Installation Manual

SAF TRAKr
with E-Maschine EM640023-SPL

Liquid cooled version

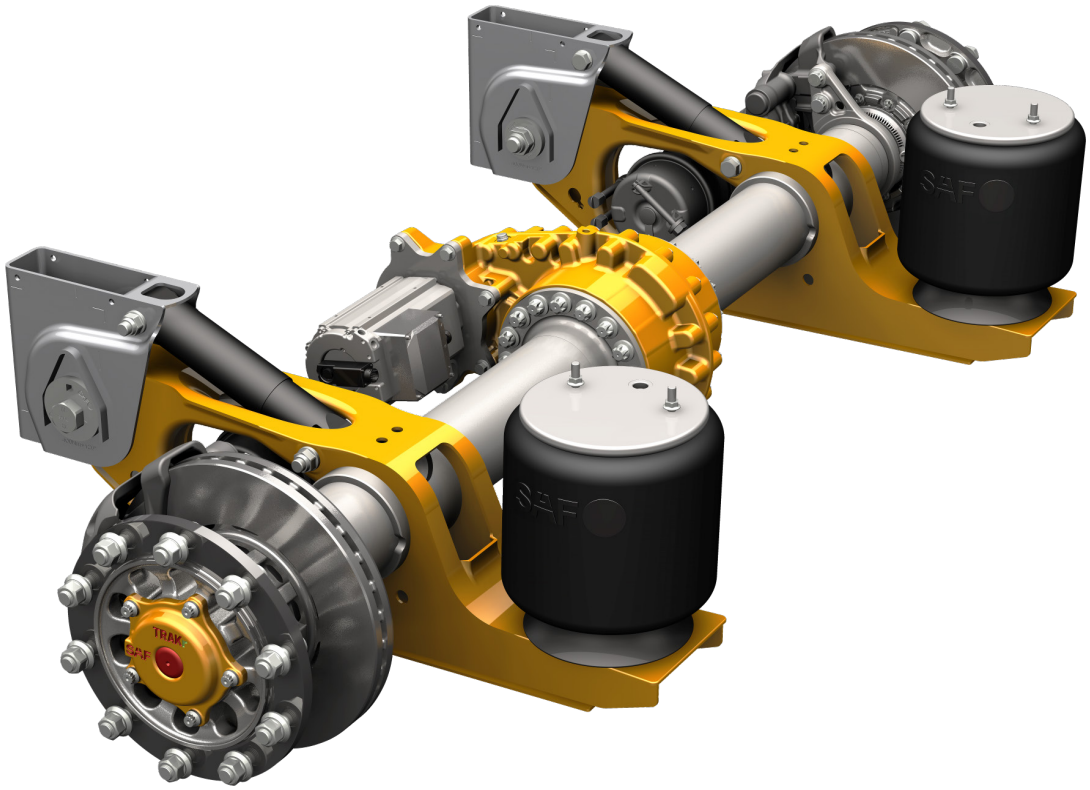

Figure: SAF INTRADISC plus with SAF TRAKr

XL-PS40050BM-en-DE Rev E
Original Installation Manual

Please note

This installation manual is intended for the exclusive use by trained persons within the commercial vehicle industry and related workshops.

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1. General information

1.1 Ordering spare parts

When ordering original spare parts from SAF-HOLLAND, make sure you accurately identify the respective product.
Non-genuine parts have a negative effect on the function of the product, have a shorter lifetime and cause risks and hazards that SAF-HOLLAND cannot estimate. It also increases the maintenance requirement.
SAF-HOLLAND operates a tight service network of partner companies for technical support of SAF-HOLLAND products and supply of parts (see www.safholland.com).
For further instructions on identifying spare parts, refer to the Aftermarket section of our home page www.safholland.com.
Updates are published as necessary on the Internet at www.safholland.com.

1.2 Responsibility and liability

Note:

The vehicle manufacturer is responsible for the entire vehicle including the installed components and systems.
This also includes the proper registration of the vehicle in accordance with the applicable legal provisions and regulations.

SAF-HOLLAND‘s „General Terms and Conditions” apply. SAF-HOLLAND accepts no liability claims for personal injury or material damage with one or more of the following causes:

- Failure to observe the proper use.
- Failure to observe the installation, user‘s and repair manual and the safety instructions contained in it.
- Arbitrary changes or modifications to the product.
- Insufficient maintenance of parts that are subject to wear.
- The use of any spare parts other than original SAF-HOLLAND parts.
- Use of damaged parts.
- Disasters due to external influences or force majeure.

