4.2 Reference Hybrid Cooler Housing Design

The cooler housing design has a significant impact on the cooling performance, which means the combination of thermal resistance, pressure drop and cooling flow rate. Thus, for all these thermal related product specifications a reference cooling system is needed, where the given specification values are valid. This cooler housing shown in Figure 1 below, is made of a high-strength thermoplastic material with metal inserts, which allows more potential in design.

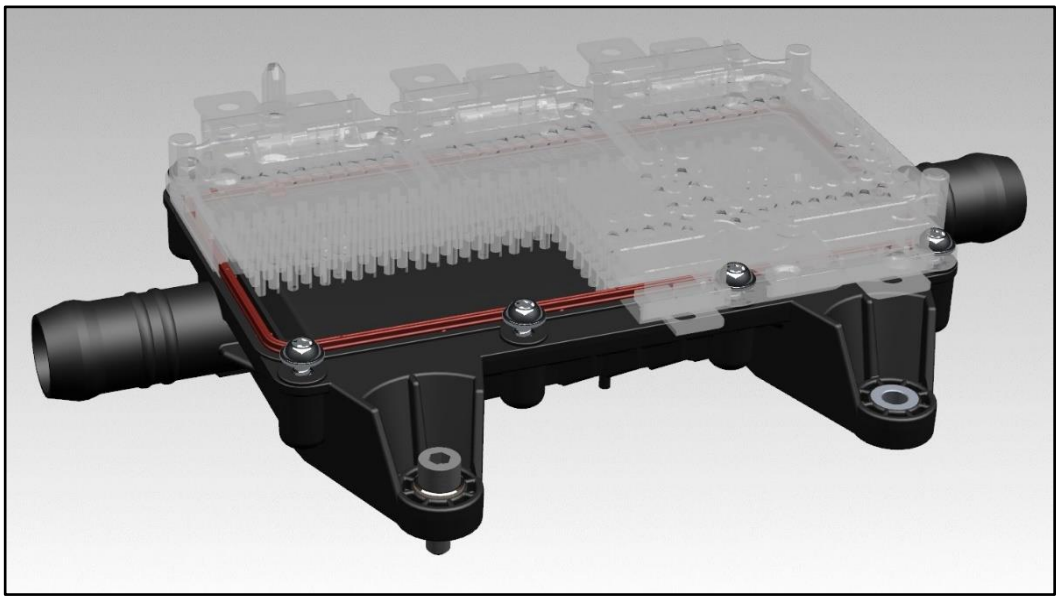


Figure 1: Thermoplastic reference cooler housing with mounted IGBT Modul for HybridPack Drive

The housing can be designed differently if other tradeoffs of thermal resistance / impendance, preasure drop and flowrate must be achieved. Therfore, the reference cooler should be regarded as a design example, where the values from the product specification can be achieved.

