6 Bijlagen

6.1 Onderhoud 1 Benodigdheden voor één onderhoudsbeurt

Nummer	EDB nr.	Beschrijving
1	096185	DRY CLEANER SOLVENT
1	096188	CLEANING FLUID HP2000
1	130552	FILTER ELEMENT PI 2108 MAHLE
12	149047	GREASE VESTAS 14, 400G CHUCK
1	149130	GREASE TEXACO HYTEX EP2
8	149139	GREASE SKF LG W M1
0	149155	TECTYLE 127 CGW (ALU.)
1	149186	ESSO UNIREX S2
1	149188	KLUBER CA 901 ULTRA SPRAY
1	155995	CHIMS Ø100X75X0.25MM
1	155996	CHIMS Ø100X75X0.5MM
4	NL188476	BATTERY HELL. 916 1,5V ALK
2	NL198001	JOBTORK

6.2 Onderhoud 2 Gereedschap voor onderhoud

Nummer	Ordernr.	Beschrijving	Maten	Fabrikant
1	33-8	Soksleutel	8	Gedore
1	33-9	Soksleutel	9	Gedore
1	33-10	Soksleutel	10	Gedore
1	33-13	Soksleutel	13	Gedore
1	753-02	Momentsleutel mini	input ¼"	Gedore/Rahsol
1	754-00	Opsteekratel	input ¼"	Gedore/Rahsol
1	754-04	Opsteekratel	input ¾"	Gedore/Rahsol
1	735/10	Insteek ratelkop	½" output	Stahwille
2	735/40	Insteek ratelkop	¾" output	Stahwille
2	735/20	Insteek ratelkop	½" output	Stahwille
1	731/40	Insteek steeksleutel	17 mm	Stahwille
1	731/40	Insteek steeksleutel	19 mm	Stahwille
1	731/40	Insteek steeksleutel	24 mm	Stahwille
1	731/10	Insteek steeksleutel	19 mm	Stahwille
1	13050001	Ratel ratchfix DBGM	520	Stahwille
1	1993 GU-3	Omschakelbare ratel	input ½"	Gedore
1	20 ITU-3	Dopsleutel set	input ¼"	Gedore
1		Set met ringratels		
1	19 nr 10	Dopsleutel	input ½"	Gedore
1	19 nr 12	Dopsleutel	input ½"	Gedore
1	19 nr 13	Dopsleutel	input ½"	Gedore
1	19 nr 16	Dopsleutel	input ½"	Gedore
1	19 nr 17	Dopsleutel	input ½"	Gedore
1	19 nr 18	Dopsleutel	input ½"	Gedore
1	19 nr 19	Dopsleutel	input ½"	Gedore
1	19 nr 24	Dopsleutel	input ½"	Gedore
1	19 nr 30	Dopsleutel	input ½"	Gedore
1	19 nr 32	Dopsleutel	input ½"	Gedore
1	3293 U-2	Omschakelbare ratel	input ¾"	Gedore
1	K19 - 24	Dop 24mm	input ½"	Gedore
1	32 nr 32	Dopsleutel	input ¾"	Gedore
1	32 nr 24	Dopsleutel	input ¾"	Gedore
1	K19 KB 1995	Kardangewricht 1/2 "		Gedore
1	1990-5	Verlengstuk 125	input ½"	Gedore
1	1990-10	Verlengstuk 250	input ½"	Gedore
1	8313-140 TL	Zijkniptang voor kunststof		Gedore
1	145-15 C	Waterpomptang		Gedore
1	D19 L nr 17	Dop lang 17mm	input ½"	Gedore
1	D19 L nr 19	Dop lang 19mm	input ½"	Gedore
1	D19 L nr 24	Dop lang 24mm	input ½"	Gedore
1	D19 nr 36	Dop 36mm	input ½"	Gedore
1	D19 nr 24	Dop 24mm	input ½"	Gedore
1	K19 - 17	Dop 17mm	input ½"	Gedore

1	K32 - 30	Dopsleutel 30	input ¾"	Gedore
1	K32 - 32	Dopsleutel 32	input ¾"	Gedore
1	IN 19 / 6	Inbusdopsleutel	input ½"	Gedore
1	IN 19 / 8	Inbusdopsleutel	input ½"	Gedore
1	IN 19 / 10	Inbusdopsleutel	input ½"	Gedore
1	IN 19 / 12	Inbusdopsleutel	input ½"	Gedore
1	IN 19 / 14	Inbusdopsleutel	input ½"	Gedore
1	KB1990-5	Verlengstuk	input ½"	Gedore
1	KB 3290-8	Verlengstuk	input ¾"	Gedore
1	KB 3290-12	Verlengstuk	input ¾"	Gedore
1	K32 L KB 3295	Kardangewricht ¾ "		Gedore
1	K32 L KB 2132	Verloopstuk 1 op ¾"		Gedore
1	K32 L KB 3221	Verloopstuk ¾ op 1"		Gedore
1	1932	Verloopstuk ½ op ¾"		Gedore
1	42 L 2	Inbussleutel lang	2mm	Gedore
1	42 L 2,5	Inbussleutel lang	2,5mm	Gedore
1	42 L 3	Inbussleutel lang	3mm	Gedore
1	42 L 4	Inbussleutel lang	4mm	Gedore
1	42 L 5	Inbussleutel lang	5mm	Gedore
1	42 L 6	Inbussleutel lang	6mm	Gedore
1	42 L 7	Inbussleutel lang	7mm	Gedore
1	42 L 8	Inbussleutel lang	8mm	Gedore
1	42 L 10	Inbussleutel lang	10mm	Gedore
1	geis8132/8 JC	Telefoontang recht	200mm	Gedore
1	geis8132AB/8 JC	Telefoontang gebogen	200mm	Gedore
1	143-10 IC	Waterpomp tang		Gedore
1	36-2-200	Bandsleutel		Gedore
1	E 36-2-200	Reserve band	930	Gedore
1	4531/5	Rolbandmaat 5m		Gedore
1	702-13 M	Voelermaat	5/100 - 100/100	Gedore
1	104P	Sleuf- of karroseriebeitel		Gedore
1	B215	Superbar		Gedore/Habero
1	520 E-1500	Bankhamer Rotband 500		Gedore/Habero
2		schroevedraaiersset	150 S-160 S-010	Gedore
1	60 P- 6	Verstelbare moersleutel	6"	Gedore
1	60 P- 8	Verstelbare moersleutel	8"	Gedore
1	60 P-15	Verstelbare moersleutel	15"	Gedore
1	74 02 160	Zijkniptang		Knipex
1	12 40 205 A	Zelfinstellende Striptang	205mm	Knipex
1	97 81 180	Aderhulstang	180mm	Knipex
1	PHG 600 CE	Hand heater	2000W	Bosch
1	2046 FEB-09	Meetklok		Mitutoyo
1	304146	Verwisselb verlengstuk	60mm	Mitutoyo
1	7019	Magneetstatief		Mitutoyo
1		schuifmaat		Mitutoyo
1		set inbus ronde kop	2-10mm	PB
1		TL-lamp met snoer		
1		stoffer		

