

SUMMARY TECHNICAL INSPECTION
WTG 20675 VESTAS V80-2000KW-690V-
50HZ-R.7035



25/11/2021

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1. Purpose

An inspection has been executed to determine the technical status of the wind turbine. The visual inspection of the gearbox has been executed with a GE Everest XLG3 Videoscope.

2. Scope

The following items have NOT been inspected and are not covered in this report:

- Minor issues which can be easily solved by a normal service are not reported in the report.
- High voltage transformer.
- Proper inspection of the rotor blades with sky climber/rope access. The blade roots and connection to the hub have been inspected, and the blades have been inspected visually from the ground.

3. Terminology, abbreviations and additional info

a. Classification turbine issues

Description in report	Clarification
OK	The item has been checked and shows no irregularities.
Info	For information purposes.
Monitor	An irregularity that should be monitored/checked closely at every service. Replacement/repair is not necessary at this moment.
Low	An irregularity, which is not a safety issue, and is relatively easy to solve.
High	An irregularity, which is not a safety issue, and is more serious and is more time and/or money consuming to solve.
Safe	Issues which concern the safety of the people working in the turbine.

4. Turbine information

<i>General data</i>	
Manufacturer	Vestas
Wind turbine type	V80-2000KW-690V-50HZ-R7035
Wind turbine S/N	WTG 20675
Hub height [m]	70
Rotor diameter [m]	80
Nominal power [kW]	2000
Year of installation	2006
Total production [kWh]	64734288 <i>(display)</i>
Total hours	135232 <i>(display)</i>
Date of visual inspection	12-10-2021

<i>Blades</i>			
Manufacturer	Vestas		
Type	761002 – GD01		
Serial Numbers	39213	39181	39232
Production Year	<i>Not on sign plate, probably 2005</i>		

<i>Main bearing</i>	
Type	Two Spherical bearing
Serial Number	unknown
Production Year	2005
Lubrication system	Grease lubrication, not automatic
Type of lubrication	Klüberplex BEM 41-141

Gearbox	
Manufacturer	Lohmann + Stolterfoht
Type	GPV 440S 3331 110 PG
Serial Number	4129
Production Year	2001
i	100.845
Gear oil type	Texaco Meropa 320 <i>according to label on gearbox</i>
Gear oil exchange data	08-2019 <i>according to logbook</i>
Revision data	BGS 12111, 17-06-2013 Replaced in 03-05-2017

Generator	
Manufacturer	Weier
Type	DVSG 500/4M SP
Serial Number	608577
Electrical rating rotor	1517A / 690V / 50Hz
Power	2000 kW
Speed nominal	1680 rpm
Production Year	2006
Grease type	Klüberplex BEM 41-141
Revision data	-

Tower			
Insert Ring no.	105925	459036 R2	400972
1 st section no.	106642	759338 R1	-
2 nd section no.	106047	759339 R0	-
3 rd section no.	105470	759338 R1	-

<i>HV-Switch</i>	
Manufacturer	Merlin Gerlin
Type	RM6
S/N	R 05 36 008 SF
U	24 kV
U _w	125 kV
I _{th}	15 kA 1s
I _{ma}	40 kA
I _n	200/630 A
Grid connection	23 kV, according to HV Single Line Diagram

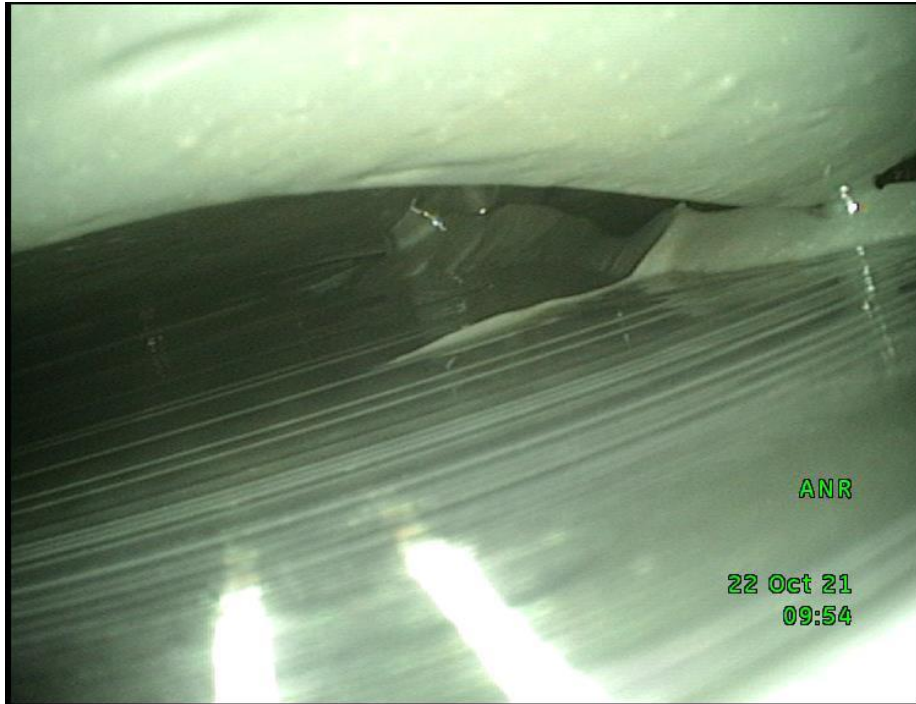
5. Logbook entries

The logbook shows that maintenance at the turbine has been performed at regular intervals. The logbook also shows periodical maintenance/inspection of the high-voltage transformer.

