

10. SII-Yaw system (yearly)

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Wind turbine type

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Wind turbine type	Mk version
EnVentus™	Mk 0A

Change description

Description of changes
Updated the version of the document.

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1 Abbreviations and technical terms

0021729975

Table 1.1: Abbreviations

Abbreviation	Explanation
LOTO	Lockout-tagout
PPE	Personal protective equipment
SDS	Safety data sheet
SPRA	Standardised procedure risk assessment

Table 1.2: Explanation of terms

Term	Explanation
None	

2 Referenced documentation

2.1 Safety documents

0027546505

Table 2.1: Safety documents

Document no.	Title
0001-0410	Personal protective equipment sheets
0004-4159	Standardised procedure risk assessment (SPRA)
0092-3874	Rotor locking system
0092-3919	Safety regulations for operators and technicians
0094-2383	Mode selector system
	Relevant SDS for the chemicals used in this document
	Appropriate LOTO document

2.2 Reference documents

0027546504

Table 2.2: Reference documents

Document no.	Title
920098	Torque wrench settings
960501	Bolt connections
0001-1995	User guide operating manual
0001-1996	Service guide, menu 11–19 operating manual
0001-1997	Service guide, picture 21 and onwards

Document no.	Title
0093-3811	Lubrication and coolant chart
0095-2705	Verification of pretension of the spring pack
0099-2738	Replacement of yaw gear and related spare parts
0099-4156	Replacement of yaw motor brake
0099-8324	Yaw lubrication pumps grease refilling instructions



Unless it is specified differently, see 920098 'Torque wrench settings' for information about bolt types and bolt lubrication, and see 960501 'Bolt connections' for information about torque values.

3 Purpose

0016758978

The purpose of this document is to give the instructions for how to do the yearly inspection of the yaw system.

4 Note

0016770707

This document gives the description of the service inspections that must be done during the yearly inspection. Unscheduled replacement procedures are not included in the yearly inspection. If it is necessary to make an unscheduled replacement, then make a note of it in the service report.

5 Yaw system

5.1 ++68 Yaw control panel

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5.1.1 To do a test of the heaters

0027456188

- 1 Open the door of the yaw control panel ++68.

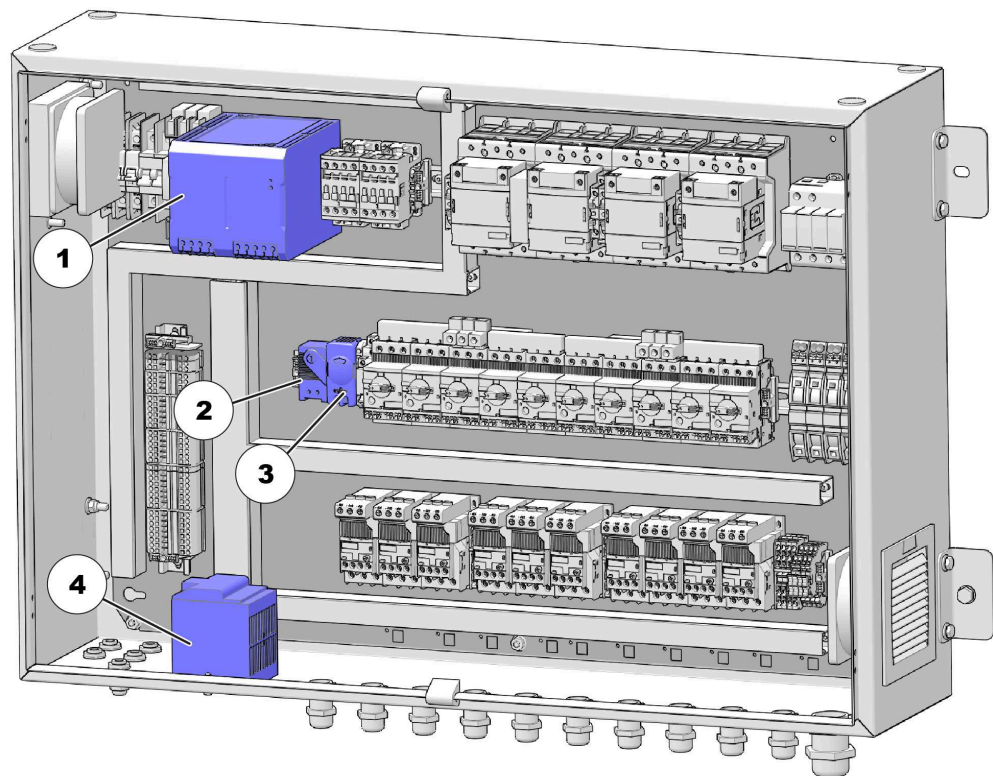
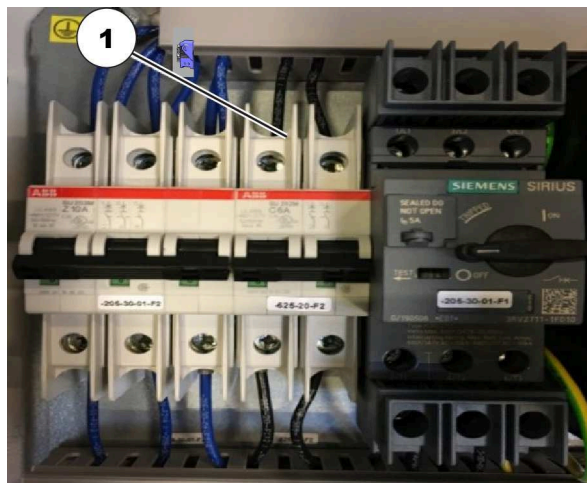


Figure 5.1: Yaw control panel ++68

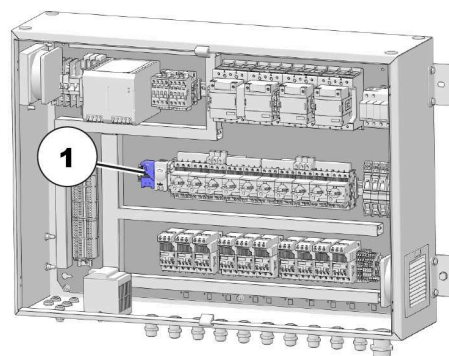
- | | | | |
|---|----------------------------|---|--------------------------|
| 1 | Circuit breaker -625-20-F2 | 2 | Thermostat -625-20-03-B1 |
| 3 | Thermostat -625-20-01-B1 | 4 | Heater -625-20-01-E1 |