1		blik		
1		IJzerzaag	groot	
1		kitspuit		
1	8065N-3C	Klemschroevendraaier		Belzer
1	8060 IEC 8-175	Geisoleerde schroevedraaier		Belzer
1		Ringsteeksleutel	10mm	Belzer
1		Ringsteeksleutel	13	Belzer
1		Ringsteeksleutel	14	Belzer
1		Ringsteeksleutel	16	Belzer
1		Ringsteeksleutel	17	Belzer
1		Ringsteeksleutel	18	Belzer
1		Ringsteeksleutel	19	Belzer
1		Ringsteeksleutel	24	Belzer
1		Ringsteeksleutel	30	Belzer
1		Ringsteeksleutel	32	Belzer
1		Ringsteeksleutel	36	Belzer
1		Ringsteeksleutel	41	Belzer
1		Ringsteeksleutel	46	Belzer
1		Multimeter 87		Fluke
1		AC stroomtang 600A		Fluke
1		Koffer C-28Y		Fluke
1		Raaco Koffer		Raaco
1		pc notebook		
1		oliepomp		Gedena
4		Grease guns		
1	809027	CABLE SET, VMP PC-TOOLS		Denmark
1	809030	CABLE KIT FOR CT232		Denmark
1	883456	CT236 interface for PC "light transmitter"		Denmark
1	883476	CT248 interface for service box "light transmitter"		Denmark
1	809025	CONTROL PANEL CT232 IN BOX		Denmark
4		Vestas Walky's		Denmark
1	991046	DIGITAL PRESSURE DAIL METER		Denmark
1	991046	DIGITAL CAPACITANCE METER YF-150		Denmark
1		duspol tester		Denmark
1		Level instrument for windvane		Denmark
1	991045	Accumulator refill set f. accum. all types		Denmark
1	733935	T-Key spanner		Denmark

6.3 Onderhoud 3 Inspectie Record Schema's 943641 and 943642

KONTROLSKEMA INSPECTION RECORD SCHEME	No.: 943641

Operation/sted: Serviceafd.	Titel: Mekanisk del.					Ref. No.: 943637 943639
Work/place: Service dep.	Item: Mechanical part.					
Rev. date R Sign. A ppd.	1	2	3	4	Udført af / Executed by: Date: GSt 99.05.19	Suppl. tegn./Dr.
5	6	7	8	9	Godkendt / Approved.	Page 1 of 8

Turbine type/no.	Montør/Engineer init.	Date:
Bemærkninger påføres servicerapport	Remarks on the service report.	

Points written in Italic font and this checkbox "☐" are for first check only, 3 months after turbine startup.		*1st 3 months*	6 months	1 year
Faldsikringsudstyr	**Fall safety device**			
Kontroller ankerpunkt for wire i top og bund.	Check anchor point for wire in top and bottom.	☐	☐	☐
Kontroller wire, sjækler samt sjækellås.	Check wire, shackles and shackle lock.	☐	☐	☐
Kontroller wirestyr på stigen samt alle boltesamlinger for stigen.	Check the wire guides on the ladder. Check all bolt connections.	☐	☐	☐
Mølleejerudstyr.	**Safety equipment for turbine owner.**			
Kontroller 2 stk. H-seler/bælter i henhold til instruktion.	Check the 2 pcs. H-belts/belts according to instruction. Note the serial number and mark for OK.	☐	☐	☐
Kontroller 2 stk. lange stropper evt. med falddæmper i henhold til instruktion	Check the two long lanyards plus an eventually fall damper device according to instruction.	☐	☐	☐
Kontroller 2 stk. opkortestropper i henhold til instruktion.	Check the two long lanyards plus an eventually fall damper device.	☐	☐	☐
Kontroller hjælmene i henhold instruktion.	Check safety helmets according to instruction..	☐	☐	☐
Kontroller 2 stk. glidestoplåse (faldsikring) i henhold til instruktionen.	Make a functional test of the sliding stop locks.	☐	☐	☐
Spinner	**Nose cone**			
Kontroller bolte i glasfiber.	Check bolts in glass fibers.	☐	☐	☐
Kontroller spinner for revner.	Check nose cone for cracks.		☐	☐
Kontroller spinnerophæng for revner.	Check welding on nose cone support.		☐	
Vinger	**Blades**			
Kontroller bolte mellem vinge - vingeleje. Tilspændingsmoment: 817 Nm.	*Check bolts between blade – blade bearing. Torque wrench setting: 817 Nm, 602 ft.-lbs.*	☐		
Kontroller vinger for revner.	Check blades for cracks.	☐	☐	☐
Noter placeringen af revner på servicerapporten	Note position of any cracks in service report.	☐		Position noted
Kontroller tidligere afmærkning af revner.	Check any marks of existing cracks.		☐	☐

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Vinger repareret?	Repair made on blade?	☐	Repair made	
Vingenav, drejekranse	**Hub, blade bearing**			
Kontroller 4 af 71 bolte, drejekrans - nav. Tilspændingsmoment: 824 Nm.	*Check 4 of 71 bolts blade bearing - hub. Torque wrench setting: 824 Nm, 608 ft. lbs.*	☐		
Kontroller 3 bolte hvor løfteudstyr sad. Tilspændingsmoment: 824 Nm.	*Check 3 bolts where lifting tool was placed. Torque wrench setting: 824 Nm, 608 ft. lbs.*	☐		
Kontroller yderste tætninger på drejekranse.	Check outer lip seals of blade bearing.		☐	☐
Check inderste tætninger på drejekranse.	Check inner lip seals of blade bearing.		☐	☐
Kontroller drejekranse for ujævn gang og slør.	Check movement of blade bearing.			☐
Smør drejekransene.	Lubricate blade bearings.		☐	☐
Pitch system	**Pitch system**			
Kontroller 1 af 6 bolte i hver halvdel af cylinderholderne. Tilspændingsmoment: 320 Nm.	*Check 1 of 6 bolts in each half part of the cylinder holder. Torque wrench setting: 320 Nm, 236 ft.-lbs.*	☐		
Kontroller 1 bolt i hver momentarm. Tilspændingsmoment: 624 Nm.	*Check 1 bolt in each crank arm. Torque wrench setting: 624 Nm, 482 ft.-lbs.*	☐		
Kontroller at låseboltene i akselenderne ikke er løse.	*Check that locking bolts in shaft ends are not loose.*	☐		
Kontroller alle bolte i ledlejehuse på stempelstænger. Tilspændingsmoment: 320 Nm.	*Check all bolts in plain bearing housings on piston rods. Torque wrench setting: 320 Nm, 236 ft.-lbs.*	☐		
Kontroller aksialslør i hydraulikcylinderens ophæng.	Check axial clearance in slide bushings to hydraulic cylinders	☐ A _____ mm ☐ B _____ mm ☐ C _____ mm		
Kontroller radialslør i plejlstangslejer i momentarme.	Check clearance in bearings to connecting rod in cranks.	☐ A _____ mm ☐ B _____ mm ☐ C _____ mm		
Kontroller gummimanchetter for beskadigelser. Kontroller hydrauliksystem for utætheder.	Check rubber sleeves for damage. Check hydraulic system for leakage.		☐	☐
Aksel-lejearrangement	**Main shaft arrangement**			
Kontroller 2 ud af 48 nav/hovedaksel-bolte. Tilspændingsmoment: 2376 Nm.	*Check 2 out of 48 blade hub/main shaft-bolts. Torque wrench setting: 2376 Nm, 1752 ft.-lbs.*	☐		
Kontroller 1 bolt i hver side, forrest og bagest i hovedlejehuse. 4 bolte ialt. Tilspændingsmoment: 3083 Nm.	*Check 1 bolt in each side, front and rear in main bearing. 4 bolts in all. Torque wrench setting: 3083 Nm, 2273 ft.-lbs.*	☐		

