10.3. Overview of serialized power components

The following power components were serialized during production.

If one of these components were replaced in the field the serialization database shall be updated, ie, the new serial number has to be reported to ABB. For a complete list of serialized parts, see “Assemblies & components PCS6000 product family with serialization profile”, 3BHE600000 E70.

Table 10–1 Serialized power components

Component name	Product number	SAP number
IGCT (Low Power)	RC-IGCT 5SHX 1960L0006, 91mm GVC736	3BHB056120R0003
IGCT (Old type)	IGCT, 4500V, 91mm, 5SHY 3545L0016	3BHB020720R0002
IGCT (New generation)	IGCT, 4500V, 91mm, 5SHY 4045L0006 (One to one replacement of the 5SHY 3545L0016)	3BHB030310R0001
Reactor	Reactor 3725A, Air	3BHE035425R0001
DC-link Capacitor	DC-link Cap DCMKP 2.6kV	3BHB006617R0013
Thyristor controller	Thyristor controller 3AC 400 V 90A	3BHE031436R3090
Pre-charging transformer	3p-Tr. 30kVA 3x400V 3x4900V	3BHE019196P1330
HFM filter capacitor	HV-Cap. 3-Ph. 3.3kV, 48A	3BHB006617R0004

10.4. General directives

10.4.1. Correct tightening torques of bolted connections

IMPORTANT! The following basic rules must be observed:

1) Use a ring spanner or flat wrench to manually tighten bolted connections (up to size M10).
2) Always check M12 or higher bolted connections with a torque wrench.
3) Check the torque of a bolt nut screw connection on the nut side.
4) Avoid overlapping washers.

Unless otherwise stated in the individual procedures the tightening torques in Table 10–2 must be used for bolted connections:

Table 10–2 Standard tightening torques for bolted connections

Bolt size	Torque
M4	2 Nm
M5	3 Nm
M6	5.5 Nm
M8	15 Nm
M10	30 Nm
M12	Busbar connections: 40 Nm Other connections: 60 Nm
M16	120 Nm

10.4.1.1. Capacitors

Tightening torques for capacitors are given in the relevant data sheets or are indicated on the capacitor housings. If not indicated otherwise, the following maximum torques apply:

- **Filter capacitors:** 10 Nm for mechanical connections and 1.2 Nm for electrical connections
- **Intermediate circuit capacitors:** 10 Nm for mechanical and electrical connections

10.4.2. Training for maintenance and repair personnel

NOTICE **Risk of component damage.**

- During the warranty period, any repair work must be carried out exclusively by ABB service personnel.
- ABB recommends periodical training for the maintenance and repair personnel.

10.4.2.1. Service training

Maintenance and service training courses are offered by ABB on request. Customer staff having successfully attended such courses, will be certified to do maintenance and repair work on the PCS6000 after the warranty period.

For more information contact your ABB service representative.

10.4.3. List of PCS6000 components > 25 kg

⚠ CAUTION **Heavy objects!**

- Use lifting aids and proper lifting technique, when lifting and moving the components that are listed in Table 10–3.

Table 10–3 contains all possible components that weigh > 25 kg, which contains the complete PCS6000 product family.