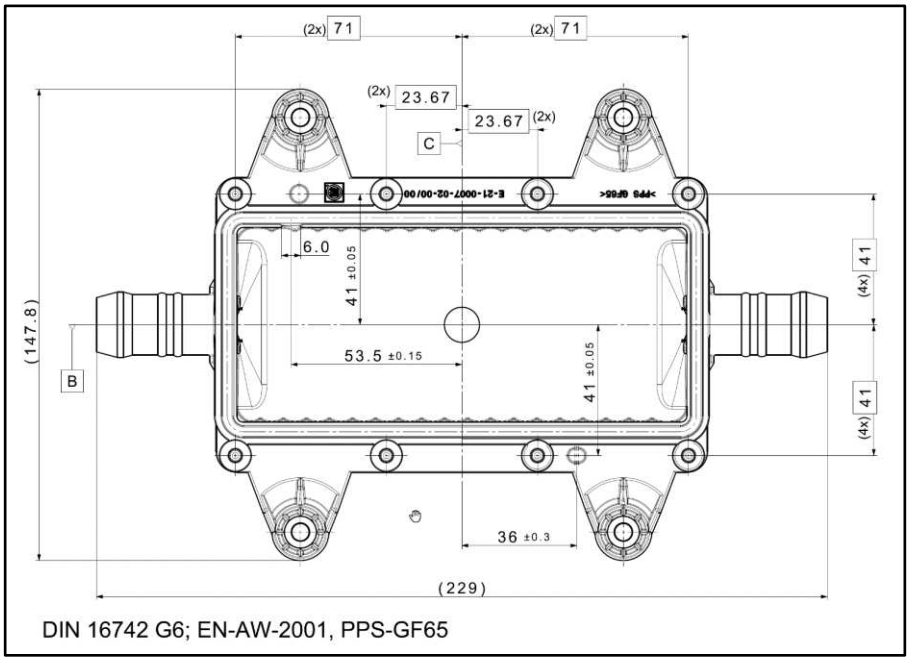
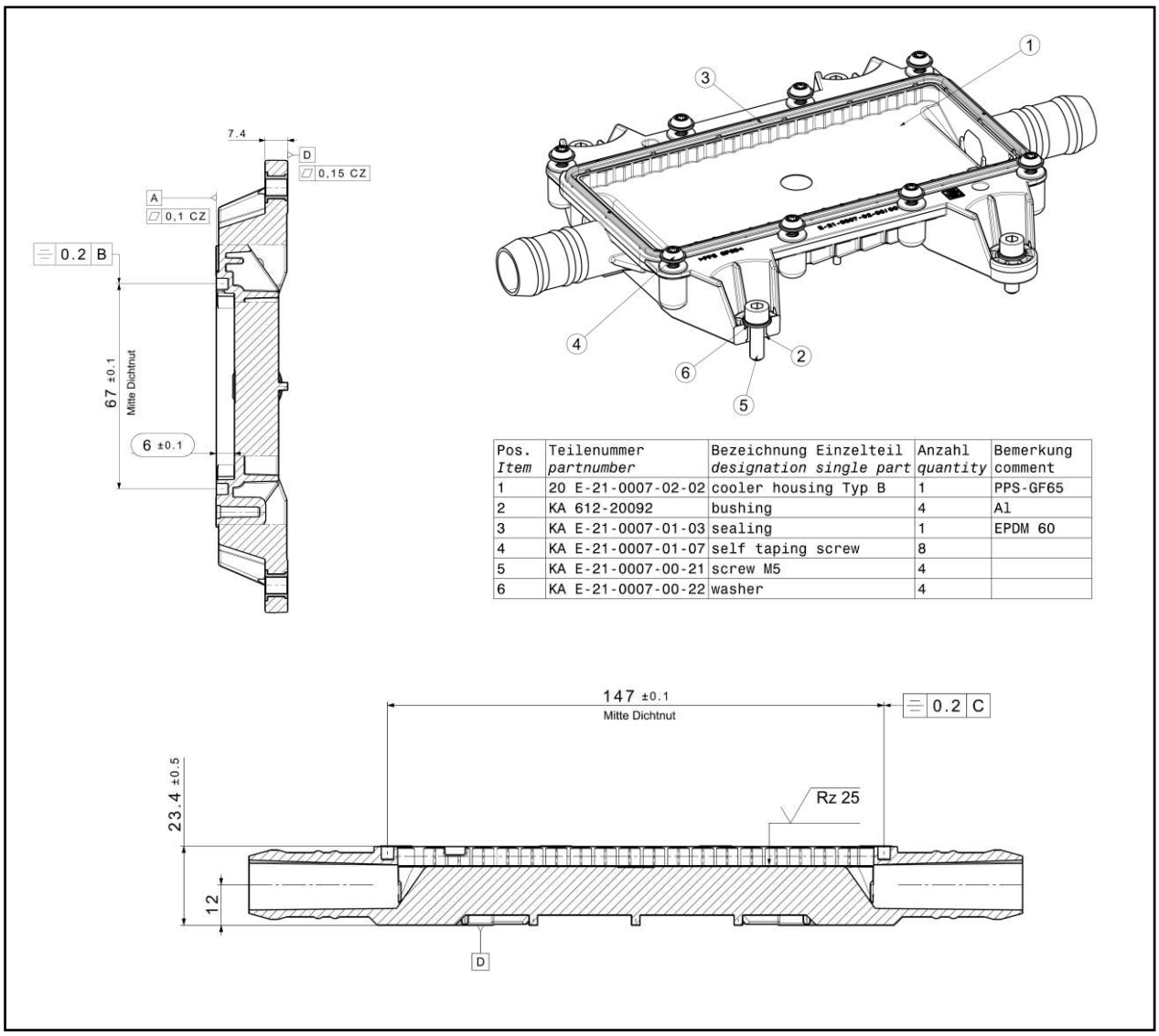