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Kontroller hovedlejerne.	Check the main bearings.		☐	☐
Smør hovedlejerne.	Lubricate the main bearings.		☐	☐
Kontroller og smør arreterdornene.	Check and lubricate the locking shafts.		☐	☐
Gearstag	**Torque arm system**			
Kontroller 3 bolte mellem gearstag – maskinramme. *Tilspændingsmoment: 1495 Nm.*	*Check 3 bolts between torque arm nacelle bedplate.* *Torque wrench setting: 1495 Nm, 1102 ft.-lbs.*	☐		
Kontroller slør i gummibøsningerne. R = højre side. L = venstre side.	Check for clearance in rubber spring package. R = Right side. L = Left side.		☐ R _____ mm ☐ L _____ mm	
Gearkasse	**Gearbox**			
Kontroller oliestand (i stilstand).	Check the oil level, (at stand still).	☐	☐	☐
Kontroller for utætheder.	Check for leakage.	☐	☐	☐
Udtag en olieprøve.	Extract an oil sample.		☐	
Olie skiftet?	Oil changed?		☐	☐
Gearet kontrolleret indvendigt, ved olieskift.	Check the gear unit internally, at oil change.	☐	☐	☐
Bremse	**Brake**			
Kontroller tykkelse af bremsebelægning.	Measure thickness of brake lining.		☐	
Kontroller bremsecalipre.	Check the calipers.		☐	
Kontroller bremseskive.	Check the brake disc.		☐	
Udluft bremsesystem.	Bleed the brake system		☐	☐
Krydskardanaksel	**Cross cardan shaft**			
Kontroller tætninger for fedtspild.	Check seals for grease waste.		☐	☐
Kontroller kardankryds for slitage.	Check the bearings in the joints for wear.		☐	
Kontroller om akslen kan forskydes aksielt:	Check that the shaft can be displaced axial:		☐	
Smør begge kardankryds.	Lubricate both cardan joints.	☐	☐	☐
Kompositkobling	**Composite coupling**			
Kontroller mellemrøret for revner omkring bolthuller.	Check the connecting tube for cracks around the bolt holes.	☐	☐	☐
Kontroller kompositskiver for rundgående og radielle revner.	Check composite discs for circular and radial cracks.	☐	☐	☐
Gearoliesystem	**Gear oil system**			
Skift gearoliefilter?	Change gear oil filter		☐	☐
Kontrol af flow-/trykovervågning.	Check of flow-/pressure monitoring.		☐	
Kontrol for lækager.	Check for leakage.	☐	☐	☐
Kontroller oliekøleren for snavs.	Check for contamination of oil cooler.		☐	☐
Primær generator	**Primary generator**			
Tilspænd kabler i klemkasse *M8: 8 Nm, M16: 92 Nm.*	*Tighten cables in generator terminal box.* *M8: 8 Nm, 6 ft.-lbs. M16: 92 Nm. 69 ft.-lbs.*	☐		
Kontroller gummidæmpere.	Check the rubber elements.		☐	
Kontroller lejer.	Check the bearings.	☐	☐	☐
Smør forreste generatorleje.	Lubricate front generator bearing.		☐	☐
Smør bageste generatorleje	Lubricate rear generator bearing.		☐	☐
Kontroller RCC	Check RCC		☐	☐

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Sekundær generator	**Secondary generator**			
Tilspænd kabler i klemkasse. 51 Nm.	*Tighten cables in generator terminal box. 51 Nm, 38 ft.-lbs.*	☐		
Kontroller lejer.	Check the bearings.	☐	☐	☐
Smør forreste generatorleje.	Lubricate front generator bearing.		☐	☐
Smør bageste generatorleje	Lubricate rear generator bearing.		☐	☐
Hydraulik.	**Hydraulic.**			
Kontrol af oliestand:	Check of oil level.		☐	☐
Olieskift.	Change of oil.			(5 years) ☐
Skift hydraulikoliefilter på hydraulikenhed.	Change pressure line filter on hydraulic unit.			☐
Tilsmudsning af oliefilter på hydraulikenhed. Olie temperatur Olietryk på 19.2 (før filter): Olietryk på 19.3 (efter filter): Trykforskel (19.2 – 19.3):	Contamination of the pressure line filter on power unit Oil temperature Oil pressure on 19.2 (before filter): Oil pressure on 19.3 (after filter): Pressure difference (19.2 – 19.3):			☐ _____ °C _____ Bar _____ Bar _____ Bar
Lækage i nacelle.	Leakage in nacelle	☐	☐	☐
Lækage i hovedaksel	Leakage in main shaft.	☐	☐	☐
Tryk digitalt manometer/servicepanel. Maksimum afvigelse 5 bar.	Pressure digital pressure gauge/service panel. Maximum deviation is 5 bar.	☐		_____/_____ Bar
Kontrol af pumpe. 180 bar Pumpe starttryk: 200 bar Pumpe stoptryk:	Check of pump. 180 bar Pump start pressure: 200 bar Pump stop pressure:	☐		_____ Bar _____ Bar
Kontrol af overtryksventil. 210 bar +5 /-15 bar. Før justering: Efter justering:	Check of oil pressure relief valve. 210 bar +5 /-15 bar. Before adjustment: After adjustment:	☐		_____ Bar _____ Bar
Forladetryk i pitchakkumulator på hyddraulikenhed. 143+0/-5 bar ved 20°C. Før justering: Efter justering:	Precharge pressure in pitch accumulator on hydraulic unit. 143+0/-5 bar at 20°C. Before adjustment: After adjustment:		☐	☐ Temp.= _____ °C _____ Bar _____ Bar
Kontrol af oliekøler	Check hydraulic oil cooler		☐	☐
Tryk i bremsesystem. 50 Hz: 18.5±1 bar. 60 Hz: 15.5±1 bar. Før justering: Efter justering:	Pressure in brake system. 50 Hz: 18.5±1 bar. 60 Hz: 15.5±1 bar. Before adjustment: After adjustment:		☐	_____ Bar _____ Bar
Tryk i bremseakkumulator.	Precharge pressure brake accumulator. 50 Hz: 11±1 bar.		☐	☐

Points written in Italic font and this checkbox "☐" are for first check only, 3 months after turbine startup.		*1st 3 months*	*6 months*	*1 year*
50 Hz: 11±1 bar. 60 Hz: 9 ±1 bar. Før justering: Efter justering:	60 Hz: 9 ±1 bar. Before adjustment: After adjustment:	Temp.= _____ °C _____ Bar _____ Bar		
Kontroller bremsetrykventil 10±2 bar	Check brake pressure switch 10±2 bar	_____ Bar		
Lækage i vingenav.	Leakage in hub.	☐	☐	☐
Kontroller lækolietank	Check leak oil tank	☐	☐	☐
Forladetryk i pitchakkumulator. 143+0/-5 bar ved 20°C. Før justering: Efter justering:	Precharge pressure pitch accumulator. 143+0/-5 bar at 20°C. Before adjustment: After adjustment:	☐	☐	Temp.= _____ °C _____ Bar _____ Bar
Forladetryk i nødkantstillingsakkumulatorer. 73+0/-5 bar ved 20°C. Før justering: Efter justering:	Precharge pressure in emergency pitch accumulators. 73+0/-5 bar at 20°C. Before adjustment: After adjustment:	☐	☐	Temp.= _____ °C _____ Bar _____ Bar
Forladetryk i dæmpningsakkumulatorer i returledning. 20 ± 3 bar ved 20°C. Før justering: Efter justering:	Precharge pressure in damping accumulators in return line. 20 ± 3 bar at 20°C. Before adjustment: After adjustment:	☐	☐	Temp.= _____ °C _____ Bar _____ Bar
Skift trykfilter i vingenav.	Change pressure line filter in hub.			☐
Trykfald over trykfilter i vingenav	Pressure drop over filter in blade hub			☐
Nødkantstillingsventil A. 170±2 bar ved skift fra + til -. Før justering: Efter justering:	Emergency pitch pressure switch. A 170±2 bar at change from + till -. Before adjustment: After adjustment:		A ☐	_____ Bar _____ Bar
Nødkantstillingsventil B. 170±2 bar ved skift fra + til -. Før justering: Efter justering:	Emergency pitch pressure switch. B 170±2 bar at change from + till -. Before adjustment: After adjustment:		B ☐	_____ Bar _____ Bar
Nødkantstillingsventil C. 170±2 bar ved skift fra + til -. Før justering: Efter justering:	Emergency pitch pressure switch. C 170±2 bar at change from + till -. Before adjustment: After adjustment:		C ☐	_____ Bar