Table 10–3 List of components > 25kg of PCS6000 product family

Material	Name of material	Weight (kg)	Dimensions (mm)
3BHE034815R0001	BRM Braking Resistor Module 3R0 Widap	74.00	1000 x 330 x 236
3BHE034908R0001	BRU50 Braking Resistor Unit	200.00	1150 x 400 x 1025
3BHE046614R0001	BRU51 Braking Resistor Unit	235.00	1156 x 790 x 731
3BHE045278R0001	BRU55 Braking Resistor Unit	260.00	1500 x 1190 x 872
3BHE046412R0001	BRU56 Braking Resistor Unit	238.00	1504 x 1190 x 935
3BHE034909R0001	BRU70 Braking Resistor Unit	400.00	1200 x 650 x 1025
3BHE046363R0001	BRU70 Braking Resistor Unit Gen01	340.00	1300 x 650 x 1081
3BHE038360R0001	BRU71 Braking Resistor Unit	400.00	1200 x 650 x 1025
3BHE044919R0001	BRU80 Braking Resistor Unit	500.00	1050 x 650 x 1169
3BHE035425R0001	Reactor 0.005mH, 3725A, air	25.00	370 x 320 x 220
3BHL000733P0108	Reactor 0.69mH, 928A, core	782.00	110 x 53 x 73
3BHE008528R0001	Filter Capacitor 3X 36uF 2.3 kV AC	72.00	340 x 190 x 779
3BHE034911R0001	FRM70 Filter Reactor Module	900.00	880 x 646 x 1170
3BHE034913R0001	GBM30 Generator/Grid Breaker Module	160.00	720 x 390 x 704
3BHE034914R0001	GBM50 Generator/Grid Breaker Module	120.00	704 x 526 x 730
3BHE041013R0001	GBM80 Generator Breaker Module	210.00	550 x 650 x 850
3BHE044922R0001	GDM80 Generator/Grid Disconnector Module	55.00	752 x 476 x 425
3BHB006617R0004	HV-Capacitor 3-Phase 3x80µF, 3.3kV, 48A	44.00	345 x 175 x 560
3BHE031197R0001	PES PEB 3PH 3kV PCD I01 -A01	360.00	570 x 742 x 1367
3BHE034555R0001	PES PEB 3PH 3kV PCD I02 -A01	300.00	570 x 742 x 1367
3BHE019196P1330	Precharging Trans. 30 kVA, 400 V, Yny0	115.00	400 x 156 x 450
3BHE038551R0001	Pump WCU30, 300 l/min 3x400V 50Hz 5.5kW	77.00	218 x 498 x 300
3BHE043674R0001	Pump WCU80, 565min/l 3x400V, 50Hz, 11kW	90.00	218 x 498 x 300
3BHE037940R0001	Pump with Motor 525l/min 3AC400V 7.5kW	146.00	218 x 498 x 300
3BHE034919R0001	VLM30 Voltage Limiting Module	50.00	512 x 528 x 440
3BHE034262R0001	VLM70 Voltage Limiting Module	60.00	528 x 513 x 440

Table 10–3 List of components > 25kg of PCS6000 product family (continued)

Material	Name of material	Weight (kg)	Dimensions (mm)
3BHE045468R0001	Wilo Pump (Helix) 520l/min 3AC400V 7.5kW	84.00	320 x 296 x 1177
3BHE045481R0001	Wilo Pump (Helix) 580l/min 3AC400V 9.0kW	146.00	320 x 296 x 1177
3BHE048994R0001	Wilo Pump (Helix) V2204/3-2/16/V/K/460-6DC-Link	137.00	320 x 296 x 1177
3BHB006617R0013	Cap. DCMKP 2.6kV/2x1.5mF	49.00	345 x 175 x 690
3BHB006617R0014	DC-Link Cap. DCMKP 3.15kV/2x1.01mF	49.00	345 x 175 x 690

10.5. Preparation of cooling liquid circuit before replacing components

⚠CAUTION Hot liquid!

Cooling liquid temperature can exceed 50°C!

- Pay attention to the direction of the vent hose and make sure that escaping cooling liquid does not cause injury to persons or damage to the components.
- Leakage of cooling liquid into the converter needs to be avoided, especially glycol causes severe pollution of the converter.

10.5.1. Releasing the over pressure from the cooling liquid circuit

Replacement of certain components connected to the cooling liquid circuit requires releasing the over pressure from the cooling liquid circuit.

1. Switch off cooling pump and secure against restarting.
2. Place a catching tray under the valve V82 in such a way that escaping cooling liquid when releasing pressure does not spill into the converter.

   IMPORTANT! The catching tray must be capable of catching approximately 5 liters of liquid.
3. Close valve V51.
4. Isolate all parts of the cooling circuit which do not need to be released (V30/V31 for the Filter, V56 for the expansion vessel or, if applicable, valves in the external cooling circuit.
5. Open valve V82.
6. Close valve V82 again if no further cooling liquid escapes.
7. Remove the catching tray from the converter cabinet.

8. Wipe up any remnants of leaked cooling liquid.

10.5.2. Emptying the cooling liquid circuit

Replacement of certain components connected to the cooling liquid circuit requires emptying the cooling liquid circuit.