Figure 2: Technical drawing of reference cooler housing design - overview

ASSEMBLY INSTRUCTION FOR THE HYBRIDPACK DRIVE

POWER MODULE ASSEMBLY TO THE COOLING SYSTEM



Pos. *Item*	Teilenummer *partnumber*	Bezeichnung Einzelteil *designation single part*	Anzahl *quantity*	Bemerkung comment
1	20 E-21-0007-02-02	cooler housing Typ B	1	PPS-GF65
2	KA 612-20092	bushing	4	Al
3	KA E-21-0007-01-03	sealing	1	EPDM 60
4	KA E-21-0007-01-07	self taping screw	8	
5	KA E-21-0007-00-21	screw M5	4	
6	KA E-21-0007-00-22	washer	4	

Figure 3: Technical drawing of reference cooler housing design - cross-section

Boundary condition:

- System pressure at < 40 °C: 2.5 bar
- System pressure at > 40 °C: 2.0 bar
- Min. fluid temperature: - 40 °C
- Nom. fluid temperature: + 65 °C
- Max. fluid temperature: + 75 °C

The cooler housing and gasket are designed for use with water-glycol liquid only. When using other cooling media, e.g. immersion fluids, please contact the manufacturer (www.quarder.de).

POWER MODULE ASSEMBLY TO THE COOLING SYSTEM

Many variants are possible for the fluid connectors. In Figure 4 the cooler housing is shown with a Hasco Z83 19x19 connector. Other couplings (e.g. NT413, SAE J2044) can be implemented according to customer requirements.