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		Bar		
Krøjegear	**Yaw gear**			
Lejeslør på krøjedrevsaksel kontrolleret.	Check bearing clearance on yaw pinion shaft.			☐
Kontroller de nederste pakdåser for lækage.	Check the lower lip seals for leakage.		☐	☐
Skift olie på snekkegearet, (hvert 5. år).	Change oil on worm gear, (every 5 years).	☐		Oil changed:
Skift olie på planetgearet, (hvert 5. år).	Change oil on planetary gear, (every 5 years).	☐		Oil changed:
Krøjelejring	**Yaw bearing system**			
Kontroller 5 af 90 bolte for sammenspænding af krøjetop og tårn. Tilspændingsmoment: 1553 Nm.	*Check 5 bolts of 90 for connecting yaw top and tower. Torque wrench setting: 1553 Nm, 1145 ft.-lbs.*	☐		
Kontroller endestop (messingklods) for radialglideplader. Tilspændingsmoment: 164 Nm	Check end-stop (brass piece) for radial slide plates. Torque wrench setting: 164 Nm, 121 ft.-lbs			☐
Kontroller bolte for endestop for store glideplader. Tilspændingsmoment: 209 Nm	Check bolts for end-stop for the big slide plates. Torque wrench setting: 209 Nm, 154 ft.-lbs.			☐
Smør via de 2 smørerør i glideklodserne.	Lubricate via the 2 tubes in the sliding plates.		☐	☐
Smør glidefladerne på krøjetoppen med et meget tyndt lag fedt.	Lubricate the sliding surface of the yaw top with a very thin layer of grease.		☐	☐
Smør tandkransen.	Lubricate the yaw teeth with a brush.		☐	☐
Vindfane og anemometer	**Wind vane, anemometer**			
Kontroller vindfane og topmøtrik.	Check wind vane and cap nut.		☐	☐
Kontroller vindfanens bevægelse.	Check rotation of wind vane.		☐	☐
Kontroller anemometer.	Check anemometer.		☐	☐
Kontroller anemometrets bevægelse.	Check rotation of anemometer.		☐	☐
Kontroller varmelegemerne.	Check the heating elements.		☐	☐
Maskinskærm	**Nacelle cover**			
Kontroller bolte, beslag og glasfiberskærm.	Check bolts, fittings and nacelle cover.			☐
Kontroller lydisolering.	Check the sound isolation.			☐
Kontroller udv. gelænder	Check the outer roof rail.	☐	☐	☐
Brandslukker	**Fire extinguisher**			
Kontroller dato for kontrol af brandslukker samt evt. manometer og overtryksventil.	Check the date for control of the fire extinguisher plus eventually manometer and pressure relief valve.		☐	☐
Rørtårn	**Tubular tower**			
Kontroller 6 bolte bundflange - fundamentssektion:. Tilspændingsmoment: 2800 Nm.	*Check 6 bolts bottom flange - foundation section: Torque wrench setting: 2800 Nm, 2064 ft.-lbs.*	☐		
Kontroller 6 bolte i sektionssamlinger. Tilspændingsmoment: 2800 Nm.	*Check 6 bolts in middle flanges. Torque wrench setting: 2800 Nm, 2064 ft.-lbs*	☐		
Kontroller svejsninger ved dør for revner.	Check welding at doorframe for cracks			☐
Kontroller bolte på stiger og platforme.	Spotcheck bolts to ladder and landings.	☐		☐
Kontroller svingningsdæmper.	Check oscillation absorber.			☐
Overfladebehandling	**Surface treatment**			
Kontroller overfladebehandling.	Check surface treatment.			☐

Points written in Italic font and this checkbox "☐" are for first check only, 3 months after turbine startup.		*1st 3 months*	6 months	1 year
Kran	**Crane**			
Kontroller bremsefunktion. 8.2.4	Check of brake function. 8.2.4			☐
Justering af bremse. 8.2.1/8.2.2	Adjustment of brake. 8.2.1/8.2.2			☐
Kontroller glidekobling med nominel last. 8.3.1/8.3.2	Check sliding clutch with nominal load. 8.3.1/8.3.2			☐
Kontroller kæde for slidtage. 8.4.2/8.4.3	Testing the chain for wear. 8.4.2/8.4.3			☐
Kontroller ophæng, blok og krog.	Check suspension, crane block, load hook.			☐
Kontrol af kabler og samlinger.	Check electrical cables and connecting leads.			☐
Generel check.	General checks.			☐
Smøring af kæde. 8.4.1	Lubrication of load chain. 8.4.1			☐
Kontroller støtter til kranskinner for skader	Check cantilevers in runway for damages.			☐
Kontroller dele i travers for skader	Check components in traverse for damages.			☐
Visuel inspektion af elkabler	**Visual inspection of electric cables**			
Kontroller at kabler er i orden.	Check cables.	☐	☐	☐
Kontroller kabelstrips.	Check cable strips.	☐	☐	☐
Kontroller jordingskablernes tilspænding.	Check grounding system cables tightening.	☐	☐	☐
Afsluttende visuel kontrol	**Final visual check**			
Kontroller for oliespild, løse bolte etc.	Check for oil waste, loose bolts etc.	☐	☐	☐

KONTROLSKEMA INSPECTION RECORD SCHEME						No.: 943642
Operation/sted: Serviceafd.		Titel: Elektrisk del, VMP-3500.				Ref. No.: 943638
Work/place: Service dep.		Item: Electrical part, VMP-3500.				943640
Rev. date R Sign. Appd.	9803131 SDP IHS	9807032 SDP IHS	9904163 ANH IHS	4	Udført af / Executed by: Date: IHS 971103	Suppl. tegn./Dr.
5	6	7	8	9	Godkendt / Approved. LB	Page 1 of 5

Mølle nr./ WEC no.:	No.:
Kontrolleret af/ Supervisor:	Name:
Dato/ Date:	Date:
Bemærkninger påføres servicerapp. nr:	**Remarks to be recorded in the service rep. no:**