Item no.	Quantity	Description	Type no.	RDS no.
29124385	As necessary	ERP: MCB SU202M-C6 6A C 10kA 2P	SU202M-C6	-625-20-F2
29124388	As necessary	ERP: THERMOSTAT NC 10A 01115.0-00	STO01115.0-00	-625-20-01-B1
114447	As necessary	ERP: THERMOSTAT KTS 01147.9-00	KTS 01147.9-00	-625-20-03-B1
29121810	As necessary	ERP: HEATER ELECTRIC CSL02810.0-14	CSL02810.0-14	-625-20-01-E1

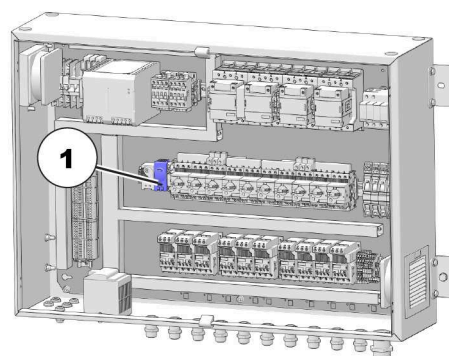
- 2 Close circuit breaker -625-20-F2 (1).



- 3 Adjust the temperature of thermostat -625-20-01-B1 (1) to 15°C.



- 4 Adjust the temperature of thermostat -625-20-03-B1 (1) to 40°C.



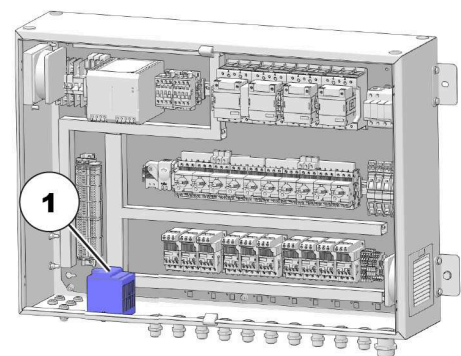
- 5 Do the steps that follow to check the functionality of the thermostats.

- a** Turn the thermostats switch clockwise and make sure that the thermostats start to heat.



- b** Make sure that there is no abnormal noise while the thermostats get heated.
- c** Turn the thermostat switch counterclockwise and make sure that the thermostats stop to heat.

- 6** Make sure that heater -625-20-01-E1 (1) warms up after a short period of time.



- If the fan does not operate or if heat is not generated, replace the heaters.



Carefully feel the heater with hands to make sure that the fan operates.

- 7 Adjust the temperature value of thermostats -625-20-01-B1 and -625-20-03-B1 again to the original position after the test.
 - a Set the temperature of thermostat -625-20-01-B1 to 0°C.
 - b Set the temperature of thermostat -625-20-03-B1 to 30°C.

5.1.2 To do a visual inspection of the air filters

0027456187

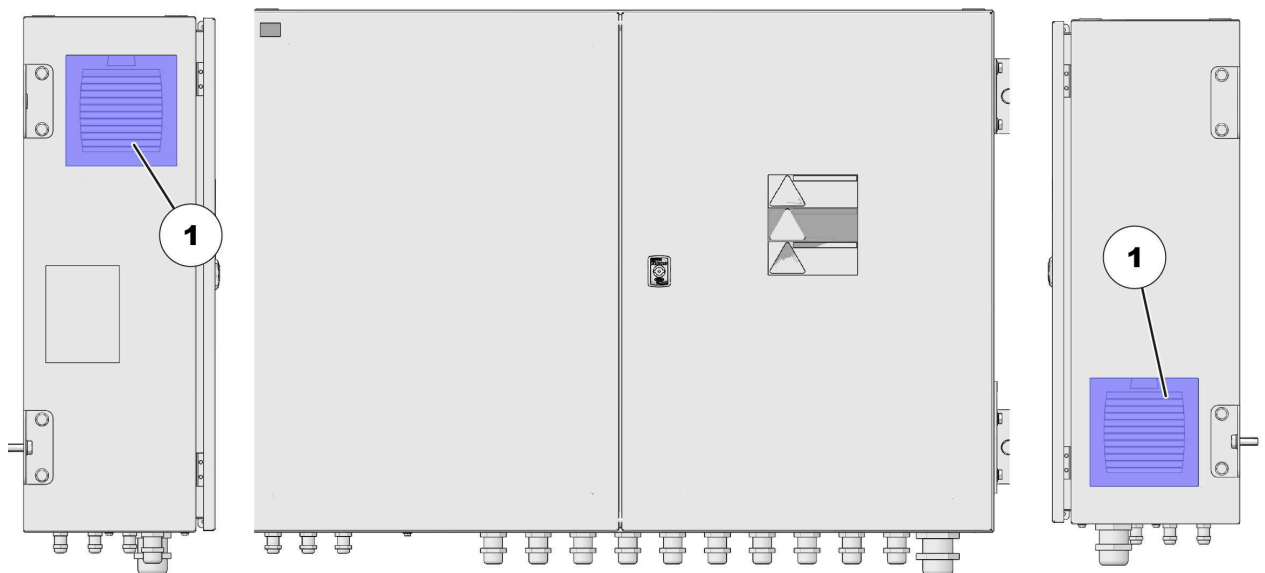
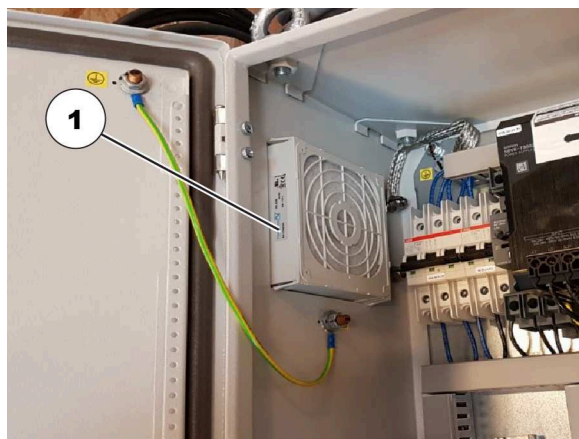


Figure 5.2: ++68 yaw control panel

1 Air filter 1

2 Air filter 2

- 1 Visually examine the 2 air filters (1) in the + +68 yaw control panel.