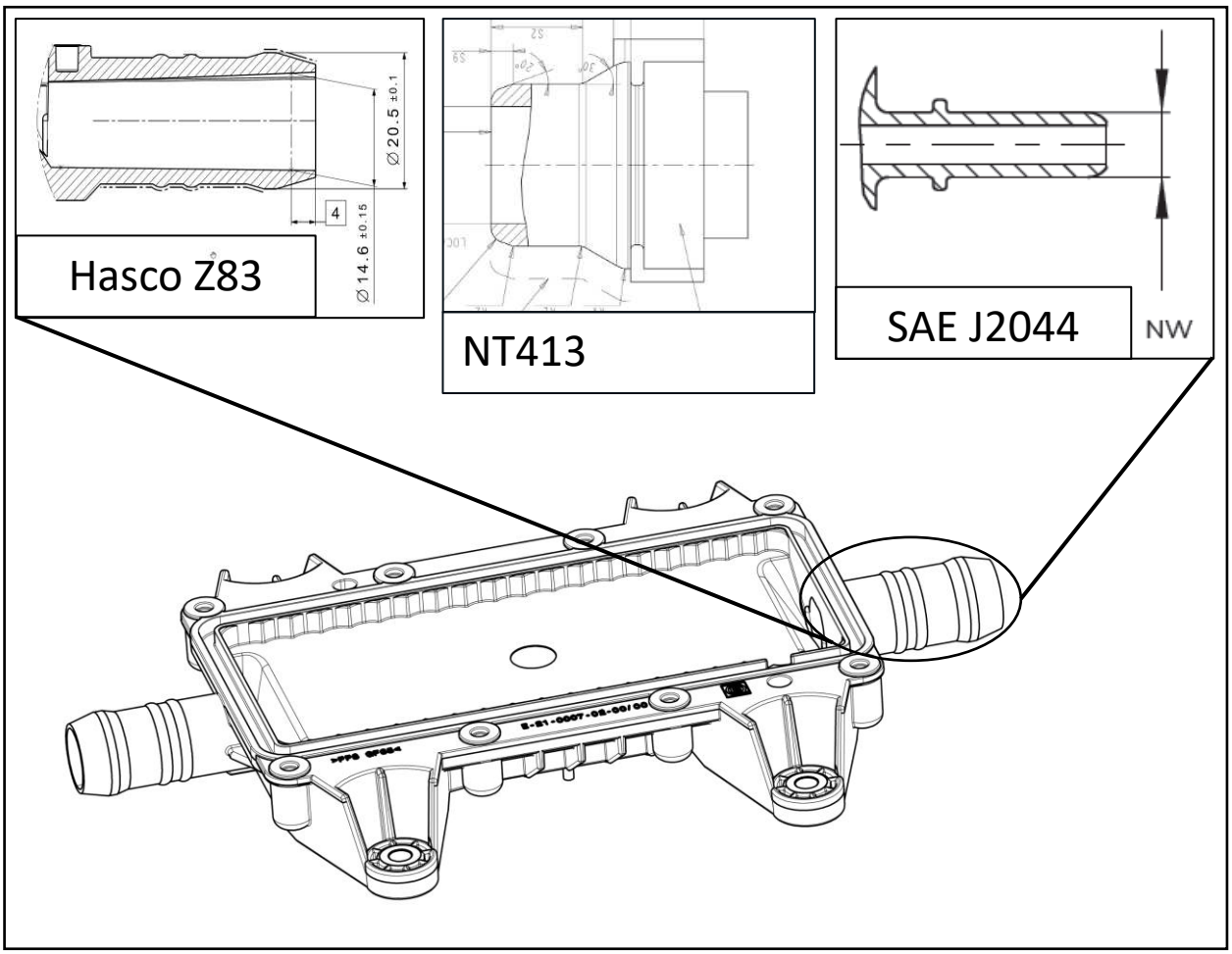
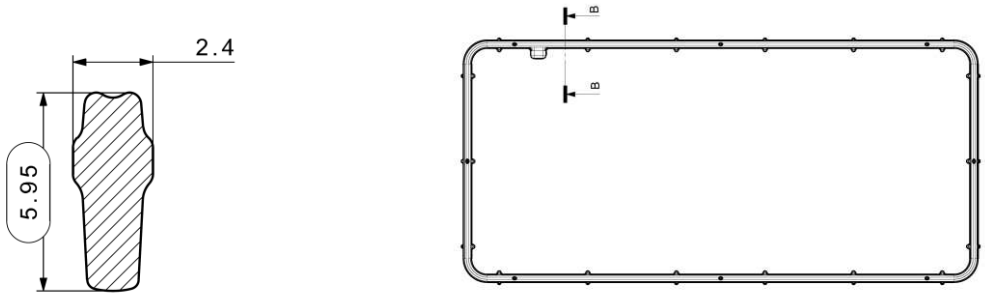


Figure 4: Example for connectors of the cooler housing design

POWER MODULE ASSEMBLY TO THE COOLING SYSTEM

A)



Sealing profile for the thermoplastic reference cooler housing

B)