1.3 Warranty and general terms and conditions of business

Refer to the “Sales” section of our home page www. safholland.com for information on current warranties and general terms and conditions.

1.4 Environmental protection

All components and consumables used for maintenance and care must be disposed of in an environmentally friendly manner.
Recyclable components must be cleaned of oil and lubricants and recycled.
When doing so, you must adhere to the disposal instructions for the respective consumables and the valid national and regional regulations.

1.5 Target group

The installation manual of the product is restricted exclusively to be used by trained personnel from authorised specialist workshops.

1.6 Proper use

The product has been constructed using state-of-the art technology and in accordance with recognized rules of technical safety.
However, its use may result in hazards for the operator or third parties or damage to the device or other objects of material value.
Proper use also includes:

- Observance of the operating manual and the installation manual, as well as implementation of the working steps stipulated in the installation manual.
- Adherence to the performance limits of the product.
- Adherence to all repair and care instructions, as well as additional inspections.
- Use of the auxiliary and operating materials listed, as well as their environmentally-friendly disposal.

Operationally safe function can only be guaranteed if all the instructions, setting and performance limits for the product are adhered to.

1.7 Rescue data sheet

Note:

The creation and provision of a rescue data sheet in accordance with ISO17840-2 is under responsibility of vehicle manufacturer.

1.8 Safety instructions and symbols used

The following symbols are used to denote particularly important information and sections of the text.
It must be ensured that they are always read and observed before working with the product.

Danger!

This safety instruction with the exclamation mark warns of a possible safety risk or serious and fatal injuries.

Attention!

This safety instruction with the exclamation mark warns of possible damage to the product.

Note:

Marking for special user tips and other particularly useful and important information for efficient work and economical use.

1.9 Marking used for sections of text

- Marking for instructions for actions and information in safety instructions

1., 2., 3., ... Marking used for working steps.

2. Safety instructions

Danger!

The installation of the product is restricted exclusively to trained personnel from authorised specialist workshops.

Dangerous electrical voltage!

- Dangerous electrical voltages can occur during installation, operation and maintenance of the product. Assembly and repair work may only be carried out by qualified personnel trained in accordance with national laws and regulations.
- The personal has to be trained and certified according to the national legislation and/or regulations (e.g. DGUV 209-093 Level 2 S or E or comparable).

3. General instructions

Danger!

- It must be ensured that the cooling system works properly during the transfer journey. For this purpose, the cooling system can be pre-supplied with the vehicle-side source (+24V, e.g. driving light). The pre-supply of the cooling system for the electric motor is only permitted for transfer journeys.
- It must be ensured that the cooling system is working properly when the generator is delivering power.
- For normal use, the cooling system for the e-machine must be connected to the electric recuperation system (see „7. Liquid cooling system for E-Machine“ on page 10).

Danger!

The TRAKr gearbox is not filled with oil on delivery. The oil for the initial gearbox filling is included in the TRAKr axle delivery. Before operation the gearbox must be filled with the supplied gearbox oil:

- Filling gearbox oil SAF Synlube SAE 70W-90 capacity: 0.45 l
- Article number: 03 387 1004 00
- Oil class: SAE 70W-90

See „6. Initial gearbox oil filling“ on page 9.

Danger!

The operation of the TRAKr in ADR* vehicles is not allowed.

*) European agreement concerning the International carriage of dangerous goods by road.

Note:

The creation and provision of a rescue data sheet in accordance with ISO17840-2 is under responsibility of vehicle manufacturer.

Note:

See also the recommendations for the installation position of the liquid cooling circuit in our design handbooks for INTRA and MODUL.