1. Cut off the external cooling circuits to/from external heat exchanger and to/from the filter unit if they need not be emptied (external valves and valves V30 / V31 and V56).
2. Release the over pressure of the cooling system as described in section 10.5.1, **Releasing the over pressure from the cooling liquid circuit**, page 138.
3. Place a catching tray under the drain valve V82 to collect the escaping cooling liquid when opening the valves.

   IMPORTANT! The volume of the cooling liquid can be more than 250 L.
4. Open valve V82 to drain the cooling liquid. Ensure that V51 is open.
5. Open the venting valve in the FCA.
6. Close valve V82 again if the cooling liquid circuit is empty.
7. Remove the catching tray from the converter cabinet.
8. Wipe up any remnants of leaked cooling liquid.

10.6. Replacing components in POU

After faulty semiconductors have been identified, they have to be ex-changed according to the procedures below.

Converter service tools from the toolbox (3BHB008753R0001) for standard converters are required to carry out these procedures eg, a spreading tool and a stabilizer plate (see chapter 3, **Service tools**, page 31).

To ensure sufficient cooling, each stack is clamped with a specified clamping force. To exchange semiconductors, the clamping force must be released.

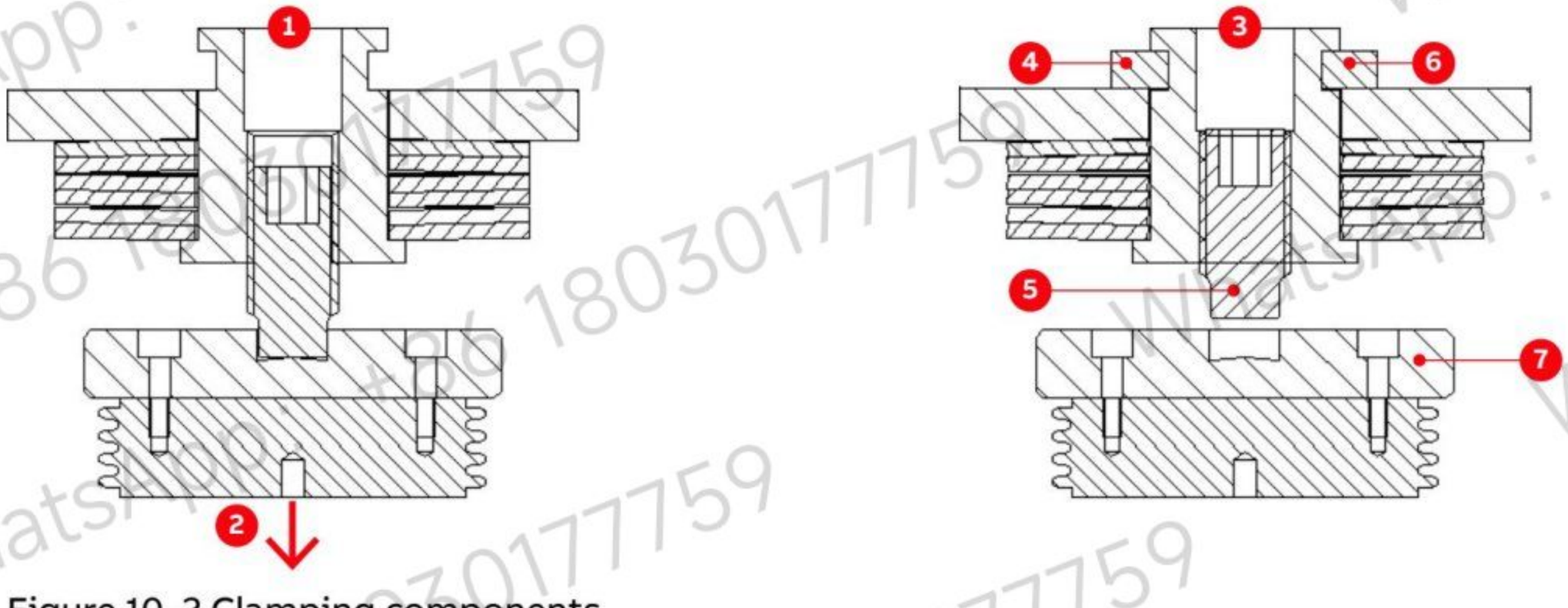

Figure 10–2 Clamping components

1) Stack clamped
2) Force
3) Stack released
4) Tension
5) Clamping screw
6) Pressure loading gauge
7) Pressure plate

10.6.1. General procedure to replace power semiconductors

NOTICE **Risk of component damage.**

- All stacks containing semiconductors must be released before using the spreading tool.