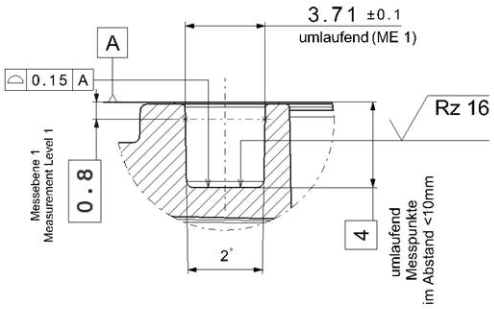
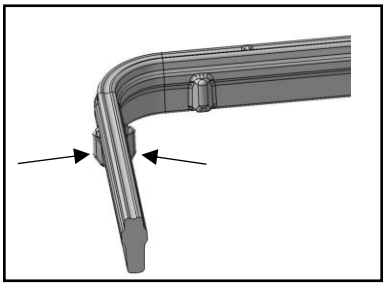


Figure 5: Technical drawing of sealing system for reference cooler housing design

The profile sealing is held in a groove, which must be designed in the cooling system. For the given shape and material, a groove as shown in Figure 5B is recommended (tolerances of edges, surface must be taken from the reference cooler housing design Figure 2 & 3). The sealing system is designed for automatic assembly by www.quarder.de .

A validation in accordance with AQG324 was passed. A tightness of short-term pressure (pressure shock) up to four bar is ensure by this system. **Please consider the maximum pressure load capacity of the HP Drive modules.**



This sealing is designed with “fixing knobs” supporting an easier assembly process. These knobs can fix the profile sealing after it is assembled to the cooler grove and will avoid the risk of displacements during the module assembly process.

Figure 6: Profile sealing with knobs by Erwin Quarder supporting the automatic assembly process

PLEASE NOTE: Infineon does not recommend the usage of a silicon gasket or other sealing methods. The usage of sealing methods different then sealing ring can cause damage on HybridPACK™ Drive module. In case other than the recommended methods are applied, it has to be tested and qualified in the customer system without support from Infineon.

POWER MODULE ASSEMBLY TO THE COOLING SYSTEM

Note for the assembly of the gasket.

For the correct mounting position, there is a tab on the seal which must be placed in the housing at the notch of the seal groove. In **Figure 7** is shown the correct assembly of mounted seal. In **Figure 8** the seal is incorrect mounted.