4. Function diagram

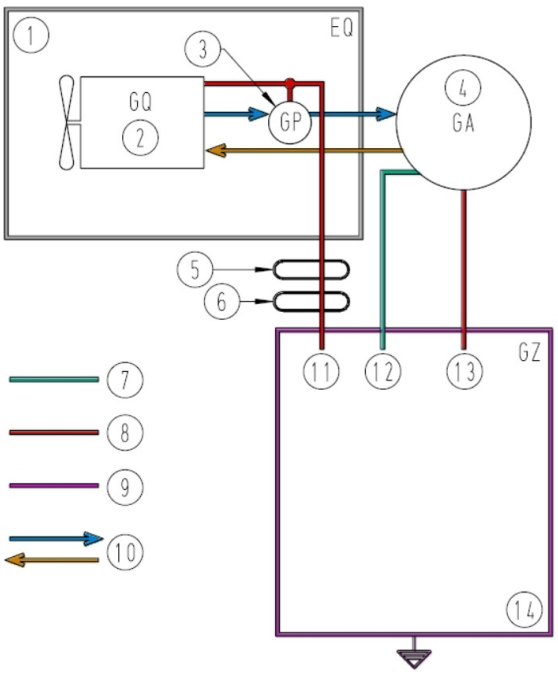

Fig. 1: Function diagram

Note:

The descriptions of the function diagram correspond to IEC 81346-2.

Pos	Description
1	TRAKr electrical components
2	Radiator + fan
3	Pump
4	E-Machine
5	Superseal connector – LV_DC interface Pin 1: +24V Pin 2: 0V
6	Harting connector – LV_DC interface Pin 1: +24V Pin 2: 0V
7	Signal
8	Power
9	Ground
10	Water pipes
11	Cable: LVDC, 2 * 2.5 mm^2. Included at liquid cooling system kit 03 422 5090 01.
12	Cable: E-Machine power, ADD 4 * 6mm^2 (12m). (not included)
13	Cable: E-Machine signal, ADDM12, 8P (10m). (not included).
14	ADDM/L R (not included)

5. Suspension system

Note:

Installation of the suspension system analogous to the installation specifications and recommendations according to the SAF construction manual (before the installation of the ground strap).

5.1 Driving height plate

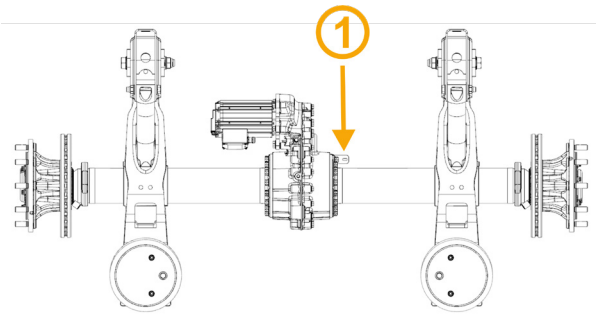

Fig. 2: Driving height plate

Pos	Description
1	Driving height plate

Note:

- The driving height plate is out of center.
- The dimensions are specified in the customer drawing.

5.2 Lifting thread

Attention!

The lifting thread on the gearbox is not suitable for lifting the entire axle - this will cause damage and can lead to injuries.

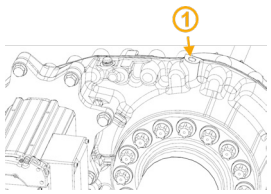

Fig. 3: Lifting thread

Pos	Description
1	Lifting thread

5.3 Installation of the ground strap

Attention!

Final tightening torque for ground strap: 9 ±1 Nm
Resistance E-Machine - chassis: < 0.1Ω at 0.2 A

Attention!

When installing the ground strap, the compression and rebound travel of the axle must be taken into account.

5.3.1 Mounting with ground strap

The ground strap is to be mounted on the frame of the semi-trailer.
The mounting can be done either through a blind hole or through a hole. The generator has four holes (M6) for mounting the ground strap (Fig. 5).

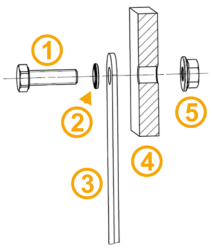

Fig. 4: Mounting with through hole - 1

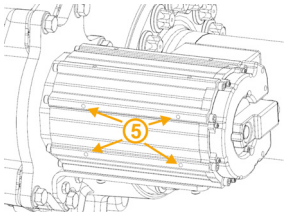

Fig. 5: Mounting with blind hole - 2

Pos	Meaning
1	Hex bolt
2	Lock washer type VS
3	Ground strap
4	Frame of the semi-trailer
5	Tapped hole

5.4 Ground concept - equipotential bonding

The electrical connection of all metallic surfaces that can be touched up to the screw connection at the equipotential bonding on the electrical machine is a maximum of 20mΩ.

Attention!

The vehicle manufacturer is responsible for implementing requirements for equipotential bonding between the electrical machine and ground or other HV components.