1. Discharge the DC-link, earth all power connections at the foreseen positions and check the converter for residual voltage before doing any other work on the converter.
2. Check the computer screen in “PCS6000 HMI” to find out which phase module has initiated the failure.
3. Check all IGCTs according to section 9.8, **Checking IGCTs with multimeter (if a FADEC 3 is unavailable)**, page 127.
4. Replace faulty IGCTs according to section 10.6.4, **Replacing IGCTs**, page 149.
5. Check all power diodes according to section 9.9, **Checking power diodes with multimeter**, page 129.
6. Replace faulty diodes according to section 10.6.5, **Replacing power diodes**, page 153.
7. After the replacement of the faulty diodes recheck all diodes in the corresponding module.

   IMPORTANT! More than one semiconductor in the module may be faulty due to secondary failures after a short circuit in one phase module.

10.6.2. Releasing the stacks

1. Switch off MCB -Q401 to interrupt the 3AC 400 V input voltages of the AC/DC converter (24 V power supply).
2. On the UPS -G402 turn the selector switch “Bat.-Select” to “Service”, then back to “7.2 Ah” (Fig. 8–11 in section 8.8, **Replacing PECINTM**, page 97) to interrupt the 24 V battery supply voltage (the yellow LED “Bat.-Mode” must be dark).

   NOTE – No IGCTs in the stack are powered anymore; all LEDs are dark.

   Verify that all power supply cables to the IGCTs are voltage-free.

   NOTICE The power supply to the IGCTs must be switched off before releasing the stack! Otherwise the IGCTs could be damaged.

   IMPORTANT! Towards the back on top of each triple stack module you will find three U-shaped pressure loading gauges in their storage place (mounted with screw, use 19 mm wrench to loosen).
3. Take the three pressure loading gauges from their storage places and insert them completely under the tension jacks of the three stacks (see Fig. 10–3).

   NOTICE The pressure loading gauges must be inserted completely before the stack can be released (see Fig. 10–4). Otherwise the tension jacks can break.