Item no.	Quantity	Description	Type no.	RDS no.
60014621	As necessary	ERP: FILTERPAD PFM2X000-54 119X119MM	18611600030	-



The filter mats can be accessed and examined without opening the panel doors.

- 2 Do a visual check of the filter mats (1) at both sides of the ++68 yaw control panel for deposition of dust, salt, or other particles.



► If the filter mats are clogged, replace the filter mats. Do the steps that follow to replace the filter mats.



Risk of dust! SPRA ID No. 23.04

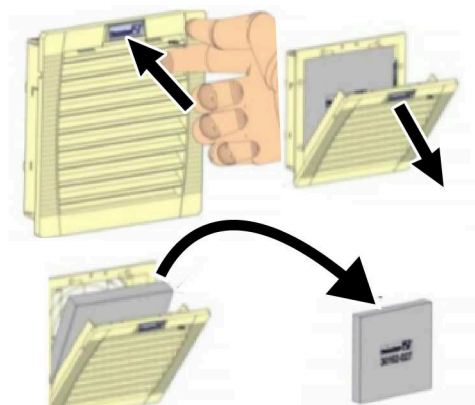
- Use the necessary PPE that is given in PPE sheet S.



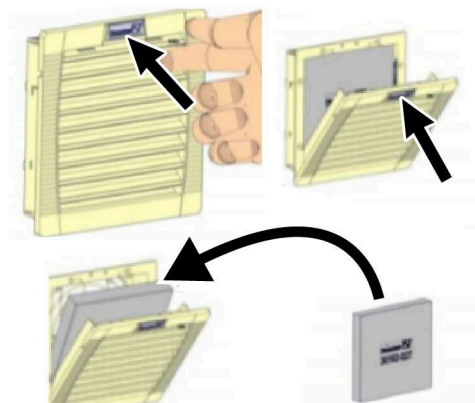
The protective cover can be opened easily as there are no fixing screws.

- a Open the protective cover.

- b** Remove the old filter mat from the front protective cover.



- c** Put the new filter mat (item no. 60014621) into the protective cover.



- d** Close the protective cover.

- 3** Do a check to make sure that the filter mats are installed in the correct position in the ++68 yaw control panel.

5.2 Yaw system

0027546564

5.2.1 To do a general check of the yaw system

0027546502



Risk related to rotating parts! SPRA ID No. 5.03

- Obey the applicable LOTO procedures.
- Stop the wind turbine to prevent unintended starts and remote operation.
- Apply the brake before you remove the covers.
- Lock the rotor mechanically before you remove the covers.

1 Do a check of the yaw system for unusual noise while the yaw system runs for 20–30 seconds both CW and CCW.

2 Do a check for oil and grease spillage on the platform.

3 Visually examine the yaw pinion teeth for external damage.

4 Visually examine the yaw ring teeth for external damage.

► It is only possible to see the back end of the yaw ring. To examine complete yaw ring, obey the procedure that follows:

- a** Do an inspection of the yaw ring and yaw the nacelle 90°.
 - b** Do an inspection of the yaw ring and yaw the nacelle 90°.
 - c** Do an inspection of the yaw ring and yaw the nacelle 90°.
 - d** Do an inspection of the yaw ring.
-

5.2.1.1 To clean yaw grease spillage trays

0029124557

-
- 1** Remove the collected grease from the spillage trays to avoid grease overflow and spillage onto the platform.
-

5.2.2 To do a check of the oil level in the yaw gears

0027546501



Risk of exposure to hazardous substances and mixtures, yaw gear oil! SPRA ID No. 2.02

- Read and comply with PPE sheet G and relevant SDS.

-
- 1 Do a check of the oil level in the planetary gears. See 'Replacement of yaw gear and related spare parts' in section 'Reference documents'.
 - a Examine the oil level in the planetary gear by the use of the oil level indicator. See 'Lubrication and coolant chart' in section 'Reference documents'.
 - ▶ If the oil level is below the minimum level, fill the oil in the yaw gears.
-

5.2.3 To do a check of the bolts that connect the yaw ring and the tower

0027662410

The check that follows must be done during the 4-yearly inspections.

-
- 1 Do a check of every third M30 bolt that connects the yaw ring and the tower.
 - ▶ If it is necessary to tighten 1 of these M30 bolts, make sure that the 2 x M30 bolts on each side are also tightened.
 - ▶ If loose bolts are found, contact Vestas technical support.
-

5.2.4 To do a check of 2 yaw motor brakes to do a check of the brake torque and air gap

0027546500

-
- 1 Do a check of 2 of the 9 or 10 yaw motor brakes every year.
 - ▶ If 1 yaw motor brake needs adjustment, do a check of all the 9 or 10 yaw motor brakes.

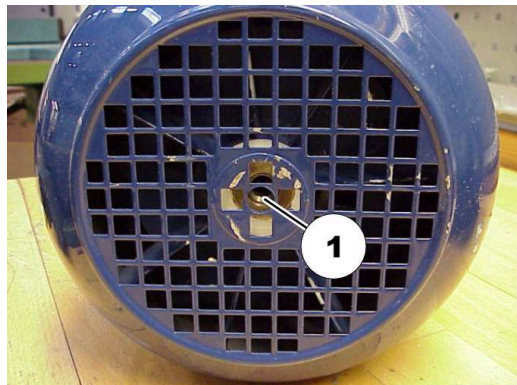


The 10-yaw-motor-brake configuration is for EnVentus™ V162 and the 9-yaw-motor-brake configuration is for EnVentus™ V150.



The yaw motor brake check must vary. For example, the yaw motor brakes 1 and 5 will be examined in the first-year inspection, and the yaw motor brakes 8 and 3 will be examined in the second-year inspection, and so on.

- 2 Insert a torque wrench with an 8 mm Allen key (1) into the end of the yaw motor to do a check of the torque on the yaw motor brake.



- 3 Do the steps that follow to do a check if the yaw motor brake is too loose:

- a Set the torque wrench to 47 Nm.



The torque wrench must make click sound.
The tolerance limit is $\pm 10\%$.

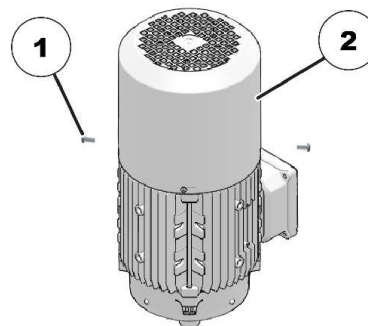
- b Turn the torque wrench in both directions.