Attention!

The ground connection of the electrical machine to the body is absolutely necessary in terms of the HV safety concept (equipotential bonding) and is the responsibility of the customer.

According to ISO 6469-3:2001 (E) and ECE regulation no. 100, the resistance to the body must be kept <0.1 ohms over the service life. The supplied ground strap kit (item number 03 424 2050 00) should be used for this. The electrical connection is to be made between the body and the E-Machine. An electrical connection can be made via bare metallic surfaces.

6. Initial gearbox oil filling

Danger!

Before operation the gearbox unit GU051401-10 must be filled with the supplied gearbox oil SAF SynLube SAE 70W-90 (0.45 l, article no: 03 387 1004 00).

Attention!

We recommend to use only original SAF operating supplies.

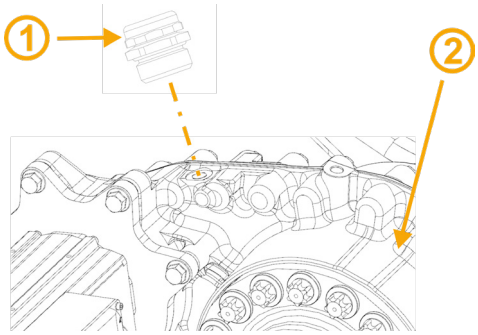

Fig. 6: Initial gear oil filling

Pos	Description
1	Pressure compensation element - oil filler opening.
2	Gearbox

6.1 Pressure compensation element

Attention!

- The proper function of the pressure compensation element is crucial for the proper function of the gearbox. The gearbox will be damaged if the pressure compensation element is replaced by an ordinary screw.
- Overpainting the pressure compensation element is not allowed. A coat of paint prevents the operation of the pressure compensation element and will result in a defect gearbox.

- The tightening torque of the pressure compensation element is 5 Nm +2/ Nm.
- The article number of the pressure compensation element is 04 337 0077 00.

7. Liquid cooling system for E-Machine

Danger!

- Do not tow a trailer with a SAF TRAKr without a functioning cooling system for the electric motor!
- Pre-supplying the cooling system with the vehicle‘s source (+24V, e.g., headlights) is possible.
- It must be ensured that the cooling system is functioning properly during vehicle operation and generator load output.
- Pre-supplying the cooling system for the electric motor is only permitted for transfer journeys.
- For normal operation, the cooling system for the electric motor must be connected to the electrical recuperation system.

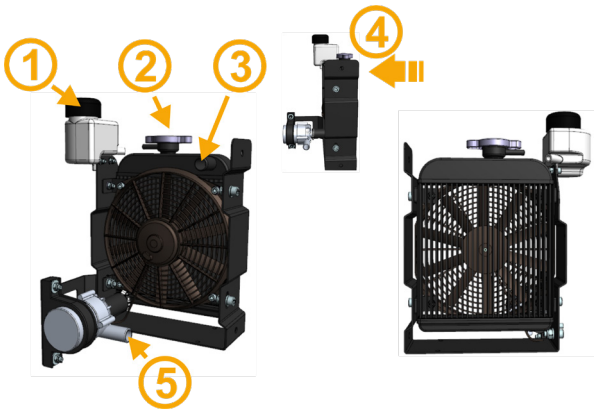

Fig. 7: Liquid cooler - 04 422 5090 00

Pos	Description
1	Expansion tank
2	Radiator cap
3	Cooling inlet
4	Air flow direction
5	Cooling outlet