		3 months	6 months	1 year
Forudsætninger	**Preconditions**			
Sikkerhedbetingelser.	Security conditions.	☐	☐	☐
Sikkerhedskomponenter	**Security components**			
Vindhastighed. Billede 1	Windspeed. Picture 1.	_____ m/s		
Udendørstemperatur. Billede 6. Gear olie temperatur	Ambient temperature. Picture 6 Gear oil temperature	_____ °C _____ °C		
Relativ vindretning. Billede 11.34 Peg mod rotor: Undamped,+off=0° Peg mod anemometer: -90°	Relative Wind Direction. Pict. 11.34 Point against rotor: Undamped,+off=0° Point against anemometer: -90°	☐ ☐	☐ ☐	☐ ☐
Test af nødstopknapper. Billede 1. S933 Nødstoptryk, gear: S934 Nødstoptryk, krøjeplade: S935 Nødstoptryk, COM-styring: S936 Nødstoptryk, nacellestyring:	Test of emc stop buttons. Picture 1. S933 Main Shaft: S934 Yaw Plate: S935 COM-controller: S936 Nacelle controller:	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Test af bremse, billede 12B, S208. Aktiveret ved manuel nødstop: Først løsnet ved kvittering i billede 1: (Indført 1/2-99 og servicepakke 2)	Test of brake, Pict. 12B, S208: Applied when man. emc.: Only released by ackn. error, pict 1. (Introduced 1/2-99 and Servicepackage 2):	☐ ☐	☐ ☐	☐ ☐
Test af batteriback-up hvis installeret. Afbryd Q16. Check bremse ikke aktiveret inden efter 60-120 sek. Slut Q16 igen.	Test of battery back-up if installed. Switch off Q16. Check brake not applied before 60-120 sec. Close Q16 again.	☐	☐	☐
Test af vibrationsføler. Billede 12F. S403	Test of vibration sensor. Pict. 12F. S403	☐	☐	☐
Kontrol af pressostater. Pitch-system A: A2.X1, 44-71 og 94-71: Pitch-system B: A2.X1, 45-71 og 95-71:	Test of pressure switches. System A: A2.X1, 44-71 and 94-71: System B: A2.X1, 45-71 and 95-71:	☐ ☐	☐ ☐	☐ ☐

		3 months	6 months	1 year
Pitch-system C: A2.X1, 46-71 og 96-71:	System C: A2.X1, 46-71 and 96-71:	☐	☐	☐
Test af nødkantstillingsventiler. Bill. 15 <FUNC><→> <1>/<0> Lyt. Y210A (afmonter W283A) Y210B (afmonter W283B) Y210C (afmonter W283C) Y212A Y212B Y212C	Test of emergency pitch system. Pict.15. <FUNC><→><1>/<0> Listen Y210A (dismount W283A) Y210B (dismount W283B) Y210C (dismount W283C) Y212A Y212B Y212C	 ☐ ☐ ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐ ☐ ☐
Test af PTS5, COM-styring Test af PTS5, Nacelle styring	Test of PTS5, COM-controller Test of PTS5, Nacelle controller	☐ ☐	☐ ☐	☐ ☐
Opvarmning af vindsensorer. Option. Anemometer, A6.8 Vindfane, A6, 4	Heating of windsensors. Optional. Anemometer, A6.8 Windvane, A6, 4	 ☐ ☐	 ☐ ☐	 ☐ ☐
Pitch	**Pitch**			
Efterfølgende test må ikke udføres i vindhastigheder over 15 m/s.	**Following tests must not be perfor-med in windspeed above 15 m/s.**			
Krøj ind i vinden. Forlad servicetilstand.	Yaw into the wind. Leave Servicemode.	☐	☐	☐
Udfør følgende tests for hvert system for sig med vingen pegende nedad. Arreter rotoren. Test 11.7.	Perform following tests for each system with the blade pointing downwards. Lock the rotor locking system. Test 11.7.	☐	☐	☐
Valg af pitch system. 11.7 <#>.	Choose pitch system. 11.7 <#>.	☐	☐	☐
Negativ pitch ende-stop. Test 11.8 A: 0.040V [0.020→0.060]: B: 0.040V [0.020→0.060]: C: 0.040V [0.020→0.060]:	Negative pitch end-stop. Test 11.8 A: 0.040V [0.020→0.060]: B: 0.040V [0.020→0.060]: C: 0.040V [0.020→0.060]:	☐ ☐	☐	
Positiv pitch ende-stop. Test 11.8 A: 9.710V [9.690→9.730]: B: 9.710V [9.690→9.730]: C: 9.710V [9.690→9.730]:	Positive pitch end-stop. Test 11.8 A: 9.710V [9.690→9.730]: B: 9.710V [9.690→9.730]: C: 9.710V [9.690→9.730]:	☐ ☐	☐	
Pos. offset indst. Test 11.9. Pitch hast. A: 1.2°/sec [0.5→1.9]: B: 1.2°/sec [0.5→1.9]: C: 1.2°/sec [0.5→1.9]:	Positive offset adjust. Test 11.9. Pitch vel. A: 1.2°/sec [0.5→1.9]: B: 1.2°/sec [0.5→1.9]: C: 1.2°/sec [0.5→1.9]:	☐ ☐	☐	
Neg. offset indst. Test 11.10. Pitch hast.	Neg. offset adjust. Test 11.10.	☐	☐	

V

V

V

V

V

V

°/sec.

°/sec.

°/sec.

A: -1.2°/sec [-0.5→-1.9]: B: -1.2°/sec [-0.5→-1.9]: C: -1.2°/sec [-0.5→-1.9]:	Pitch vel. A: -1.2°/sec [-0.5→-1.9]: B: -1.2°/sec [-0.5→-1.9]: C: -1.2°/sec [-0.5→-1.9]:	☐ _____ °/sec. _____ °/sec. _____ °/sec.
Positiv flow test. Test 11.11. Pitchhast. A: 10°/sec [5→13]: B: 10°/sec [5→13]: C: 10°/sec [5→13]:	Pos. flow test. Test 11.11. Pitch velocity. A: 10°/sec [5→13]: B: 10°/sec [5→13]: C: 10°/sec [5→13]:	☐ ☐ ☐ _____ °/sec. _____ °/sec. _____ °/sec.
Negativ flow test. Test 11.12. Pitchhast. A: -10°/sec [-7→-14]: B: -10°/sec [-7→-14]: C: -10°/sec [-7→-14]:	Neg. flow test. Test 11.12. Pitch velocity A: -10°/sec [-7→-14]: B: -10°/sec [-7→-14]: C: -10°/sec [-7→-14]:	☐ ☐ ☐ _____ °/sec. _____ °/sec. _____ °/sec.
Sinus test. Test 11.13 A: Pitch, Act↔Pitch, Ref: Faktisk pitch: B: Pitch, Act↔Pitch, Ref: Faktisk pitch:	Sine test. Test 11.13 A: Pitch, Act↔Pitch, Ref: Physical pitch: B: Pitch, Act↔Pitch, Ref: Physical pitch:	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
C: Pitch, Act↔Pitch, Ref: Faktisk pitch: Alle: Pitch, Act↔Pitch, Ref: Faktisk pitch:	C: Pitch, Act↔Pitch, Ref: Physical pitch: All: Pitch, Act↔Pitch, Ref: Physical pitch:	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Strømmåling ved kondensatortest: Ingen systematiske fejl over 1%.	Current measurements by cap.test: No systematic error above 1%.	☐ ☐ ☐
Rotor og generator	**Rotor and generator**	
Krøj ind i vinden. Fjern arreteringen.	Yaw upwind. Remove lock.	☐ ☐ ☐
RPM sinus-test. Test 11.19. GenRPM,Act↔GenRPM,Ref:	RPM sine-test. Test 11.19. GenRPM,Act↔GenRPM,Ref:	☐ ☐ ☐
RPM step-test. Test 11.19. GenRPM,Act↔GenRPM,Ref:	RPM step-test. Test 11.19. GenRPM,Act↔GenRPM,Ref:	☐ ☐ ☐
Bemærk: Testene 5.4 og 5.5 udføres kun ved vindhastighed over 6,5 m/s.	**Remark: The tests 5.4 and 5.5 is only performed if the windspeed is above 6.5 m/s.**	
Test af Gen overhastighed. Test 11.21. Noter "Alarm omdr/min. aktiveret" 50Hz: 1770RPM [1740→1800RPM]: 60Hz: 2125RPM [2085→2165RPM]:	Test of generator overspeed. Test 11.21. Note "Alarm rpm act", 50Hz: 1770RPM [1740→1800/RPM]: 60Hz: 2125RPM [2085→2165RPM]:	☐ ☐ ☐ _____ RPM
Test af VOG. Test 11.22. Noter "Alarm rotor omdr.", 23.3 RPM [22.3→24.3 RPM]:	Test of VOG. Test 11.22. Note "Alarm Rotor RPM", 23.3 RPM [22.3→24.3 RPM]:	☐ ☐ ☐ _____ RPM
Reset af VOG-alarm	Reset of VOG-alarm	

Kvitt. uden reset af VOG ikke mulig: Kvitt. med reset af VOG mulig:	Ackn. without reset of VOG not pos.: Ackn. with reset of VOG possible:	☐ ☐	☐ ☐	☐ ☐
Afslutning	**Finish**			
Skift batterier.	Change batteries.			☐
Reset tællere. Billede 1A.	Reset counters. Picture 1A.	☐	☐	☐
VDF-mode. Billede 27.1 "Full-recycle"	VDF-mode. Picture 27.1 "Full-recycle"	☐	☐	☐
Forlad Service, sæt i RUN, billede 1.	Leave Service, bring in RUN, picture 1.	☐	☐	☐

6.4 Onderhoud 4 Reserve onderdelen voor storingscorrectie

Recommended spare parts for Vestas Wind Turbines.