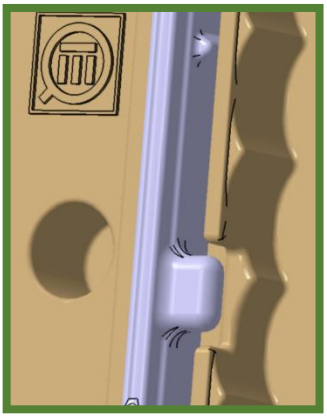


Figure 7: Correct assembly

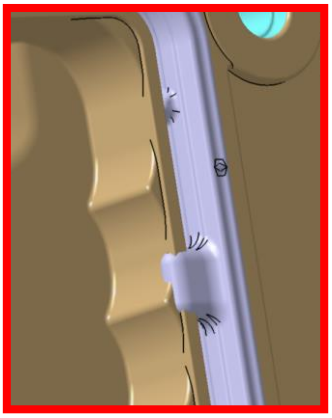


Figure 8: Incorrect assembly

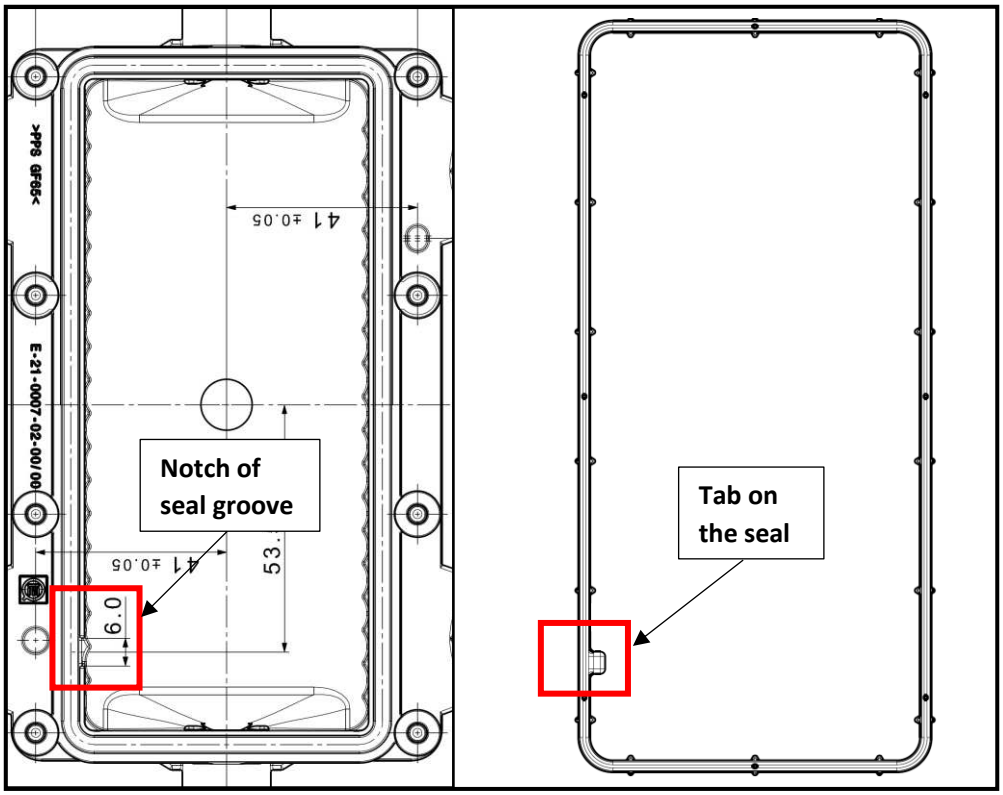


Figure 9: Area of seal grove and notch at the seal

4.3 Baseplate Mounting Screws

The power module baseplate is designed to be fixed on the cooling system by means of self-tapping screws for thermoplastic.

Considering production complexity and highest mechanical robustness, we recommended the following screw type to fix the baseplate to the thermoplastic cooler.

Recommending baseplate fixing screw Ejot Evo PT WN7451 40x14/12 ISO4042/Zn5/An/T0 (Figure 11)

No	Description	Min.	Typ.	Max.	Remarks
1	first mounting torque		1 Nm		(For manual assembly)
2	mounting torque	3.1 Nm	3.3 Nm	3.5 Nm	
3	max mounting speed	400 rpm	450 rpm	500 rpm	Lower than 400 rpm is not recommended
4	effective length of screw in cooler	10 mm			

Alternative Recommending baseplate fixing screw Ejot Delta PT WN 5451 40x14 VZ

No	Description	Min.	Typ.	Max.	Remarks
1	first mounting torque		1 Nm		(For manual assembly)
2	mounting torque	3.6 Nm	3.8 Nm	4.0 Nm	
3	max. mounting speed	400 rpm	450 rpm	500 rpm	Lower than 400 rpm is not recommended
4	effective length of screw in cooler	10 mm			

In the case of manual assembly, it must be ensured that the screws are pre-tightened to 1 Nm in the first operation. For this purpose, the sequence shown in **Figure 10** must be observed. In the second work step, the screws are to be screwed to the final torque in the specified sequence.
When using a screwdriving device where all screws can be screwed at the same time, it is possible to screw to the final torque in one operation.

In any case, a screwdriving tool that checks torque and speed must be used.