► If the torque wrench does not make a click sound, obey the procedure to adjust the torque of the yaw motor brake given in 'Replacement of yaw motor brake' in section 'Reference documents'.

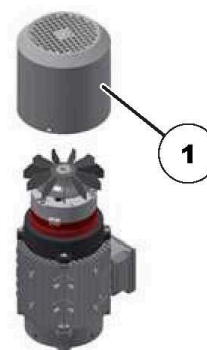
5.2.4.1 To measure the thickness of the brake lining in the Lafert yaw motor (if installed)

0030617694

- 1 Remove the fan cover screws (1) and the washers from the fan cover (2).



- 2 Remove the fan cover (1) from the yaw motor.



- 3 Measure and note the thickness of the brake lining.

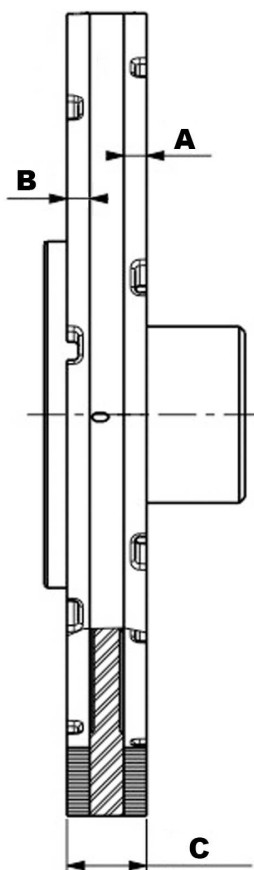


Figure 5.3: The brake lining of the Lafert yaw motor

- | | | | |
|---|----------------------|---|---------------------|
| A | Brake lining (right) | B | Brake lining (left) |
| C | Brake disk thickness | | |



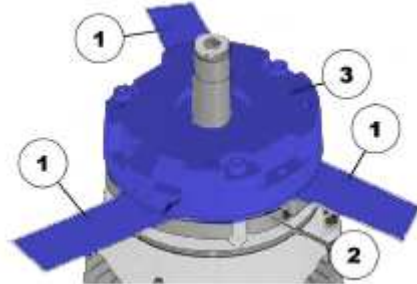
The minimum thickness of the brake lining for the Lafert yaw motor is 1 mm (S_{min}).

- ▶ If the wear of the brake lining is more than the tolerance level, the brake disk must be replaced.
- ▶ If the wear of the brake lining is less than the tolerance level, continue to adjust the brake. See [section 5.2.4.1.1 To adjust the air gap for the yaw motor DC brake, page 17](#).

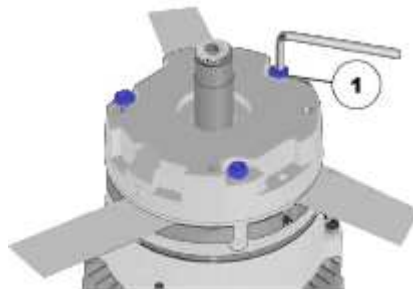
5.2.4.1.1 To adjust the air gap for the yaw motor DC brake

0029282590

- 1 Put the 3 feeler gauges (1) (thickness 0.3 mm) at equal spaces between the electromagnet (3) and the brake anchor (2).



- 2 Use the Allen key to tighten the 3 bolts (1).



- a Make sure that the 3 feeler gauges move with a small interference.
- b Remove the 3 feeler gauges from the air gap between the electromagnet and the brake anchor.
- c Torque the lock nuts to between 20.25 Nm and 33.75 Nm.

-
- 3 Do a check of the air gap with 0.3 mm and 0.35 mm feeler gauges.
 - Make sure that it is possible to put the 0.3 mm feeler gauge in the air gap between the electromagnet and the brake anchor.
 - Make sure that it is not possible to put the 0.35 mm feeler gauge in the air gap between the electromagnet and the brake anchor.
-

- 4 Do steps 1 to 3 again, if necessary.

- 5 If the air gap adjustment is completed, measure the brake torque.

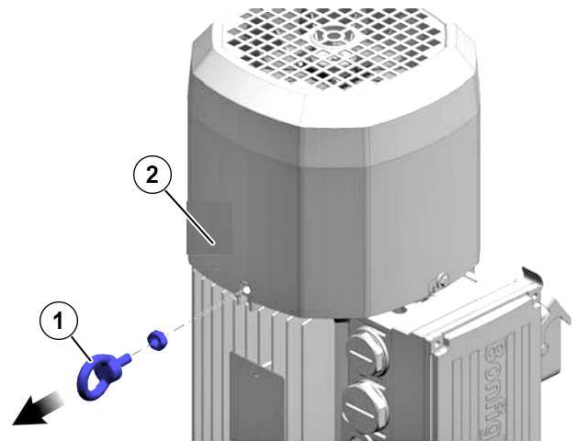


The brake torque must be according to the specification.

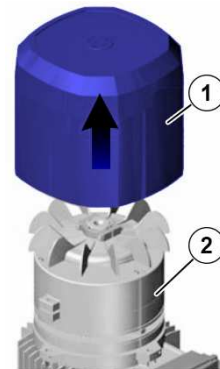
5.2.4.2 To measure the thickness of the brake lining in the Bonfiglioli yaw motor (if installed)

0030617693

- 1 Remove the 2 x M8 DIN 580 bolts (1) from the fan cover (2).



- 2 Remove the fan cover (1) from the yaw motor (2).



- 3 Measure and note the thickness of the brake lining.

