Values:
Check of filter mats			Filter pads must be replaced regularly depend- ing on the ambient conditions.
Check of IGBT modules			
Cleaning the system			
Energized – after re-connection			
Check of heating system			
Check of cooling system			
Check of 24V buffer bat- tery charge			Battery voltage of 22V maintained for 3 minutes at an ambient temperature of 10°C to 40°C. yes/no
Check of UPS battery			Load of 7 minutes maintained at nominal condi- tions.
Check and data back-up after maintenance			
Finally			
Check of trigger files			
Required data as per para. 4.1 / 4.19 has been sent to ConverterTec			Date:

[illegible]

7.3 Explanation

Through his signature, the technician declares that he has carried out expert maintenance on the CONCYCLE® Wind Frequency Converter System in accordance with the maintenance instructions.

He declares furthermore that all defects in the system have been removed and that he can again authorize operation of the converter system in the wind power plant without risk to persons and machines.

YES	The wind power plant has been put back into operation.
NO	It has not been possible to put the wind power plant back into operation.

The maintenance was carried out on:

Date:

Technician 1

Name:
(please print)

Signature _____

Technician 2

Name:
(please print)

Signature _____

(will be processed by ConverterTec)	
Acknowledgement of receipt:	
Date:	Company stamp
Maintenance accepted.	
Maintenance not accepted because	

Maintenance results in a contractually agreed extension of warranty yes ☐ no ☐	

8. Signs and abbreviations used

A	
B	
BGFE	Berufsgenossenschaft der Feinmechanik und Elektrotechnik (Employers' Liability Insurance Association for Fine Mechanics and Electrical Engineering)
C	
CSC	CONCYCLE System Control
D	
E	
ESD	Electrostatic discharge
F	
G	
H	
I	
IBN	Commissioning
IGBT	Insolated Gate Bipolar Transistor
F	
G	
H	
L	
M	
N	
O	
P	
Q	
R	
S	
SPD	Surge Protection Device
T	
U	
UPS	Uninterruptible power supply
V	
W	
WPP	Wind power plant
X	
Y	
Z	

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