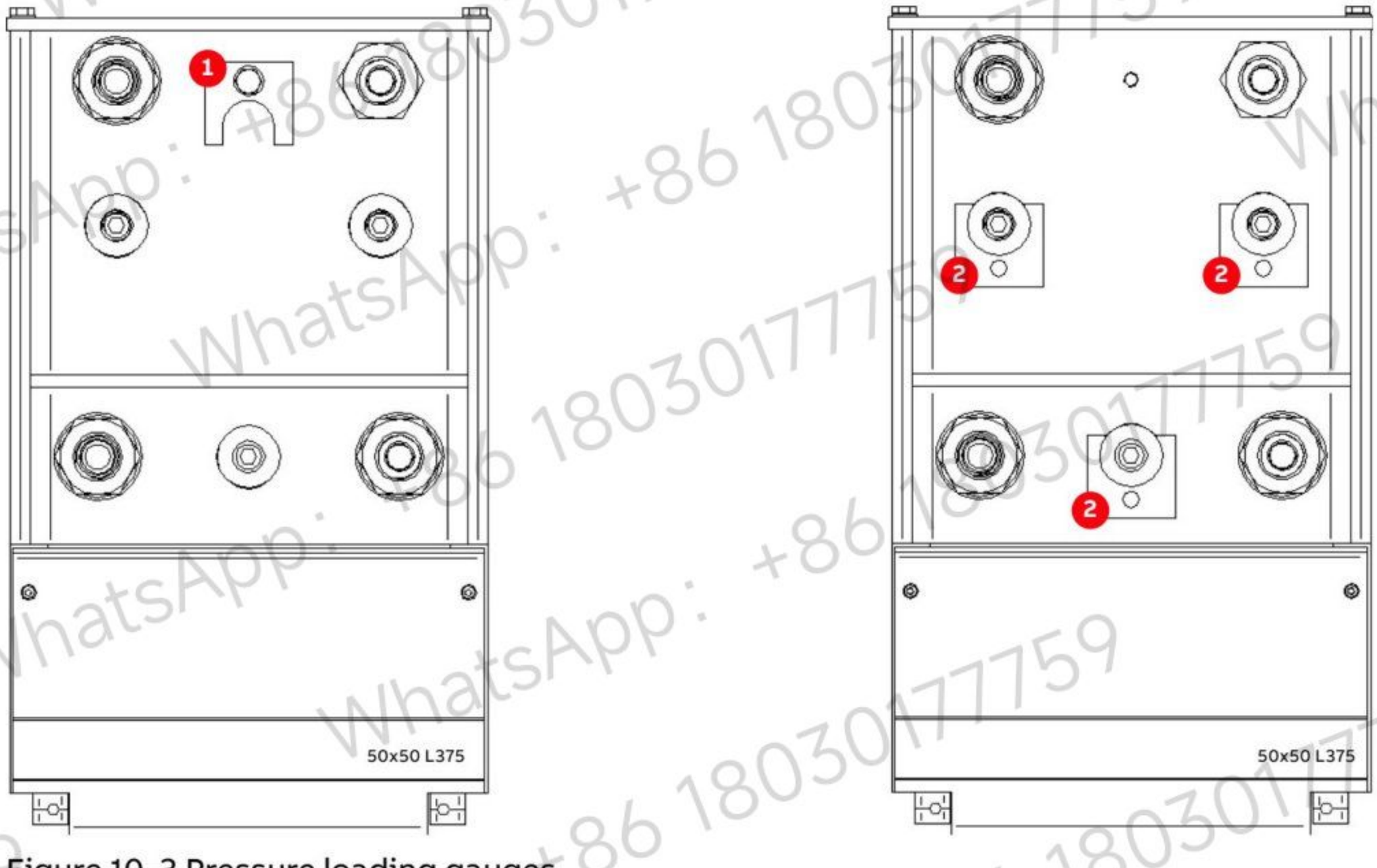

Figure 10–3 Pressure loading gauges

1) Pressure loading gauge in storage place	2) Pressure loading gauges placed under tension jacks