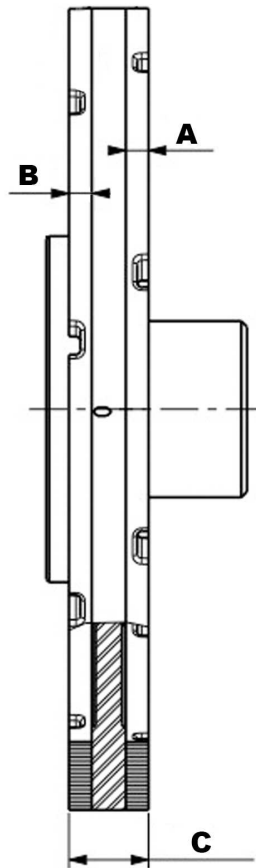


Figure 5.4: The brake lining of the Bonfiglioli yaw motor

- | | | | |
|---|----------------------|---|---------------------|
| A | Brake lining (right) | B | Brake lining (left) |
| C | Brake disk thickness | | |



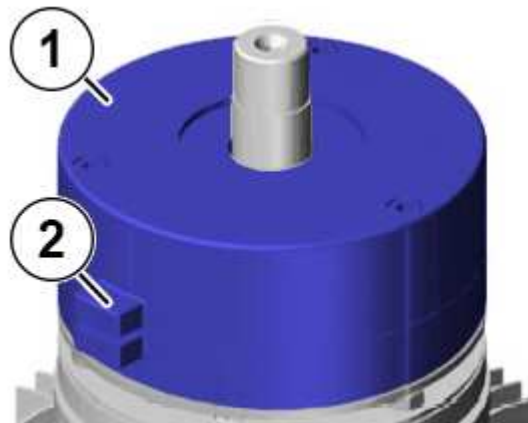
The minimum thickness of the brake lining for the Bonfiglioli yaw motor is 1 mm (S_{min}).

- If the wear of the brake lining is more than the tolerance level, the brake disk must be replaced.
- If the wear of the brake lining is less than the tolerance level, continue to adjust the brake. See [section 5.2.4.2.1 To adjust the air gap for the yaw motor DC brake, page 20](#).

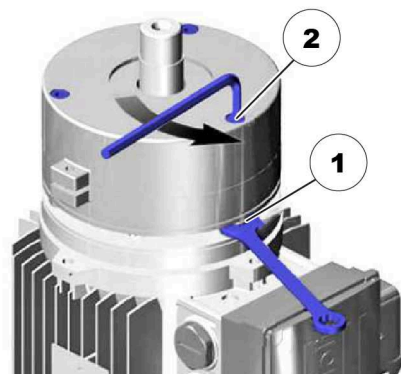
5.2.4.2.1 To adjust the air gap for the yaw motor DC brake

0029287970

- 1 Put the 3 feeler gauges (thickness 0.3 mm) at equal spaces between the brake coil assembly (1) and the armature plate (2).



- 2 Loosen the 3 lock nuts (1) and adjust the 3 fixing screws (2) by the use of the Allen key.



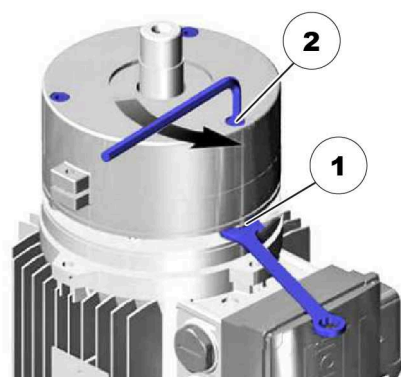
- a Make sure that the 3 feeler gauges move with a small interference.
- b Remove the 3 feeler gauges.

- 3 Do a check of the air gap with 0.3 mm and 0.35 mm feeler gauges.

- Make sure that it is possible to put the 0.3 mm feeler gauge in the air gap between the brake coil assembly and the anchor plate.
- Make sure that it is not possible to put the 0.35 mm feeler gauge in the air gap between the brake coil assembly and the anchor plate.

- 4 Do steps 1 to 3 again, if necessary.

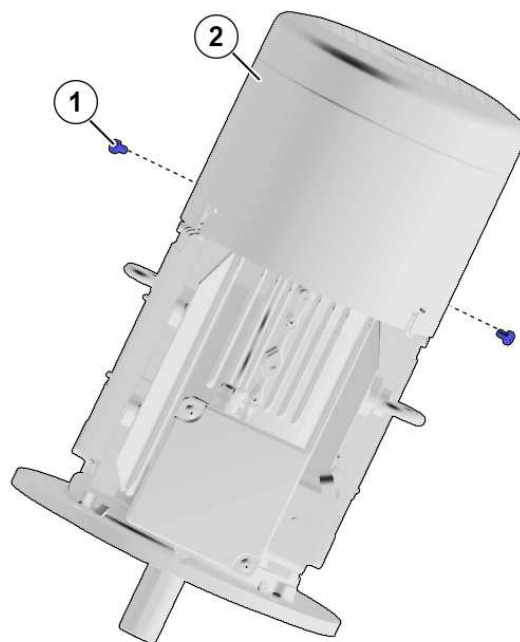
- 5 Hold the 3 fixing screws (2) and tighten the 3 lock nuts (1).



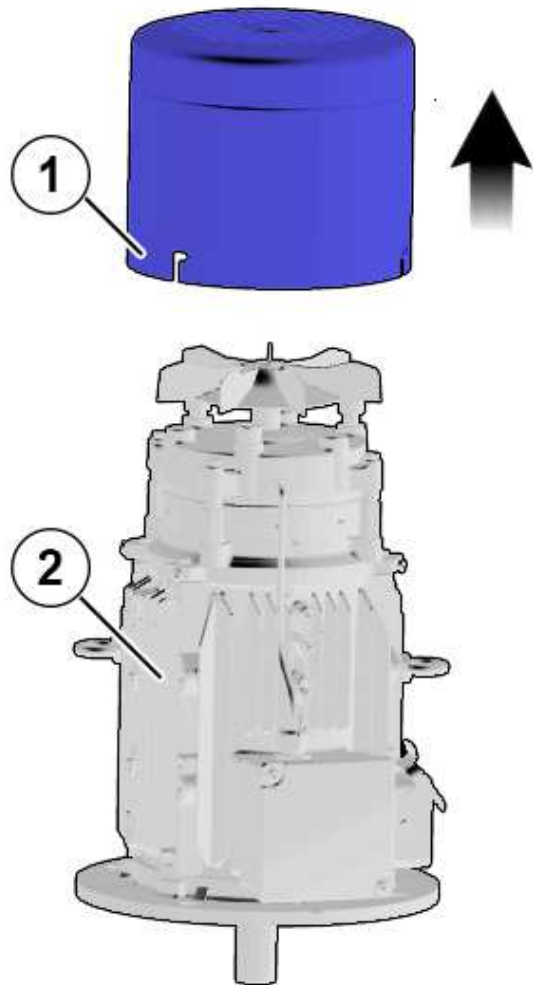
5.2.4.3 To measure the thickness of the brake lining in the NIDEC yaw motor (if installed)

0030617692

- 1 Remove the 4 fan cover screws (1) from the fan cover (2).



- 2 Remove the fan cover (1) from the yaw motor (2).