Item No.	*Description*	*Qty.*	*Comp. No*
	ELECTRICAL PARTS		
	GRID		
091991	Earth leakage relay, Vigerex RH328A, 230V	4	F59, option
091992	Earth leakage circuit breaker, F271-B13/30	4	F39
093142	Meter kWh/kVArh, ZMB410CT647 cl. 1 (2)	0	***Option***
093143	Meter kWh/kVArh, ZMB410CT647 cl. 1 (2)	0	***Option***
093996	Circuit breaker, 88A354	4	F68, F71B,option
109573	Trip coil for Uniswitch	4	
116270	Relay, trip Q4-WP,Q8, Q15, F60, RY-2S-U	10	D8, D60
116253	Relay, RH-1B-U, 24 VDC	10	K20
092391	Capasitor 2mF/450V	10	C20A-F
116633	Transformer, motor for nacelle fan	10	M20A-F
116608	Circuit breaker, S261 B13, 1 pole	6	F37A
116615	Circuit breaker, S261 C10	6	F56
116617	Circuit breaker, S261 B10, 1 pole	6	F35, F36
116619	Circuit breaker, S261 B16	6	F57
116753	Voltage transf. 690/3/400: 3V	0	T72A-C, option
116754	Voltage transf. 1100/3/110:3V	0	T69A-C, option
116810	Transformer, TA-4.0KVA 690V/230V	4	T50
117037	Circuit breaker, LN200 R100	2	Q15
117044	Circuit breaker, Isomax, S5L LSIG	2	Q4-WP
117047	Circuit breaker, Isomax, S7H-1600 3P R1600 LSIG	2	Q8
117052	Circuit breaker, Isomax S2S160	4	Q16
092014	Shunt open release	4	Q16
117080	Short circuit protection, Prolim, PL20/13 690V	4	F62, F64A-D, F66, F77
188249	Circuit breaker, MS325 0.4-0.63 A	4	F34
188250	Circuit breaker, MS325 9-12.5A	4	F76
188251	Circuit breaker, MS325 12.5-16A	4	F61, F63A-D
188252	Circuit breaker, MS325 4-6.3A	4	F78
188253	Circuit breaker, MS325 1.6-2.5 A	4	F63E
188265	Circuit breaker, MS325 2.5-4A	4	F65
188331	Current transformer, 1500/1 7.5VA	12	T4-6
188332	Current transformer for P75	0	T73A-C, option
188335	Current transformer, SA 200	0	T58, option
188345	Transformer, TA-2.5kVA 690V/230V	2	T51
188346	Transformer, TA-F100 230V/24V 100 VA	2	T54A, T54B
188385	Transformer 1600 kVA, 10.5 kV	0	T53
188386	Transformer 1600 kVA, 20.0 kV	0	T53
188391	Rotating transformer, ETK160	0	T52

188431	**Current transformer HV, 100/5A**	0	T70A-C, option
188505	**Overvoltage protection HV, 30kV**	2	F79A-C
188507	**Overvoltage protection HV, 15kV**	2	F79A-C
188508	**Overvoltage protection hub, Dehn guard 75**	2	F46A-B, F47A-B
188520	**Overvoltage protection nacelle, VED 220V**	2	F40
188521	**Dehn guard, VM500FM 550 Vac/dc**	2	F9A-F11A, F9B-F11B
188562	**Fuse, lightning arrester, grid, 63A, 690V DIN100**	6	F12-F14
188575	**Fuse for Uniswitch, 63A 24kV**	0	F60
188603	**Measuring resistans 2 ohm, Dale RH-10 2 ohm**	12	R4-6
836660	**Transformer, rectifier aux. supply, 230/24V**	4	T38
	CONTROLLER		
883380	CT 218, Panel	2	
883404	CT 227, Measuring 690V	2	
883388	CT 228, Thyristor driver	2	
883420	CT 264, VPN slave unit	2	
883490	CT 265, VPN Driver	2	
883514	CT257, RCC control unit	4	
883552	CT 279, VOG (Vestas Overspeed Guard)	4	
90793	CT 303, Thyristor driver, dual	2	
883410	CT 3133, DC input	2	
883412	CT 3153, DC output	2	
883554	CT 3211, Fibre optic port	2	
883544	CT 3218, Counter	2	
883466	CT 3220, Analog input	2	
883430	CT 3232, Analog output	2	
883432	CT 3251, Powewr control	4	
883434	CT 3354, Internal power supply	2	
883438	CT 3364, External power supply	2	
883446	CT 3503, processor	4	
883450	CT 3514, ARCNet Optical + RS 422, Top	4	
883460	CT 3514, ARCNet Optical + RS 422, Ground	4	
883526	RCC power electronic unit	2	

YAWING

093185	Thermo relay, yaw motor, T25 DU 3.1A	4	F106, F107, F110, F112
093330	Contactor, yaw motor, B9-30 10/220V 50Hz	4	K100, K101, K109, K111
115230	Yaw motor, MT100L28F130-6 1.5kW 690V Y	2	M140A-D
727320	Yaw control, X/2FR6/150-091170 TER	2	S102-S105

HYDRAULIC

093186	Thermo relay, ventilator, hydraulic, T25 DU 1.4A	2	F214, F411, F417
093189	Thermistor brake, UP62 UCHIYA, 130C	2	S207
093338	Contactor, hydraulic pump, B25-30-10	2	K204
094215	Fuse, brake valve, 2A T	20	F234
109102	Temperature sensor, hydraulic oil, PT 100	2	R206
109180	Leak oil indicator, Vegaswing	2	S217
116611	Circuit breaker, S261 B6	2	F230A-C
116769	Rectifier, KBPC15-06	2	U232A-C, U233
188240	Thermo relay, hydraulic pump, T25 DU14	2	F205
188347	Transformer, 230/26.7V, 50VA, TA-F50	4	T231
109090	Oil level sensor	2	S200
130522	Pressure switch	2	S201, S202
109537	Analog pressure transducer	2	A203
115269	Motor, hydraulic pump, 11kW, 4 pole, 690VY	2	M240
109958	Motor, hydraulic ventilator, 0.75kW, 4 pole, 690VY	2	M241