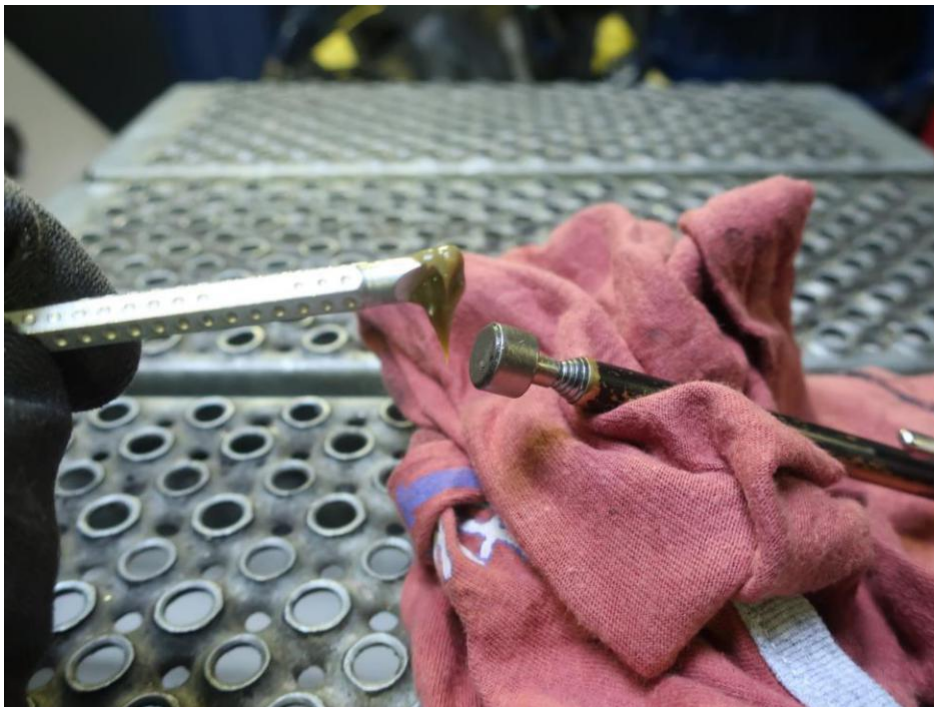
01-10-2011	Gearbox replaced.
19-04-2012	Q8 replaced.
16-06-2012	Generator bearing DE-side replaced.
14-11-2012	HV-Switch (RM6) maintenance
14-04-2013	Pitch accumulator blade B replaced.
11-03-2014	HV-Switch (RM6) maintenance
08-04-2014	Gearbox oil replaced.
09-09-2014	Blade maintenance.
09-10-2014	Generator bearing DE-side replaced.
10-02-2015	HV-Switch (RM6) maintenance
21-04-2015	Pitch accumulator blade C replaced.
13-09-2016	Gearbox oil replaced.
11-11-2016	Pitch cylinder blade B replaced.
16-03-2017	HV-Switch (RM6) maintenance
20-04-2017	Pitch accumulator blade C replaced.
03-05-2017	Gearbox replaced.
07-03-2018	HV-Switch (RM6) maintenance
22-05-2018	Vickers valve A replaced
27-09-2019	Gearbox oil replaced.
08-01-2020	Hydraulic oil replaced.
18-02-2020	HV-Switch (RM6) maintenance

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6. Visual inspection main shaft bearings

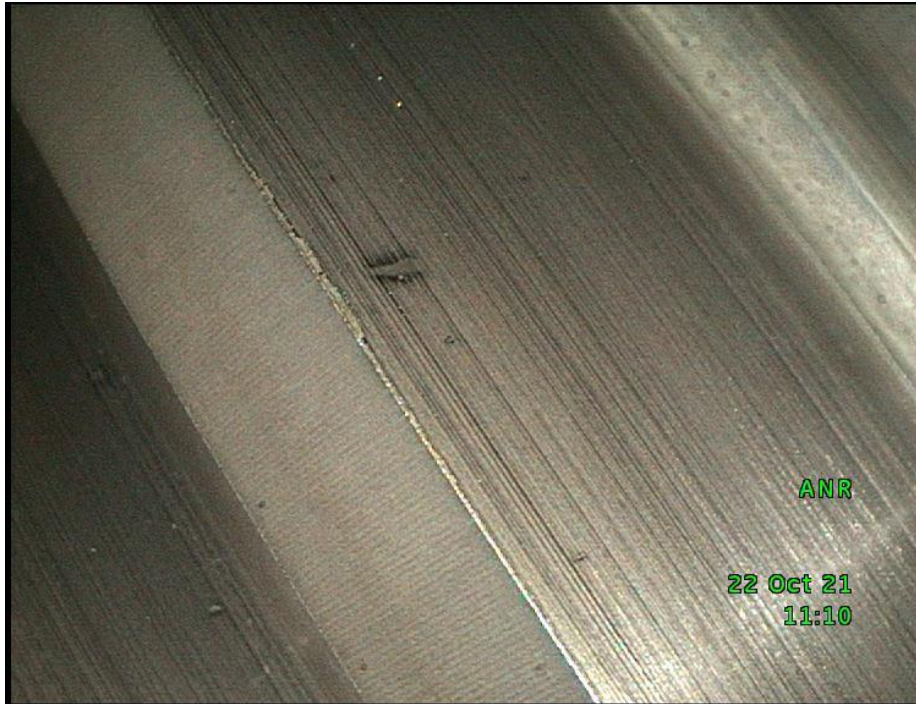


FRONT MAIN BEARING: The visual part of the main bearing shows no irregularities. The colour of the grease is correct and the grease is not magnetic.

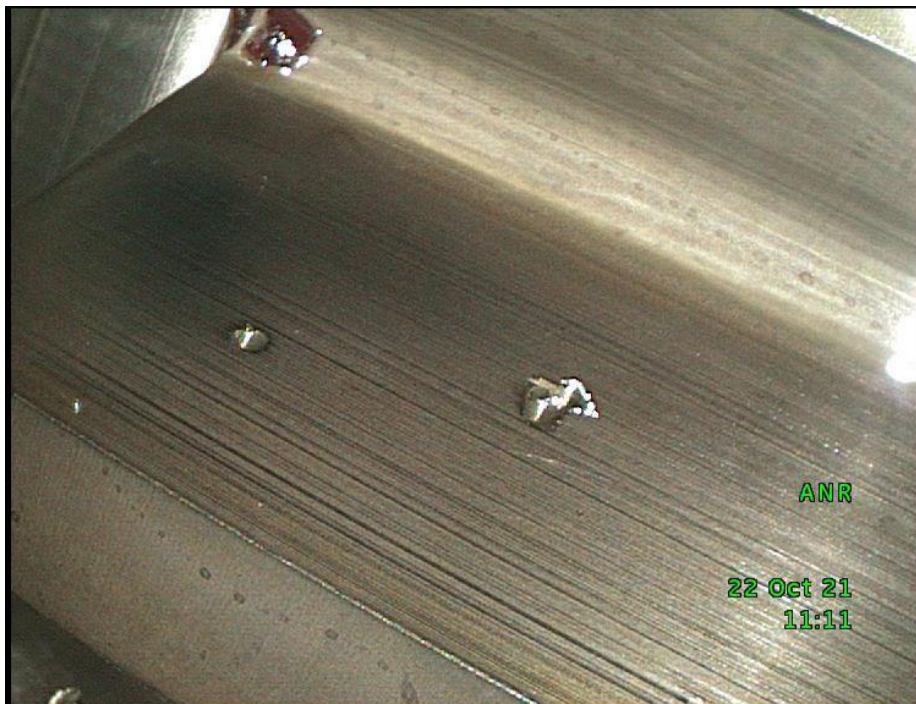


REAR MAIN BEARING: The bearing is filled with grease and not accessible with scope. The colour of the grease is correct and the grease is not magnetic.