-
- 3 Measure and note the thickness of the brake lining.

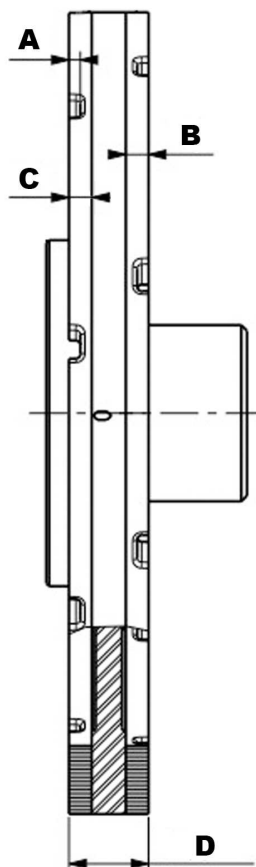


Figure 5.5: The brake lining of the NIDEC yaw motor

A	Brake pad slots	B	Brake lining (right)
C	Brake lining (left)	D	Brake disk thickness



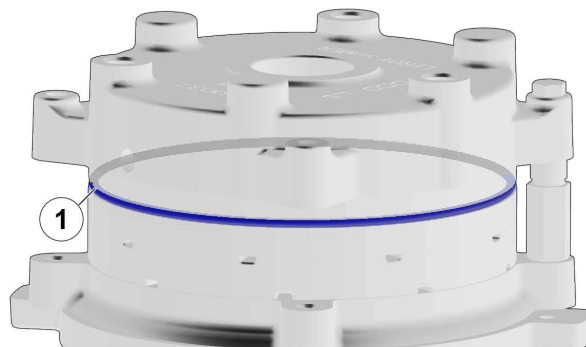
The minimum thickness of the brake lining for the NIDEC yaw motor is 3 mm (S_{min}).
If the depth of the brake pad slots is ≤ 1 mm, the minimum thickness of the brake lining will be 3 mm.

- If the wear of the brake lining is more than the tolerance level, the brake disk must be replaced.
- If the wear of the brake lining is less than the tolerance level, continue to adjust the brake. See [section 5.2.4.3.1 To adjust the air gap for the yaw motor DC brake, page 24](#).

5.2.4.3.1 To adjust the air gap for the yaw motor DC brake

0029287944

- 1 Remove the O-ring (1) to get access to the air gap.



- 2 Put the 3 feeler gauges (1) (thickness 0.3 mm) at equal spaces between the brake yoke (1) and the armature plate (2).



- 3 Release the spacers (1) and move the spacers closer to the brake yoke (2).



- 4 Adjust the screws (1) until the 3 feeler gauges move with a small interference.



- Tighten the screws to reduce the air gap between the brake yoke and the armature plate.

- Loosen the screws to increase the air gap between the brake yoke and the armature plate.

5 Remove the 3 feeler gauges from the brake yoke and the armature plate.

6 Put the 3 feeler gauges (thickness 0.3 mm) at equal spaces around the circumference.

7 Do a check of the air gap with 0.3 mm and 0.35 mm feeler gauges.

- Make sure that it is possible to put the 0.3 mm feeler gauge in the air gap between the brake yoke and the armature plate.
 - Make sure that it is not possible to put the 0.35 mm feeler gauge in the air gap between the brake yoke and the armature plate.
-

8 Do steps 1 to 7 again, if necessary.

9 Torque the spacers (1) to between 1.8 Nm and 2.2 Nm.

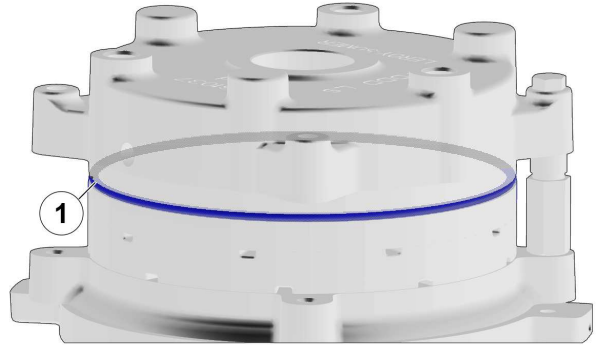


10 Torque the fixing screws (1) to between 7.65 Nm and 9.35 Nm.



11 Measure the value of the air gap again.

12 Put the O-ring (1) into the groove.



5.2.4.4 To adjust the torque of the yaw motor brake

0027546497

- 1** Adjust the torque of the yaw motor brake to 'Replacement of yaw motor brake' in section 'Reference documents'.

5.2.5 To do a check of the spring pack

00291449677

- 1** Do a check of the spring pack pretension on spring packs 1, 3, and 5 on every yaw beam according to 'Spring pack pretension verification' in section 'Reference documents'.
 - ▶ If it is necessary to tighten one of the spring packs, make sure that all spring packs are verified.
 - ▶ If loose bolts are found, contact the Vestas technical support. An overview of each yaw claw and spring pack must be created to identify all loose bolts.

5.2.6 To do a check of the lubrication pump reservoirs for grease level and re-fill the lubrication pump reservoirs

0029124555

- 1** Do a check of the lubrication pump reservoirs for grease level and refill the lubrication pump reservoirs according to 'Yaw lubrication pumps grease refilling instructions' in section 'Reference documents'.