AMBIENT SENSORES

114279	Temperature sensor, ambient	4	R300, R306, R310, R319
737260	Windvane GND	2	B320-B303
888098	Anemometer GND	2	B310
888125	Anemometer TOP	4	B310
114219	Thermostat, com. Controller	2	B304
188230	Thermo relay, fan motor, T25 DU 1.0 A	4	F308
093182	Thermo relay, fan motor, T25 DU 2.4 A	4	F314, F318, F510,
186150	Nacelle position, 30 impuls/rotation	2	B323-324
114219	Thermostat, hub controller	2	B322
114252	Inductive sensor, nacelle pos. reset, PNP M30	2	B325, B400, B418, B430
114332	Time relay, naccelle/hub cont., SB125, 8-180 sec	2	K330A, K330B
115247	Motor, fan nacelle, MT371B, 0.37kW,	2	M340
115235	Motor, fan nacelle, MT90S, 2.2kW	2	M341, M342
114214	Thermostas, hub cont, RTR6122, 5-30	2	B347

ROTATION/TRANSMISSION SYSTEM

114248	Inductive sensor, generator, PNP, M18	2	B401
114855	Vibration sensor, WLNJ-S2-G	2	S403
727400	Vestas Overspeed Guard	4	U405
131028	Pressure switch, geaar oil, KPS31	2	S412
109955	Motor gear oil pump/cooler, VEM 0,75 kW	2	M440, M441

GENERATOR

188229	Thermo relay, fan ext. low, T25 DU 0.63 A	2	F508
93185	Thermo relay, fan int. low, T25 DU 3.1 A	2	F514A, F514B
188235	Thermo relay, fan int. high, T25 DU 6.5 A	2	F516A, F516B
723600	Generator, 1.65 mW	2	G540A
743700	Generator, 300 kW	2	G540B
193953	Motor ext. fan, VEM 0.3/1.5 kW	2	M541
193951	Motor int. fan, VEM 1.0/4.6 kW	2	M544A-B

POWER FACTOR CORRECTION

092340	Capacitor, 25 KVAr, 690V 50 Hz	12	C611-C635
188559	Fuse, 100A 690V, DIN 00	20	F651-F658
093679	Contactor PFC, LC1-DWK12 PS	4	K651-K658
092320	Discharge coil, DT10353-3	4	L665-L672

THYRISTOR

093026	Contactor, by-pass, EH800, 240V	2	K700A-K700C
93174	Thermistor, thyristor, UP62 90 C	6	S702A-S702C
93306	Contactor, generator 2, EH300, 240V	2	K705
092102	Thyristor, TT430 N22 KOF	6	V710-V715
188824	Resistor	6	R716-R718
092396	Capasitor, 0,47mF	2	C719-C721

PITCH SYSTEM

114266	Linear transducer, BTL2-A10,	2	A800A-A800C
093280	Capacitor, 10000 mF, 63V	2	C801A-B
724128	Rotating AcrNet, rotor	2	T805
724129	Rotating ArcNet, stator	2	T805
094228	Fuse for proportional valve, T3, 15A	20	F830A-C
116769	Rectifier, KBPC-15-06	2	U832

EMERGENCY STOP and VARIOUS

090781	Watch Dog, relay, CT217	2	K906
116361	Emergency stop button, XAL-J174	2	S933-S934
116330	Emergency stop button, ZB-2B	2	S935-S936
094230	Fuse, T 1A,	20	F938
194992	Heating element, nacelle/com. Cont. , 400W	2	E939A-E939B
871915	Thermal control, nacelle/com. Cont. PTS5	2	E940A-E940B
194988	Heating element, hub controller, 50 W 23V	2	E941A-D
194895	Light diode, controller, Swiss Tac	2	H943A-C, H944A-C, H945 A-C
194998	Air to air cooler, EXA	0	E946A-B
701290	VAS relay	4	F948A-C, Q4-WP, Q8, Q16
727301	VAS relay, PFC	4	F949A-C
091788	Switch, tripHV circuit breaker, ZB2BA4	2	S952
092290	Fan proc. Sec.	2	E953A
092294	Fan, hub, 24V	2	E953B
107698	Crane, 70m chain 10m/min, 690V	0	M959
195009	Varistor, 24V aux supply, SIOV-S14K25	2	F960
188512	Overvoltage protection, DEHN, ALD 24V	2	F962A-B
869058	Temperature sensor, E940A-B, nacelle, NTC	2	R963A-B
188509	Overvoltage protection, moden/phone, ALD 250V	2	F965, F965A-B
193921	Light, hub controller, complete	2	E969
193924	Light, flourescent type, 8W, neon, 24V	4	E969
116335	Switch, light, hub	2	S970
193920	Light hub, complete	2	E971
193925	Light, flourescent type, 10W/33, neon, 24V	2	E971
188469	Battery charger, BCA24-1	2	G972
188478	Battery, LC-R127, 12V/7,2Ah	2	G973A-B

MECHANICAL PARTS

BLADE and BLADE BEARING

741001	Blade, 32 m	2
107025	Blade bearing	2

HYDRAULICS and PITCH SYSTEM

724180	Rotating unit, complete	0
108576	Hydraulic cylinder	2
724220	Holder for cylinder	0
134870	Plain bearing, PWM 607040	2
724210	Housing fro spherical plain bearing	0
85438	Spherical plain bearing	0

109602	Valve block	2
721045	Torque arm shaft	0
721036	Torque arm block	0
721039	Guide plate, inner	0
721030	Torque plate	0
721031	Stiffening plate	0
721038	Guide plate, outer	0
721037	Disc, Ø120/25/15	0
721065	Lock bolt M30	2
721040	Floor plate	0
131085	Check valve, Voss RHV 20	0
104219	Coupling, half for motor, Raja Dentex	0
104220	Coupling, half for pump, Raja Dentex	0
104210	Bell housing, Raja R350	0
109101	Air filter, Mahle Pi 0126	0
109114	Test nipple, Ermeto	0
131084	Check valve, Vickers CV3	0
130522	Filter, pressure, Mahle Pi 3415, Sm3	2
109537	Pressure transmitter, MBS33 0-250 bar	2
131100	Relief valve, Vickers, RV5-10	2
131101	Relief valve, Vickers, RV6-10	2
109898	Accumulator, bladder 10 l, precharge 143 bar	2
131113	Neddle valve, Vickers NV1-10-K-0	2
101301	Drain valve, man. Operated, Vickers CMPV1	0
131086	Check valve, Vickers CV2	0
109106	Test hose, l = 1000mm, Voss SMA 3	0
109450	Manometer 0-250 bar	0
131076	Pressure reduction vallve, Vickers PRV1	2
109882	Accumulator, diaphragm 1.4 l	2
131071	Relief valve, Vickers RV10	2
109109	Solenoid valve, Vickers, CVUA -6	2
109156	Pressure switch, Hydropa, DS302	2
130470	Rotating union, Deulin 9110	2
109180	Level switch, Vegaswing 71	2
130523	Filter, pressure, Mahle Pi 3415, Sm10	2
109621	Bursting disc, Rembe ST-0.5	2
109617	Sealing ring, bursting disc	2
193415	Proportional valve, Vickers KBFDG4V-H7-10	4
101321	Solenoid valve, Wandflud AS3	4
109893	Accumulator, bladder 10 l, precharge 73 bar	2
131089	Check valve, Hawe RB2	2
109876	Accumulator, diaphragm 0,075 l, precharge 20 bar	2

	MAIN SHAFT ARRANGEMENT	
722000	**Main shaft arrangement, complete**	0
722082	**Rotor lock system, complete**	0
	TORQUE ARM SYSTEM	
723190	**Torque arm, left, complete**	0
723191	**Torque arm, rught, complete**	0
	MAIN GEAR	
743000	**Main gear, complete**	2
	TRANSMISSION SYSTEM	
809100	**Transmisson system, complete**	0
	YAW SYTEM	
115375	**Yaw gear, right (Bonfig.)**	
115376	**Yaw gear, left (Bonfig.)**	
115395	**Yaw gear, right (SOM)**	
115396	**Yaw gear, left (SOM)**	
726090	**Ywa bearing system, complete**	
131086	**Check valve, Vickers CV2**	