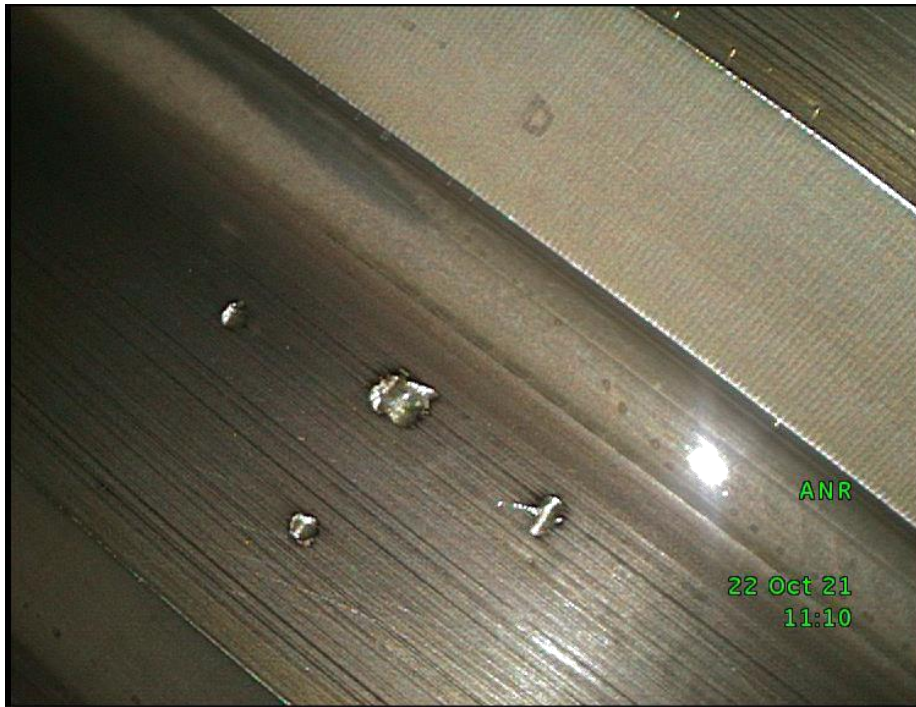
7. Visual inspection gearbox



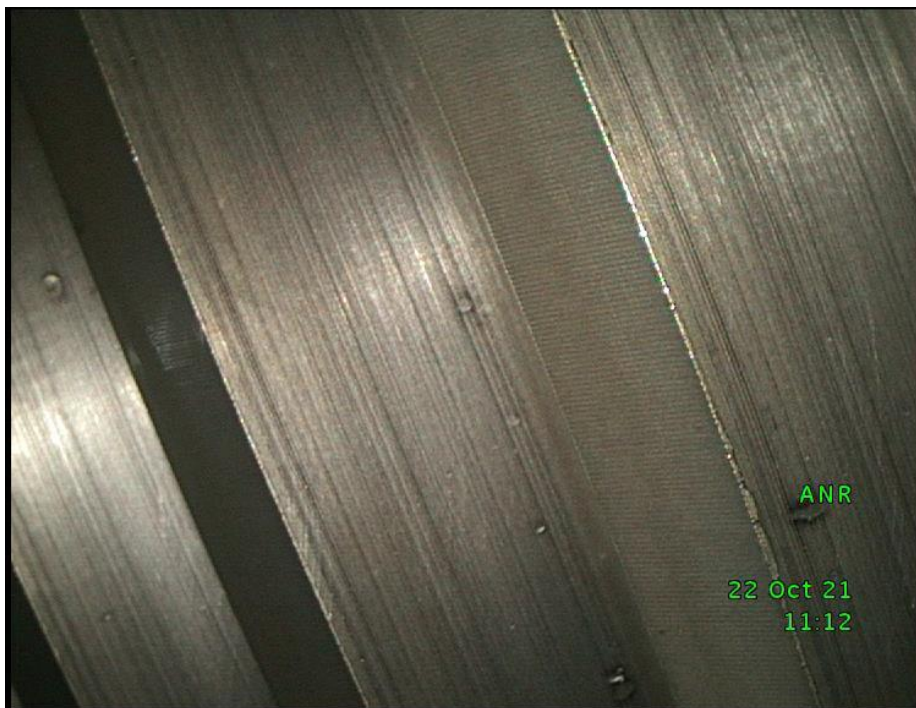
The active flank of the ring gear shows a lot of indentations.



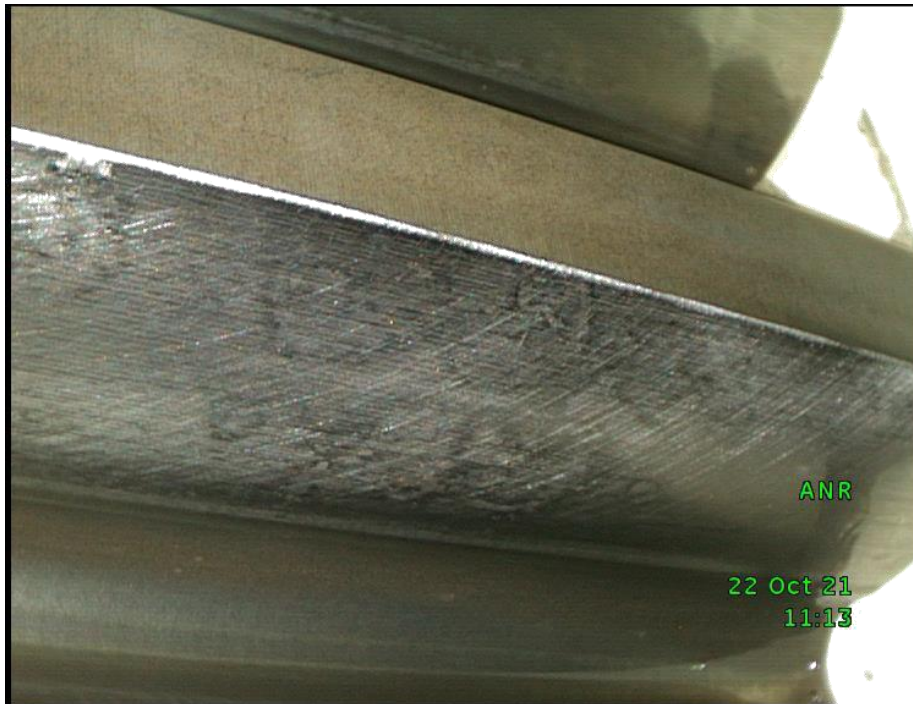
The active flank of the ring gear shows a lot of indentations.



The active flank of the ring gear shows a lot of indentations.