5.2.7 To do a functionality check of the pumps

0029124554

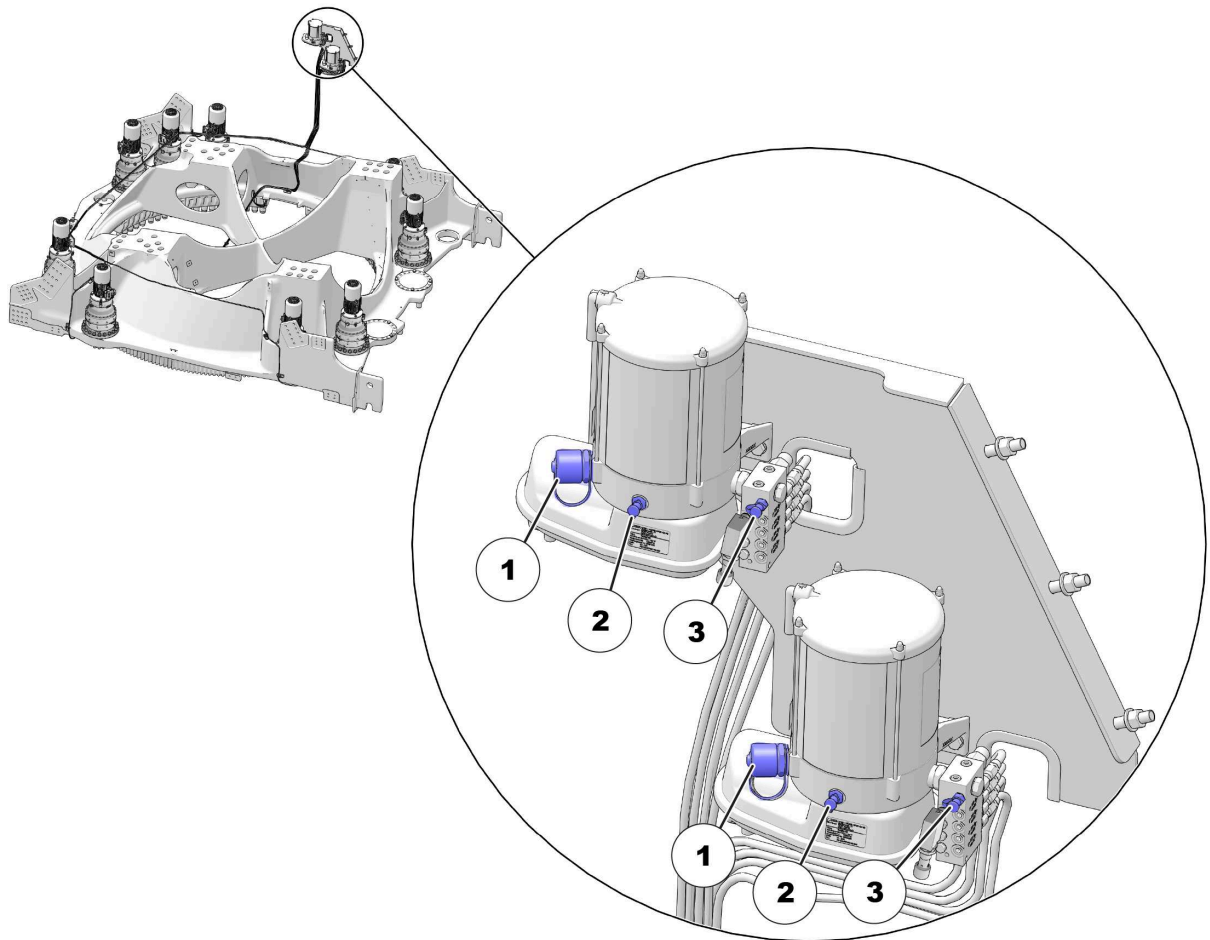


Figure 5.6: Automatic lubricator with a dual pump

- | | | | |
|---|---|---|----------------|
| 1 | Refill connection for grease reservoir | 2 | Filling nipple |
| 3 | Filling nipple on the distributor block | | |

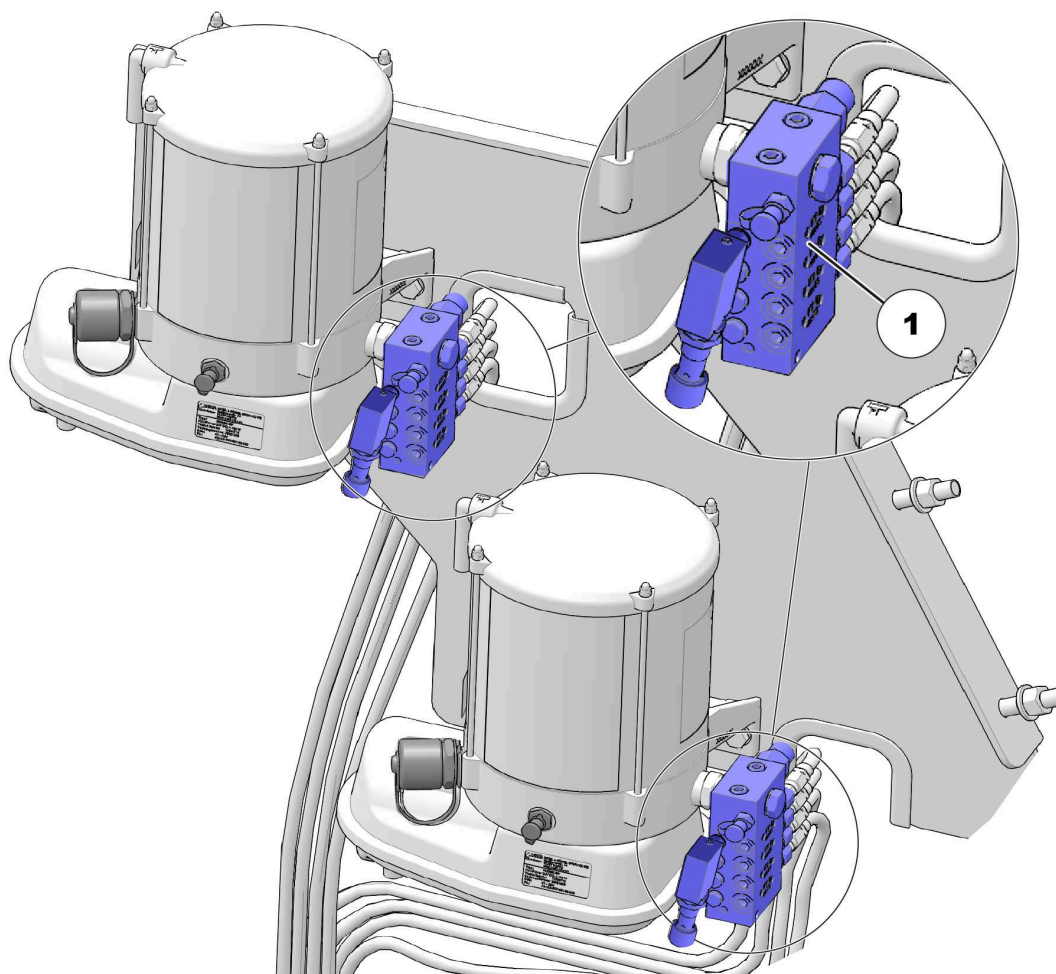


Figure 5.7: Distributor block

- 1 Distributor block



Do a check of the 2 pumps manually, one after the other.

- 1 Do a check of the warning log for yaw lubrication errors.