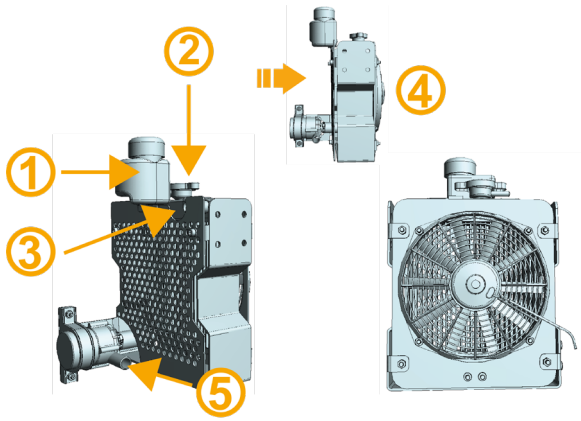

Fig. 8: Liquid cooler - 04 422 5090 01

7.1 E-Machine cooling connection

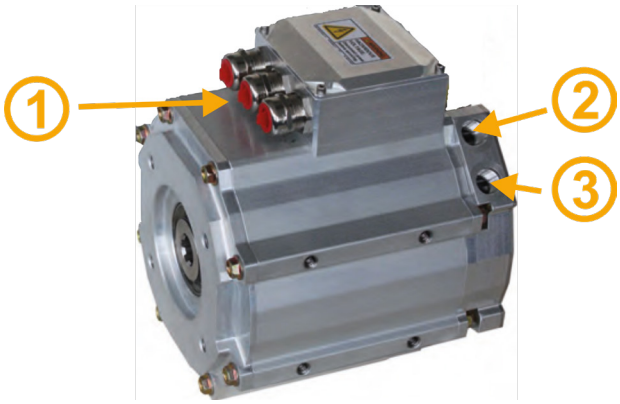

Fig. 9: E-Machine cooling connection

Pos	Description
1	U, V, W
2	Cooling Inlet and Outlet 2x 1/2“ ORB-8 SAE J1926-1 with thread 7/16-20 UNF
3	Cooling Inlet and Outlet 2x 1/2“ ORB-8 SAE J1926-1 with thread 7/16-20 UNF

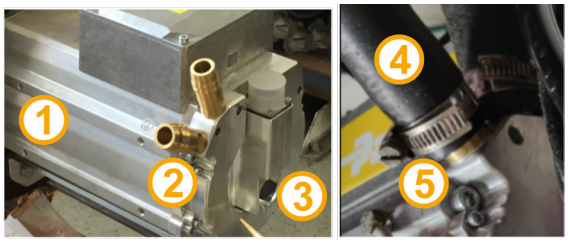

Fig. 10: Hose connection

Pos	Description
1	E-Machine
2	Threaded nozzle with seal
3	Pressure compensation element
4	Hose
5	Hose clamp

7.2 Cooling system installation

Danger!

- The air vent valve has to be placed in the highest position of the cooling circuit.
- The air vent valve has to be placed in the return line of the cooling circuit.
- The maximum cooling hose length is 4 m.

Note:

The pressure compensation element below the signal interface must not be painted over. See „Fig. 10: Hose connection“ on page 11 -Pos 3-.

The pump used in the system is a centrifugal pump, non self-priming. For this reason, the pump is mounted in the lower connection of the radiator.
A 19 mm hose must be used to connect the radiator to the E-Machine. There is no specific inlet/outlet from the E-Machine cooling connections. This means that there is flexibility to select the best hose path.
Do not push the hoses completely onto the connectors. The screw surfaces should remain free. Ideally the hoses or the E-Machine shall not rise above the radiator height. If this is not possible, the vent valve must be placed at the highest point in the return hose.

Fig. 11: Air vent valve

To fill the liquid in the radiator please proceed as follows:

Fig. 12: Radiator cap

Step	Description
1	Loose the cap from the radiator.
2	Fill 1l of coolant in measuring jug. Glysantin G48: • Mix with distilled water 50:50 • Water hardness: 0 to 20°dH (0 – 3,6 mmol/l) • Chloride content: max. 100ppm • Sulfate content: max. 100ppm
3	Switch cooling system on by system unit or external other 24V source.
4	Verify that fan & pump is running.
5	Fill in coolant until reaches the top edge of cap fill accesss.
6a	Check every two minutes for possibility of refill. Refill until reaches the top edge of cap fill access.
6b	Supportive action: move/shake tubes.
6c	Supportive action: use purge valve to de-air tubes.
7	Repeat step 6a to 6c as long as air bubbles are rising to the top surface inside of the cap filling access.
8	Filling porcess is finalized when no further air is rising to the surface inside of the filling cap. Ensure that coolant amount is filled in accordance with graph.
9	Close the cooler properly with the cap.
10	Open access cap of expansion tank.
11	Fill coolant until 3/4 of tank is filled.
12	Close access cap of expansion tank.
13	The liquid cooling system is ready for operation.
14	Ensure fan operation consideration correct rotation direction (see „Fig. 13: Radiator fan rotation direction“ on page 12).
15	Ensure pump working by 24V by touch (Correct polarity causes vibration which indicates pump working).