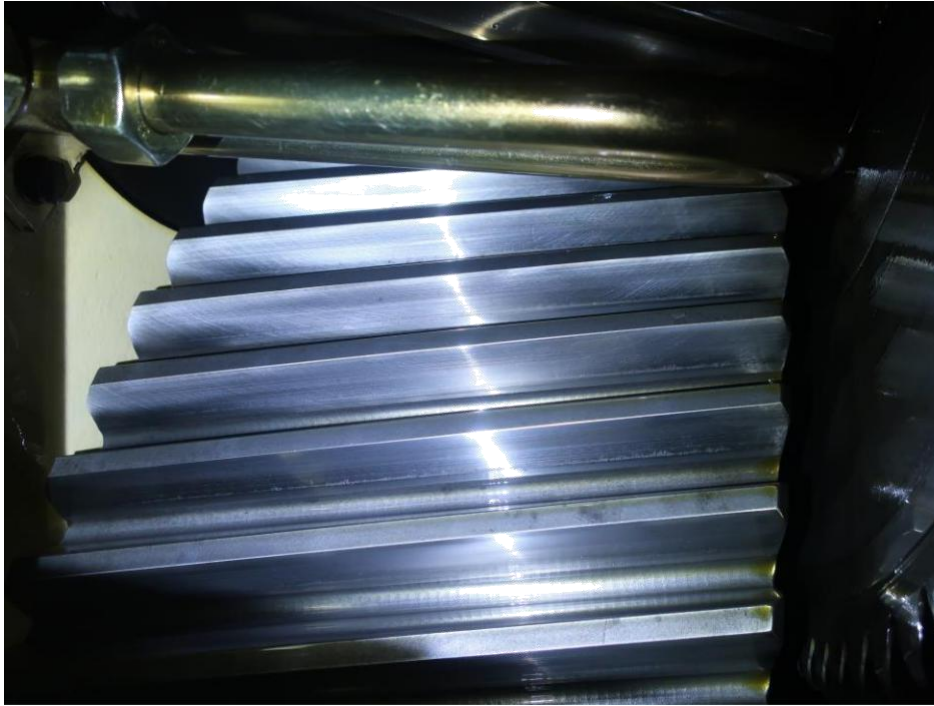
The active flank of the ring gear shows a lot of indentations.



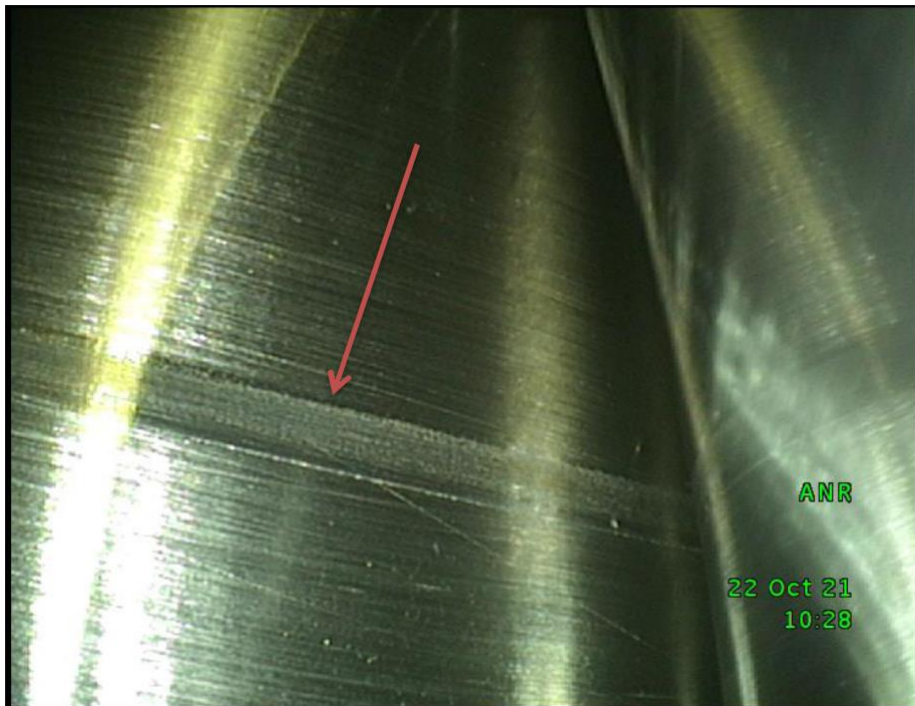
The planet wheels show a lot of irregularities on the surface.



The planet wheels show a lot of irregularities on the surface.