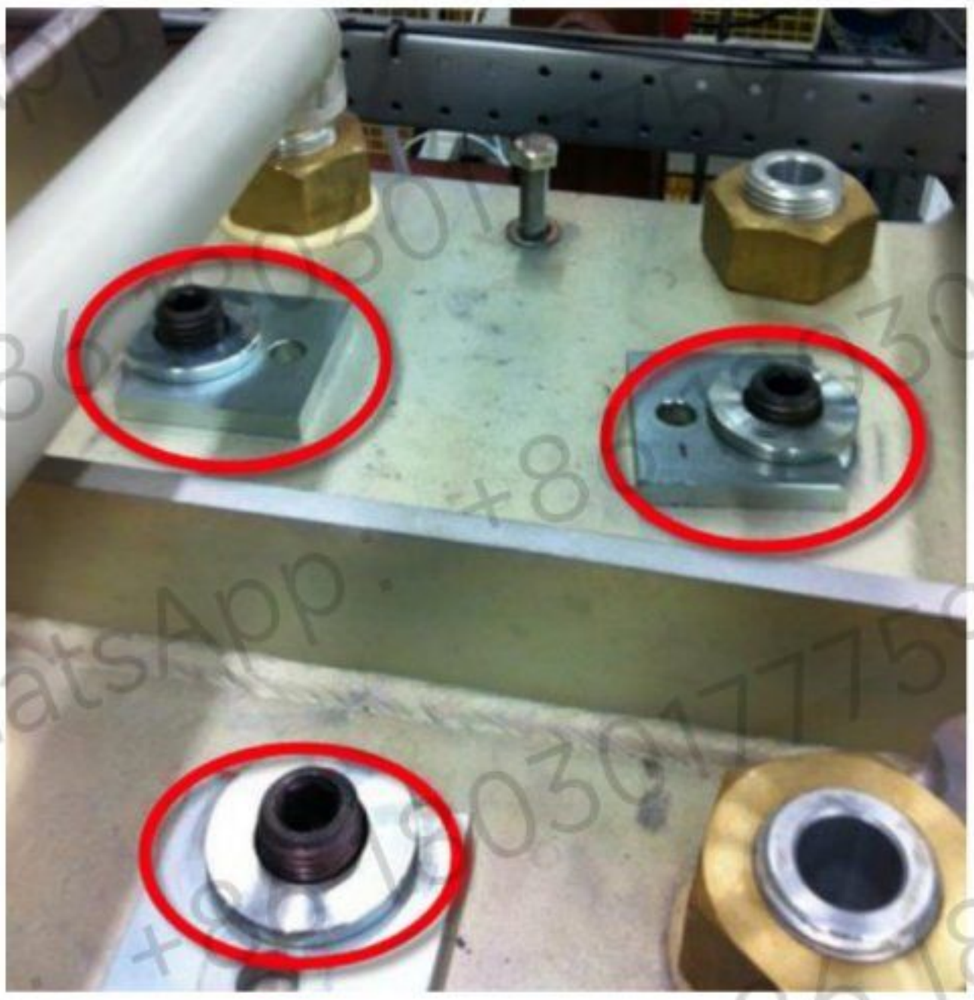

Figure 10–4 Pressure loading gauges inserted

4. Loosen all 24 fixation screws of the gate unit fixations (see Fig. 10–5) using a 5 mm Allen wrench to make sure that the gate unit fixation can move freely in vertical direction.

Figure 10–5 Gate unit fixation

1) Gate unit fixation	2) Fixation screw

5. Release all three stacks in the order given in Fig. 10–6 by loosening the clamping screws counter-clockwise using the socket wrench with 12 mm Allen socket.

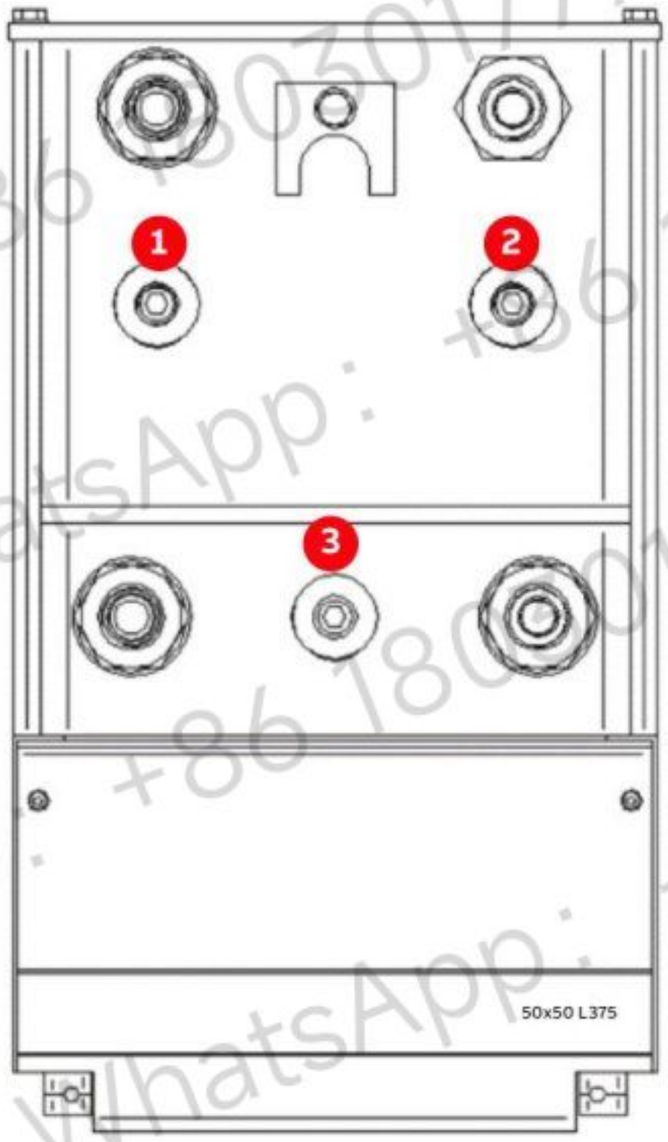

Figure 10–6 Order of loosening the clamping screws

NOTICE Stack misalignment can damage the semiconductors. Release the stacks in the following sequence:

1)Neutral point and clamp diode stack

2)Freewheeling diode stack

3)IGCT stack

The clamping screws must be unbolted until they reach above the pressure plate (see Fig. 10–2).