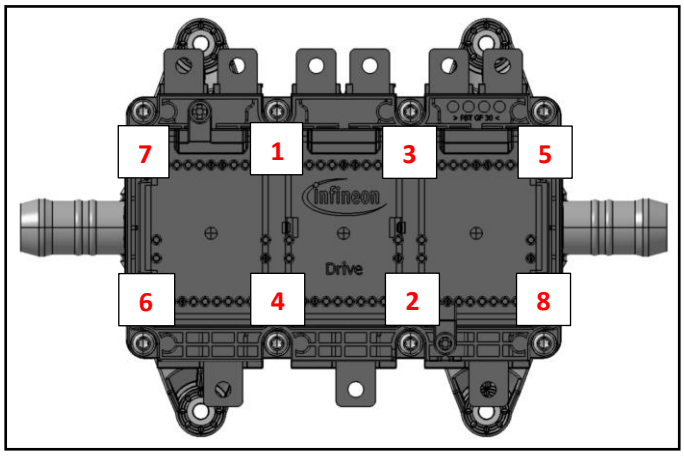


Figure 10: Baseplate fixing screw order

Figure 11: Screw Ejot Evo PT WN7451

PLEASE NOTE:
The above screw connection specifications refer to the first installation. Repeated bolting is not recommended. If the components are screwed on several times, separate screw torques must be determined.

4.4 Mounting the Reference cooler housing

To operate the reference cooler, it must be screwed onto a stable and level base. The flatness of the support surface should not exceed 0.3 mm. This is the only way to ensure safe use over the lifetime and compliance with the performance data. There are additional support surfaces shown in Figure 12 (red surfaces) on the back of the reference cooler housing. These serve to support and stabilize the housing during operation.

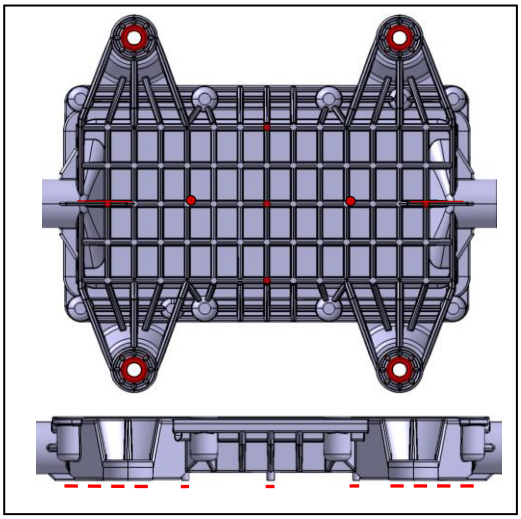


Figure 12: Support surfaces are shown in red

Recommending reference cooler fixing

Screw ISO 4762 SCREW M5x20 STEEL HEXAGON SOCKET HEAD CAP with ISO 7089 WASHER 5x10 STEEL GRADE A PLAIN NORMAL SERIES

No.	Description	Min.	Typ.	Max.	Remarks
1	Thread length	17 mm	20 mm	25 mm	
2	Thread size		M5		
2	Mounting torque	3.3 Nm	3.5 Nm	3.7 Nm	
4	Effective length (2 x d)	11 mm	14 mm		
ISO 7089 WASHER 5x10					
5	Thickness of washer		1 mm		

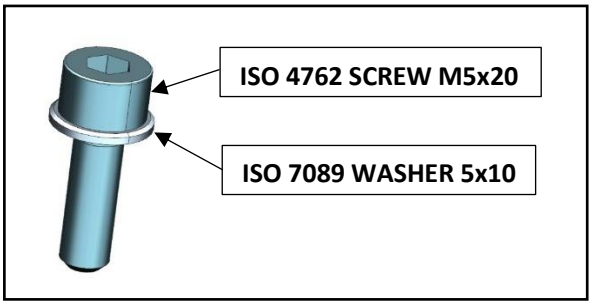


Figure 13: M5 screw with washer

A metric screw incl. washer of size M5 (Figure 13) should be used to fasten the assembly to a test table or carrier plate. The screw connection should be made with a torque wrench.

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