Fig. 13: Radiator fan rotation direction

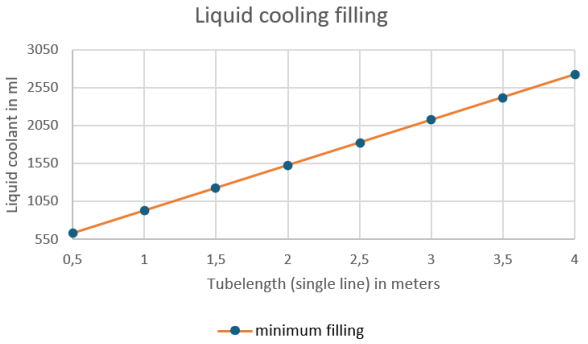

Fig. 14: Liquid cooling filling

Note:

Depending on the simple hose length selected, filling can take longer, up to half a day for full length.

8. Mounting Procedure LVDC Cooling Connector Set

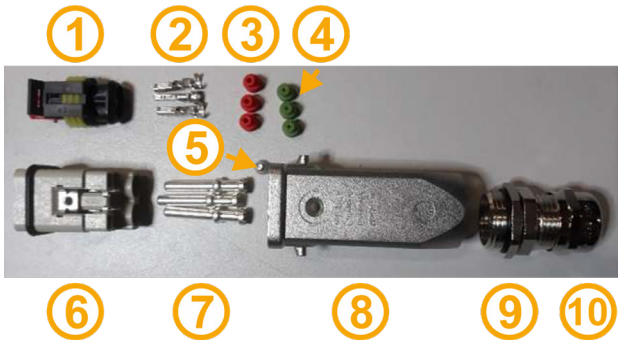

Fig. 15: LVDC overview

Pos	Description
1	Automotive Connector 1x2p 14A 60VDC FML
2	Crimp 18-15AWG FML
3	WireSeal_FML_Red
4	Wire Seal FML Green
5	HAN3_Watertight_Screw
6	HAN3_ML_Holder_2+PE_40A_830V
7	HAN3_ML_40A_4
8	HAN3_Housing_Entry_M20
9	Reducer_M20-M16_O-ring
10	CableGland_M16x1.5

8.1 Harting connector side

1. Remove 45mm of the cable coating and strip off 8mm of each conductor.

Fig. 16: Step 1

2. After inserting the cable gland in the cable, crimp the two terminals with the reference HAN3_ML_40A_4.

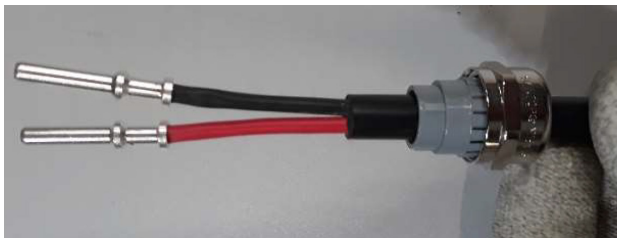

Fig. 17: Step 2

3. Insert the cable in the connector housing (HAN3_Housing_Entry_M20) and leave enough space to assemble the crimp holder.

Fig. 18: Step 3

4. Introduce the conductors in the crimp housing: Positive polarity goes to pin 1 and negative polarity goes to pin 2.

Fig. 19: Step 4

5. Place the watertight screw and tighten it with 0.5 Nm. Also tighten the cable gland with 10 Nm.

Fig. 20: Step 5

8.2 Super-seal connector side

1. Remove 40mm of the cable coating and strip off 5mm of each conductor

Fig. 21: Step 1

2. Insert the wire seal (WireSeal_FML_Red/Green) according to the cable diameter. Crimp the two terminals.

Fig. 22: Step 2

3. Insert three heat shrink pieces in the cable with the following dimensions

- Diameter: 6mm / Length: 20mm
- Diameter: 9mm / Length: 20mm
- Diameter: 12mm / Length: 80mm

The one with a diameter of 12 mm should have adhesive on the inside.

The conductors can then be introduced in the connetor housing. The positive polarity goes to pin 1 and negative polarity goes to pin 2.

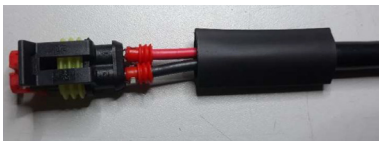

Fig. 23: Step 3

4. Heat the pieces of heat-shrink by the following order: 6mm->9mm->12mm.

- The two first must touch the connector housing and only cover the conductors .
- The 12mm piece must cover the back side of the connector housing.