6. Enter a stabilizer plate in the bottom of the stack where a semiconductor needs to be exchanged as shown in Fig. 10–7.

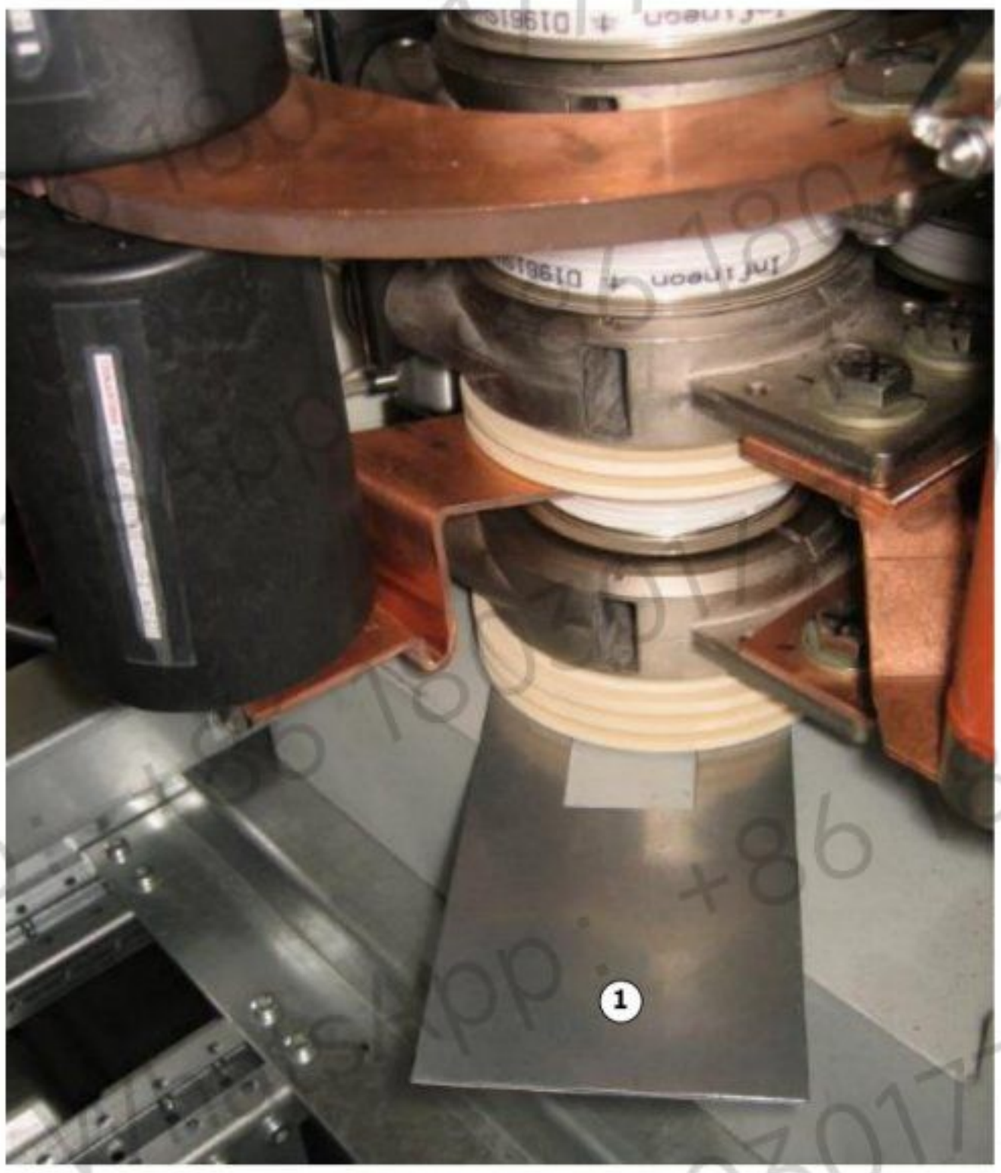

Figure 10–7 Stabilizer plate insertion

1) Stabilizer