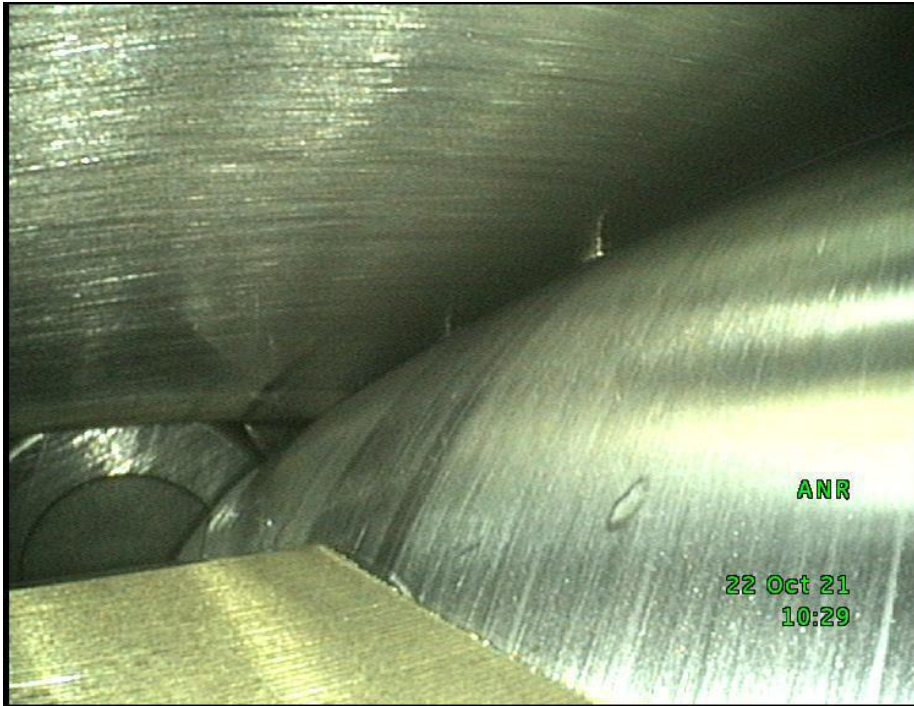


Linear gears show no irregularities

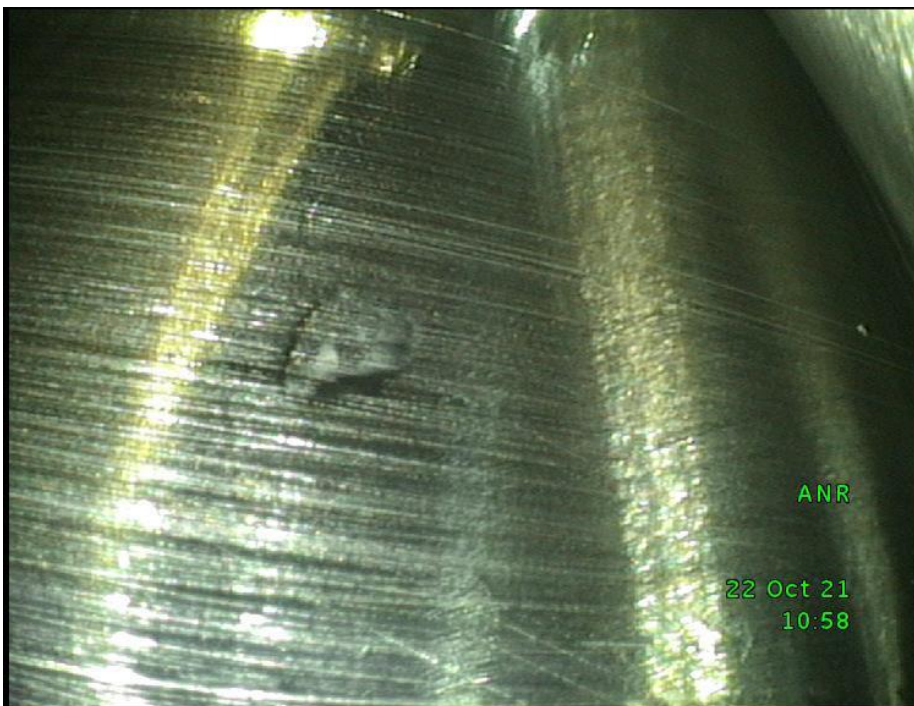


The planet wheel bearings show small irregularities. This planet bearing has a grey radial line.

Visual inspection gearbox

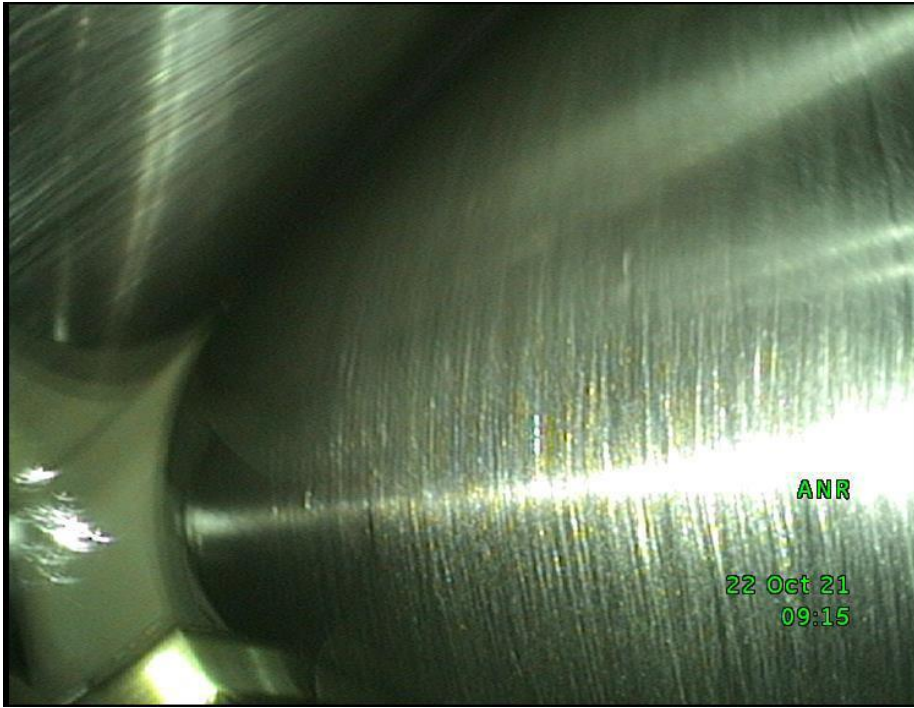


The planet wheel bearings show small irregularities. This planet bearing shows a small indentation.



The planet wheel bearings show small irregularities. This planet bearing shows a small indentation.

Visual inspection gearbox

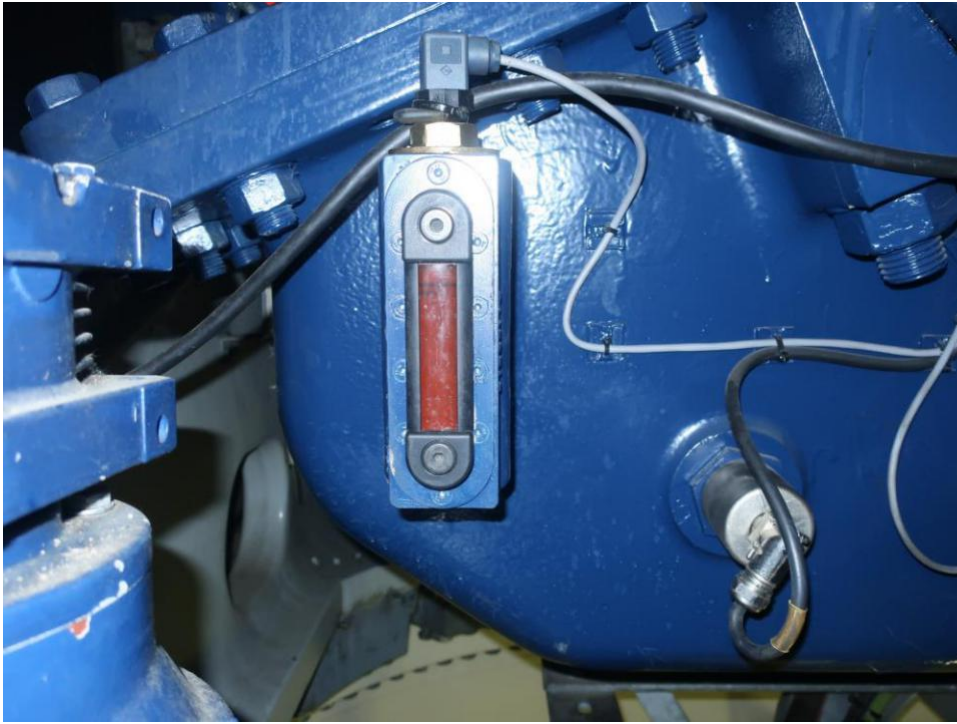


Linear bearings show no irregularities.