Fig. 24: Step 4

9. E-Machine routing

Attention!

Installation and implementation of the E-Machine routing has to be realized according to the specifications of the system manufacturer.

Attention!

Ensure proper sealing during operation and travel.

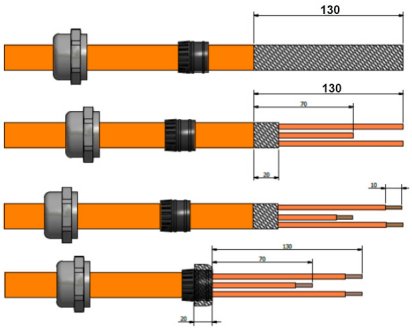

Fig. 25: E-Machine stripping

Note:

The lines are marked with 1, 2 und 3.

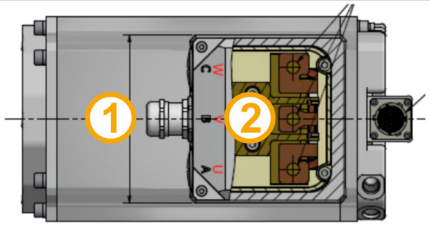

Fig. 26: E-Machine routing 1

Attention!

- Tight cable gland with 12 Nm.
- Exceeding the torque can lead to leaks!

Pos	Description
1	Cable gland
2	Terminal connection M6 x 10 Clamping range 7mm - 12.5mm Tightening torque 8.5 ±0.5 Nm.

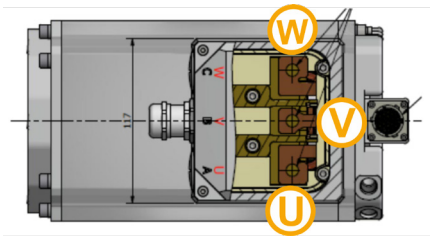

Fig. 27: E-Machine routing 2

Pos	Description
U	E-machine connection Line 1 to connection U
V	E-machine connection Line 2 to connection V
W	E-machine connection Line 3 to connection W

Attention!

The tightening torque of the terminal connection is 8.5 ±0.5 mmNm.

Attention!

Ensure proper closure of non-used cable glands.

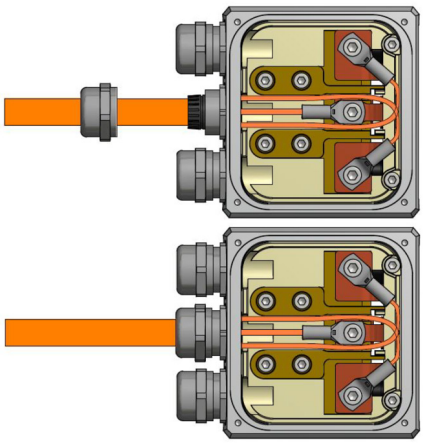

Fig. 28: Cable connection (cable laying)