► If there are errors, do the troubleshooting procedure on the automatic yaw lubrication system from the service menu **11.72: YAW LUBR. OVERVIEW**.

- 2 Operate the pump manually from the service menu **11.71: YAW LUBR** on the operator laptop.

- 3 Make sure that the pump operates continuously for a minimum of 30 seconds.

- 4 Make sure that all the tubes are connected and that there is no leakage in the tubes.

- 5 Make sure that all the lubrication wheels engage fully with the yaw pinion teeth or the yaw ring.

- 6 Make sure that there is no grease leakage from the relief valve and do a check of the level of grease in the grease containers.

- 7 Do the steps that follow if grease flows from the relief valve or the level of grease in the grease containers is less than 50%.
 - a Remove the hoses from the distributor block.

**Risk of exposure to hazardous substances and mixtures, grease! SPRA ID No. 2.02**

- Harmful if swallowed. May irritate the skin and risk of damage to eyes. Toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.
- Use the necessary PPE that is given in sheet G. Read and obey the related SDS.

**Risk of high-pressure fluid! SPRA ID No. 4.11**

- Obey the appropriate procedures for release of the pressure in the system before you replace a hose or fitting.
- Drain the fluid from the system before you do the procedure, if the part that is replaced is below the fluid level.
- Use the necessary PPE which includes protective goggles and cut-resistant gloves.

- b Apply grease through the filling nipple to see if the distributor block is blocked.
 - If grease flows out of all 4 ports of the distributor block, the distributor block functions correctly.
- c Connect the hoses to the distributor block again.

- d** Remove the hoses from the lubrication plate for bearing or the grease wheels.
- e** Apply grease through the filling nipple to find which hose is blocked.
- f** Clean the blocked hose.
- g** Connect all the hoses to the respective lubrication plate for bearing or the grease wheels.
 - ▶ If no blocks are detected in the hoses, the lubrication plate for bearing or the grease wheels can be blocked.
- h** Examine the lubrication plate for bearing or the grease wheels individually for blockages.
 - Clean the components to remove the blockages.

5.2.8 To do a check of the yaw gear

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The check that follows must be done during the 4-yearly inspections.

- 1** Do a check of every third M20 bolt that attaches the yaw gear to the base frame.
 - ▶ If loose bolts are found, contact the Vestas technical support. An overview of each yaw drive and bolts must be created to identify all loose bolts.



It is not possible to get access to the yaw gear bolts which are shown in the image, and these yaw gear bolts must not be examined during the scheduled inspection.

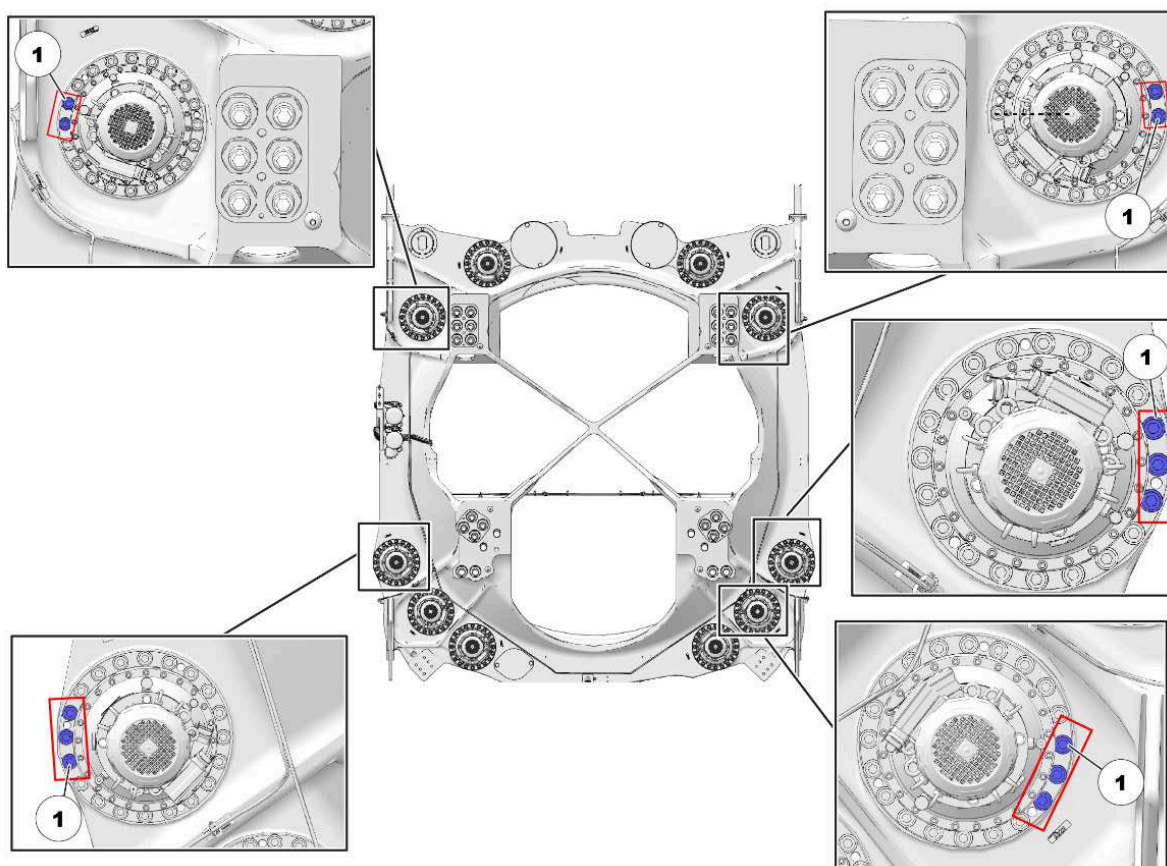


Figure 5.8: Yaw gear bolts

- 1 Yaw gear bolts which cannot be accessed

5.2.9 To do a check of 1, 3, and 5 M36 bolts on each yaw claw

0027546515

The check that follows must be done during the 4-yearly inspections.

- 1 Do a check for torque on 1, 3, and 5 M36 bolts on each yaw claw.
 - If it is necessary to tighten 1 of these M36 bolts on a claw beam, tighten all the M36 bolts on the claw beam.

5.2.10 To change oil in the yaw gears

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- 1 Change the oil in the yaw gears every 10 years according to 'Lubrication and coolant chart' in section 'Reference documents'.