The magnet of the gearbox shows no irregularities.

Visual inspection gearbox



The oil level of the gearbox is ok.



Sign plate of the gearbox.

8. Blades



The tips show no irregularities, only a bit dirty.



The leading edges show no irregularities.



The tips show no irregularities, only a bit dirty.



The leading edges show no irregularities.

9. Turbine overview



Overview nacelle and tower outside



Overview inside tower

Turbine Overview



Overview yaw brake system



Overview nacelle

Turbine Overview



Overview nacelle



Overview of the stator relays

Turbine Overview



Overview VCP-board

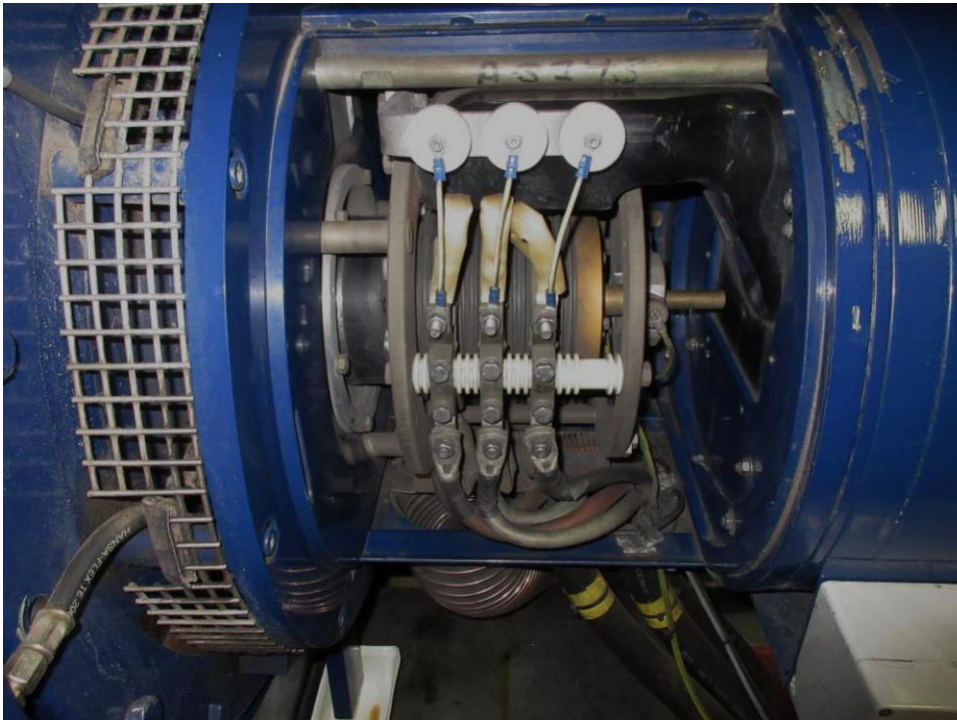


Overview IGBT-cabinet

Turbine Overview



Overview Cotas modules



Overview generator slip ring

Turbine Overview

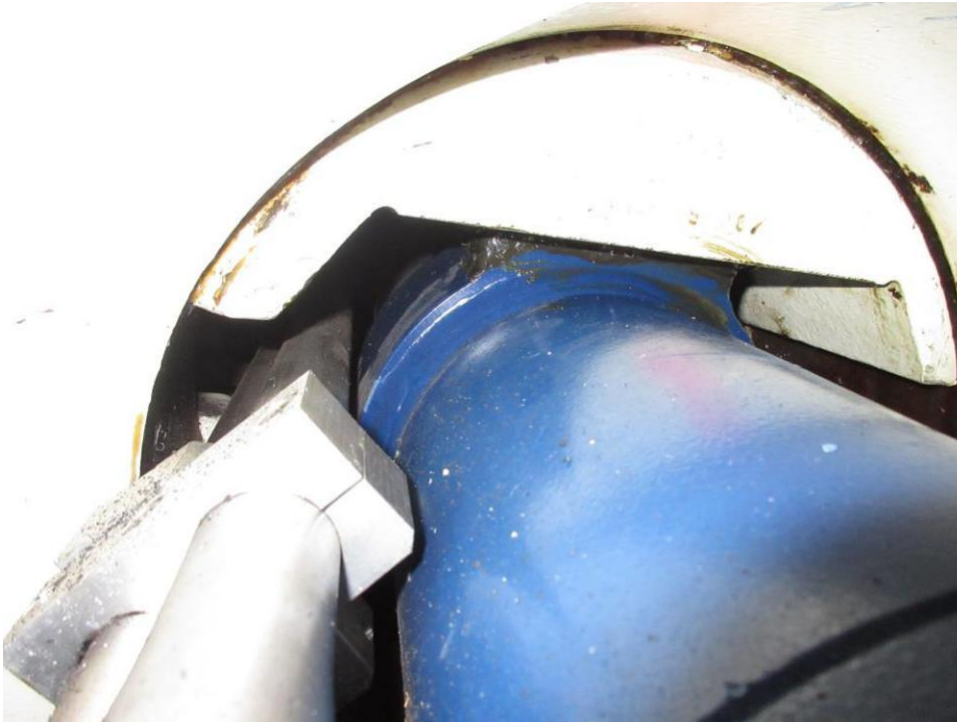


Overview hub



Overview link bearing of the pitch systems

Turbine Overview





Overview cylinder mounting of the pitch systems