10. Torques

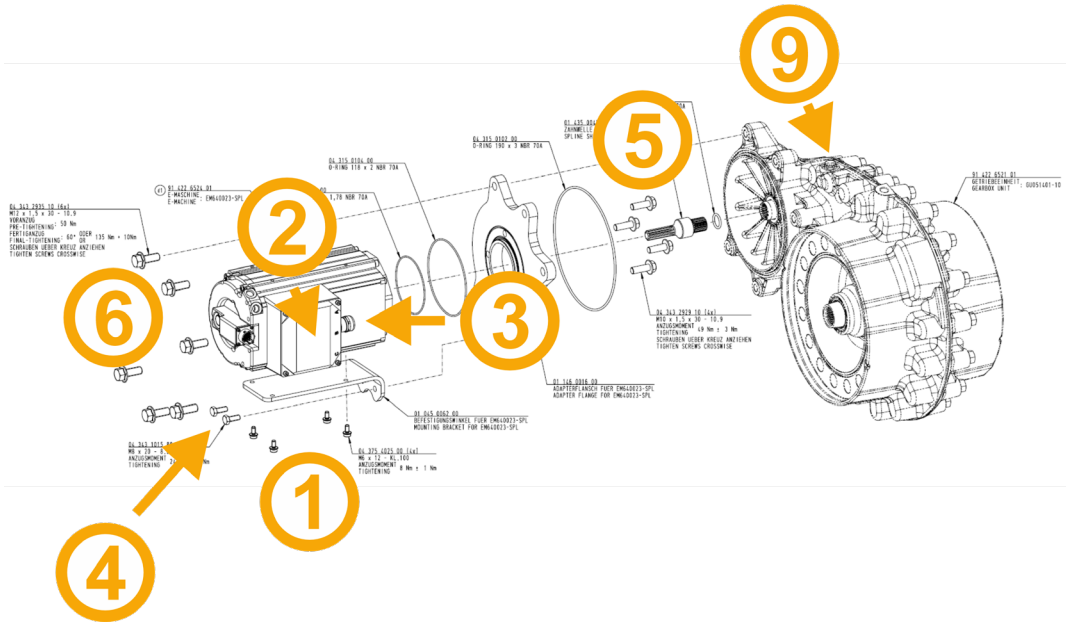

Fig. 29: Torques 1

Pos	Description	Screwing	Torque
1	Mounting bracket screws	4x M6 x 12	10 Nm +-1 Nm
2	HV system cover	4x M4	8 Nm
3	HV cable interface	1x M18 x 1,5	12 Nm
4	Mounting bracket screws – adapter flange	2x M8 x 20	24 Nm +-2 Nm
5	Adapter flange screws – generator	4x M10 x1,5 x 30	49 Nm +-3 Nm
6	Adapter flange screws – gearbox	6x M12 x 1,5 x 20	50 Nm + 60° = (135 Nm+-10 Nm)
7	Axle tube screws – gearbox	16x M20 x1,5x80	50 Nm pre tightening (550 Nm +- 50 Nm)
8	Axle shaft screws DHS AF15	5x M14 x 1,5 x65	50 Nm +120°
9	Gearbox breather AF18 oil inlet	1x M16 x 1,5	5 Nm +2 Nm
10	Gearbox drain plug AF17	1x M16 x 1,5	50 Nm + 2 Nm
11	Connection piece for hose	Hose clamp	16 to max. 20 Nm

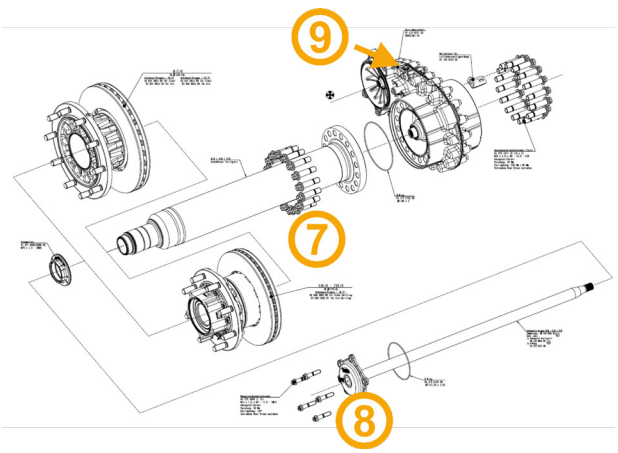

Fig. 30: Torque 2

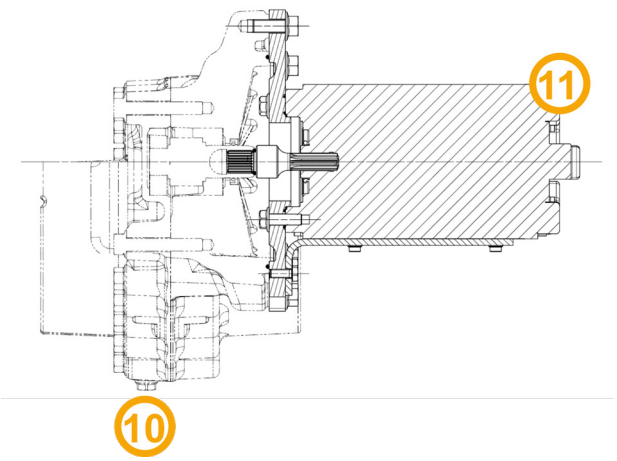

Fig. 31: Torque 3

11. Coolant

Recommended coolant:

Glysantin G48:
50:50 mixture with distilled water
Water hardness: 0 to 20°dH (0 – 3.6 mmol/l)
Chloride content: max. 100 ppm
Sulfate content: max. 100 ppm

Or coolant with a comparable specification.

Notes

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