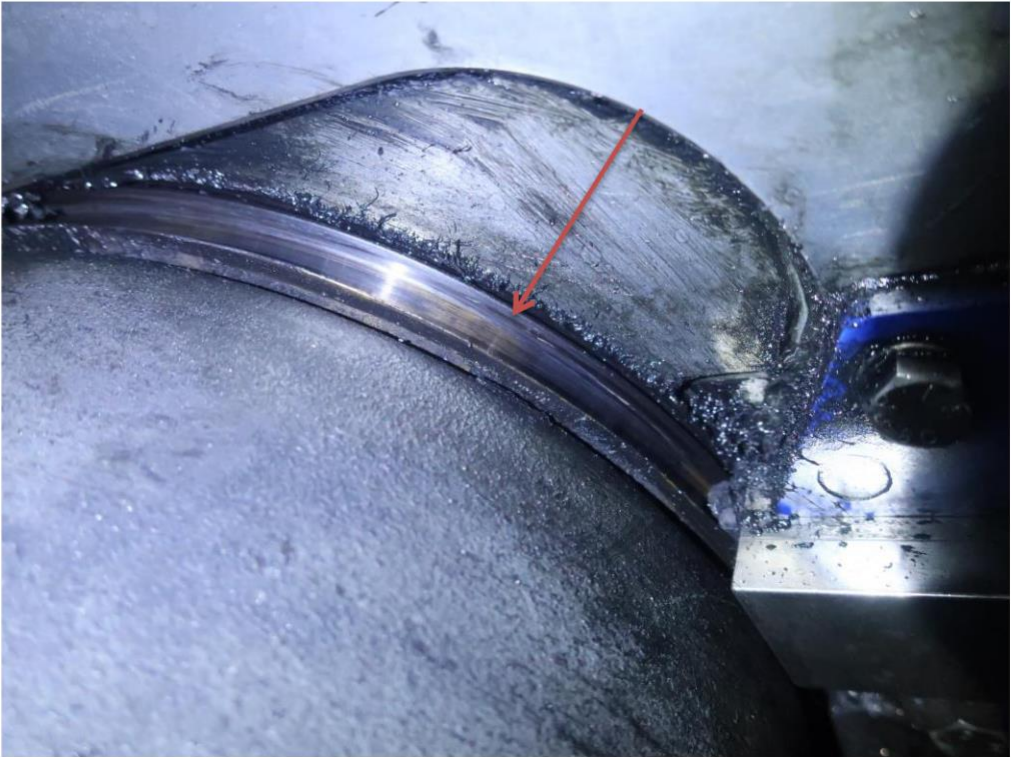
Overview wind station

10. Turbine irregularities

<i>Tower</i>		<i>Yaw platform: Oil pollution</i>
1.	Low	
The yaw platform is polluted with oil.		

<i>Tower</i>		<i>Oscillation damper</i>
2.	Low	
The M8-bolts of the oscillation damper support are loose, and the chain shows minor corrosion.		

<i>Nacelle</i>		<i>Generator slipring DE</i>
3.	High	
<p>The slipring at the DE shows considerable wear.</p> <p>Also, the earth brush on the right side is missing.</p>		

<i>Nacelle</i>		<i>Generator slipring DE</i>
4.	High	
<p>The slipring at the DE shows considerable wear.</p> <p>Also, the earth brush on the right side is missing.</p>		

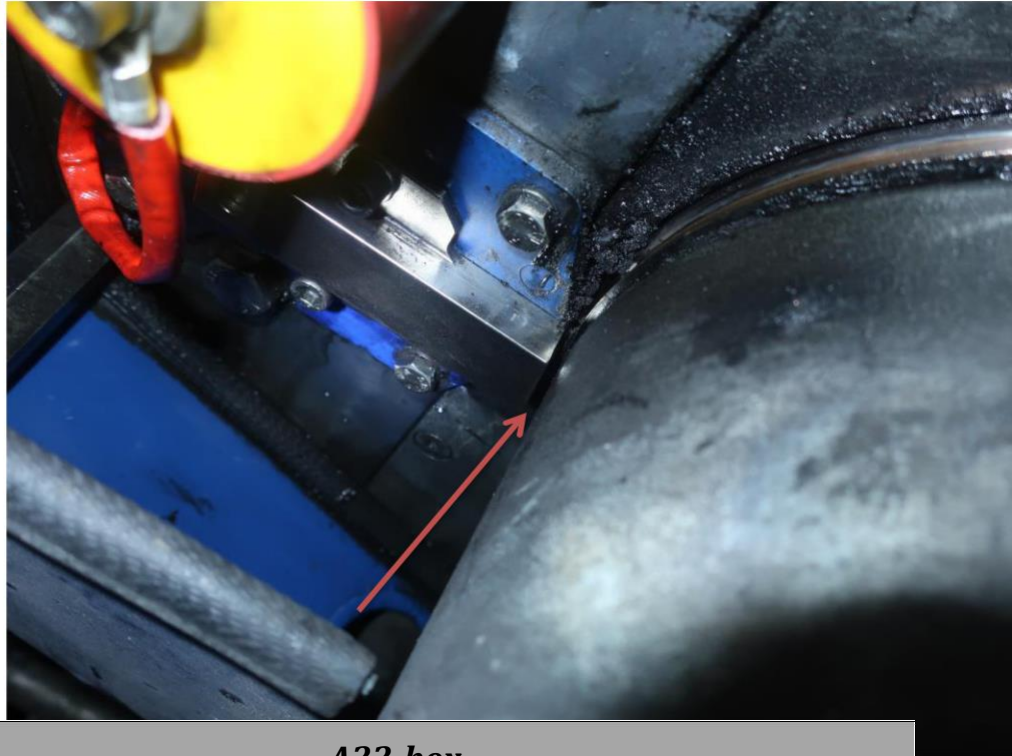
Nacelle

Generator slipping DE

5. *High*

The slipping at the DE shows considerable wear

Also, the earth brush on the right side is missing.

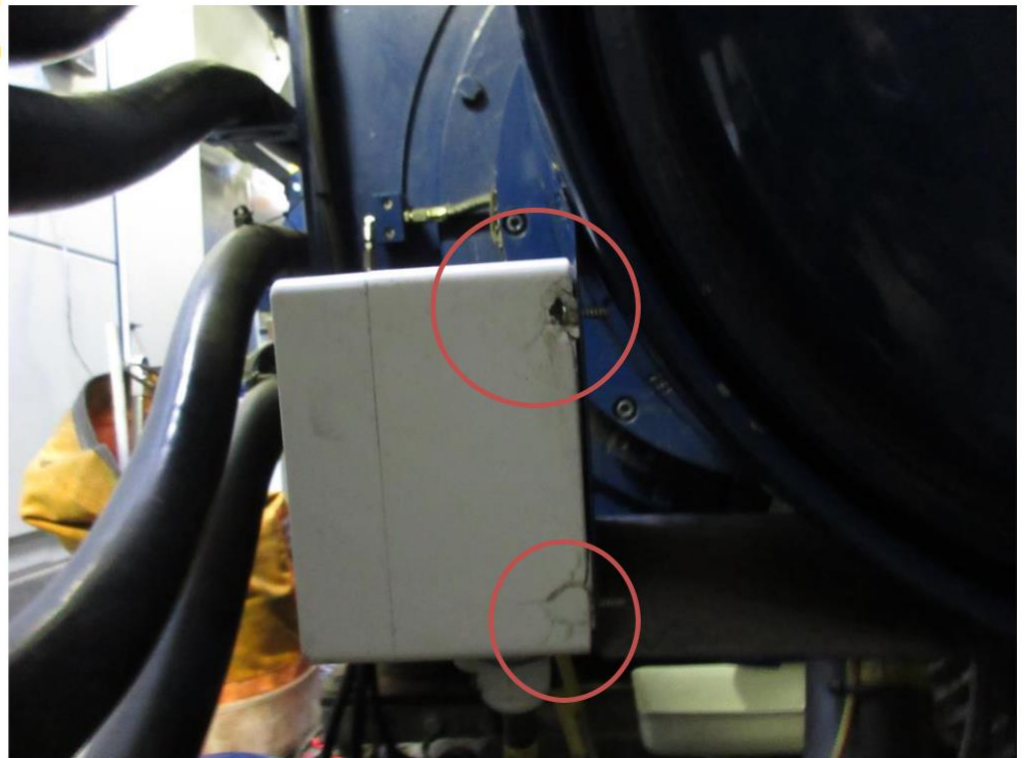



Nacelle


A33-box

6. *Low*

The A33-box is damaged.



<i>Nacelle</i>		<i>Gearbox: Leakage at the rear-right</i>
7.	Low	
<p>Some leakage is present near the rear right of the gearbox.</p> <p>It is recommended to clean the affected areas thoroughly to determine the source of the leakage and to solve the leakage.</p>		

<i>Nacelle</i>		<i>Gearbox: Leakage at the rear-right</i>
8.	Low	
<p>Some leakage is present near the rear right of the gearbox.</p> <p>It is recommended to clean the affected areas thoroughly to determine the source of the leakage and to solve the leakage.</p>		

Hub

Spinner support crack

9. High

The spinner support shows a crack.



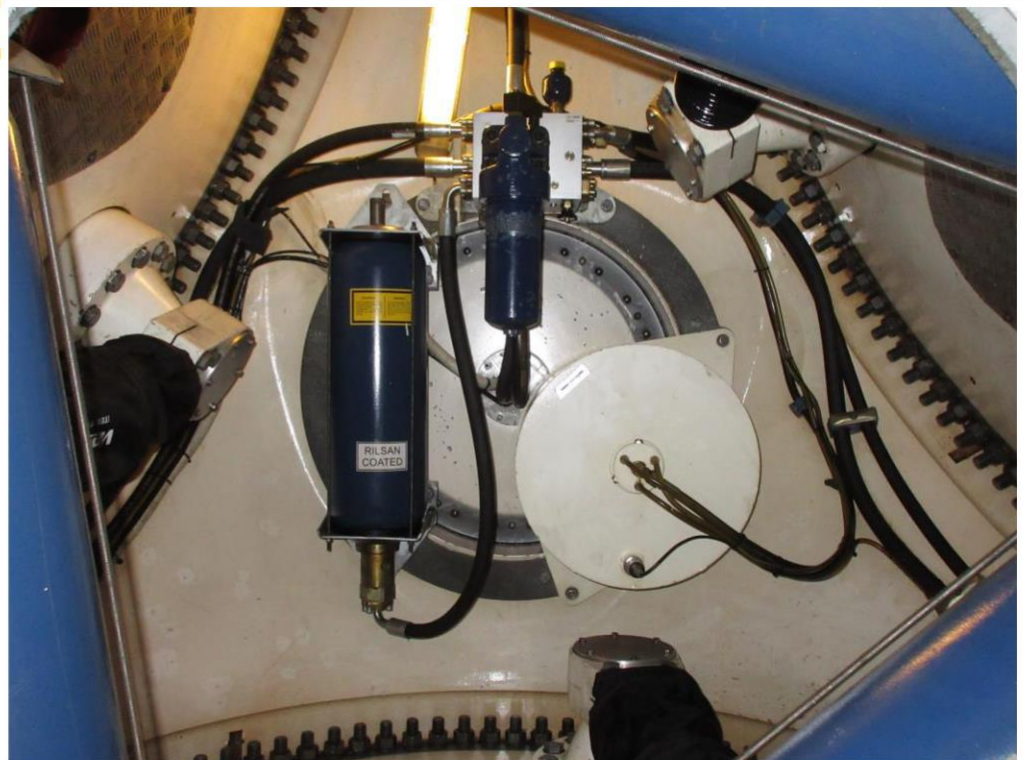
Hub


General leakage hydraulics

10. Low


The hub is covered in a thin layer of oil (hard to see in the photo).


It is recommended to clean the hub thoroughly to determine the source of the leakage and to solve the leakage.



Hub		General leakage hydraulics
11.	Low	
<p>The hub is covered in a thin layer of oil (hard to see in the photo).</p> <p>It is recommended to clean the hub thoroughly to determine the source of the leakage and to solve the leakage.</p>		

Hub		Pitch cylinder pistons A, B & C
12.	Info	
<p>The condition of the pistons is acceptable.</p>		

Hub		Cylinder link bearings A, B & C
13.	mon	
<p>The condition of the link bearings appears to be acceptable.</p> <p>Exact measurement of the bearing play has not been performed during the inspection.</p> <p>It is recommended to check the bearing play during maintenance and replace worn parts when the clearance is not within tolerance.</p>		

Hub		Cylinder suspension A, B & C
14.	mon	
<p>The condition of the cylinder suspension bearings appears to be acceptable.</p> <p>Exact measurement of the bearing play has not been performed during the inspection.</p> <p>It is recommended to check the bearing play during maintenance and replace worn parts when the clearance is not within tolerance.</p>		

11. Conclusions & Recommendations

a. Main bearing front

The condition of the main bearing is acceptable.

b. Main bearing rear

The condition of the main bearing is acceptable.

c. Gearbox

The condition of the gearbox is **moderate**.

The gearbox has been produced in 2001 and revised in 2013. In 2017 the gearbox has been installed in this turbine.

The planetary gears show a lot of indentations and other irregularities. Several indentations appear to have been “repaired” with a small grinder, most likely at a revision. Some indentations appear to be newer. Several planet bearings also show irregularities.

The condition of the gearbox is good enough to keep in operation, but one could consider replacing or revising the gearbox (properly!) should the turbine be installed at a different location.

d. Blades

The blades appear to be in an acceptable condition.

e. Turbine in general

The general condition of the turbine is quite good, considering that the turbine is 15 years old. The logbook shows periodical regular maintenance and also mentioned periodical maintenance and inspection of the high voltage transformer and the rotor blades.

Several issues that were found are relatively small and easy to repair, e.g. paintwork, corrosion, cleaning and minor leakage. These issues should be addressed, but they will not lead to alarms, dangerous situations or additional problems immediately.

The following issue(s) are more serious:

Issue	Description
3 4 5	<p><u><i>The slipring at the Driving End of the generator shows considerable wear.</i></u></p> <p>It is recommended to replace the raceway of the slipring and also the brushes.</p>
9	<p><u><i>The spinner support shows a crack.</i></u></p> <p>It is recommended to repair the spinner support as soon as possible.</p>

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