6.5 Onderhoud 5 Gereedschap voor storingscorrectie

Nummer	Ordernr.	Beschrijving	Maten	Fabrikant
1	33-8	Soksleutel	8	Gedore
1	33-9	Soksleutel	9	Gedore
1	33-10	Soksleutel	10	Gedore
1	33-13	Soksleutel	13	Gedore
1	20 ITU-3	Dopsleutel set	input ¼"	Gedore
1		Set met ringratels		
1	145-15 C	Waterpomptang		Gedore
1	42 L 2	Inbussleutel lang	2mm	Gedore
1	42 L 2,5	Inbussleutel lang	2,5mm	Gedore
1	42 L 3	Inbussleutel lang	3mm	Gedore
1	42 L 4	Inbussleutel lang	4mm	Gedore
1	42 L 5	Inbussleutel lang	5mm	Gedore
1	42 L 6	Inbussleutel lang	6mm	Gedore
1	42 L 7	Inbussleutel lang	7mm	Gedore
1	42 L 8	Inbussleutel lang	8mm	Gedore
1	42 L 10	Inbussleutel lang	10mm	Gedore
1	geis8132/8 JC	Telefoontang recht	200mm	Gedore
1	geis8132AB/8 JC	Telefoontang gebogen	200mm	Gedore
1		schroevedraaiersset	150 S-160 S-010	Gedore
1	60 P- 6	Verstelbare moersleutel	6"	Gedore
1	74 02 160	Zijkniptang		Knipex
1	97 81 180	Aderhulstang	180mm	Knipex
1	8065N-3C	Kiemschroevendraaier		Belzer
1	8060 IEC 8-175	Geisoleerde schroevedraaier		Belzer
1		Ringsteeksleutel	10mm	Belzer
1		Ringsteeksleutel	13	Belzer
1		Ringsteeksleutel	14	Belzer
1		Ringsteeksleutel	16	Belzer
1		Ringsteeksleutel	17	Belzer
1		Multimeter 87		Fluke
1		AC stroomtang 600A		Fluke
1		Raaco Koffer		Raaco
1		pc notebook		
1	809027	CABLE SET, VMP PC-TOOLS		Denmark
1	809030	CABLE KIT FOR CT232		Denmark
1	883456	CT236 interface for PC "light transmitter"		Denmark
1	883476	CT248 interface for service box "light transmitter"		Denmark
1	809025	CONTROL PANEL CT232 BOX		Denmark
4		Vestas Walky's		Denmark
1	991046	DIGITAL PRESS. DAIL METER		Denmark
1	991046	DIGITAL CAPACITANCE METER YF-150		Denmark
1		duspol tester		Denmark

6.6 Onderhoud 6 Onderdelen < 800 kg

Gewicht van onderhoudsonderdelen

SUBJECT	[kg]
Nose Cone	400
Blade Bearing Bolts (3x72)	150
Blade Bolts (3x80)	255
Rotor Lock Disc	440
Gear Stay	500
Break	200
Div.	240
Generator Cooler	650
Composite Coupling	40
Cross Cardin Shaft	70
Div.	200
Floor	250
Front Yaw Gear (2)	400
Rear Yaw Gear (2)	400
Yaw Top	800
Yaw Cooler	540
Hydraulic Pump Unit	400
Hydraulic	400
Console	80
Nacelle Controller, VMP	310
VMP - Nac., rail Section	440
Capacitor Cabinet	300
Hub-controller	63
HV board	260
HV Breaker	250
Cables in nacelle	710
Cables in Tower	554
Air Shield	300
Travers Crane, Assem	400
Crane incl Chain	125

6.7 Onderhoud 7 Onderdelen > 800 kg grote turbine onderdelen

Gewicht van onderhoudsonderdelen

SUBJECT	[kg]
Hub	8500
Nacelle bedplate	8500
Nacelle incl. hub/cone	88000
Nacelle excl. hub/cone	68000
Gearbox	23000
Generator	8500
Transformer	8000
Rotor blade	6600

6.8 Onderhoud 8 Disciplines

Offshore Installation	Electrical HV/LV	Mechanical	Specialized
Transformer	HV		
Switches	HV		
Secondary systems	HV / LV		
Fire detection			x
No-break and Emergency Generator	HV/LV	x	x
HVAC	LV		x
Electrical Infrastructure	HV		
Onshore installation			
Switches	HV		
Secondary systems	HV / LV		
No-break	HV / LV	x	x

6.9 Onderhoud 9 Tijdsgebonden onderhoud

TBM (Time Based Maintenance) BASIC HV STATION

Frequency: Yearly

Conditions:
- Activities have to be performed under applicable safety conditions
- Installation is out duty

Activities to perform

1. Housings

    - Check for actual nameplates, electrical schemes
    - Check for corrosion
    - Check for cleaning and accessibility according design rules
    - Moving ways and connections
    - Signals of shutters

2. Rail systems

    - Check the codings
    - Id grounding systems
    - Check the connections and check resistance's of parts and junctions

3. Connections and conductors

    - Visual check surfaces
    - Mechanical parts connections and supports
    - Check control equipment distance control

4. Contactors

    - Cleaning and control contactors
    - Adjust distance between contactors
    - Adjust simultaneousness action of main and burn off contactors

5. Functional tests

- On/off switches
- Zero Voltage coil
- Motorgears
- Shutt off coil
- Shutt in coil
- Reset after shutt off by control
- Indicators

Report

- Fill up the maintenance report
- Check reporting distance control and fill in measurements

TBM BASIC HV Infrastructure Cables

Frequency: Yearly
In the construction phase 2 times

Conditions:

- Activities have to be performed under applicable safety conditions

Activities to perform

1. HV Cables

    - Check support and connections to the mill and HV stations
    - Check for visible damage above sea-level
    - Check for right position and situation at sea level (every 5 years or if there is a reason to do this in a higher frequency or incidental)
    - Measure discharge curves
    - Connections are part of the HV components

2. Signal

    - Visual Check

Report

- Fill up the maintenance report
- Check reporting distance control and fill in measurements

TBM HVAC HV STATION

Frequency: Yearly
During start-up and construction phase Quarterly

Conditions:
- Activities have to be performed under applicable safety conditions
- HVAC Installation is out duty
- Conform rules of ref. STEK

Activities to perform

1. Housings and general condition equipment

- Check for actual nameplates, functional schemes
- Check for corrosion
- Check for cleaning and accessibility according design rules
- Operation panel condition and working of signs
- Condition of isolation
- Signals of shutters

2. Control system

- Measurement of pressures and temperature pressure and suction side
- Measure flows of air and air resistance
- Shut off low pressure

3. Compressor

- Visual inspection
- Connection to pipe lines tension, support system
- Check filters (installation, oil)
- Check oil level
- Functional check (start, stop)
- Check the connections and check resistance's of parts and junctions
- Check control box
- Check control signals measured off shore

4. Evaporator system

- Visual check
- Cleaning of surfaces
- Check corrosion
- Check support and corrosion
- Measure air debit and pressures

5. Condensing system

- Visual check
- Cleaning of surfaces
- Check corrosion
- Check support and corrosion
- Measure air debit and pressures

6. Installation

- Visual inspection
- Check support of lines
- Check level of refrigator if appl. fill (exception, futher action)
- Measurement of p.T curves
- Measurement of unbalance

Report

- Fill up the maintenance report
- Check reporting distance control and fill in measurements

TBM MAIN SWITCH GEARS

Frequency: Yearly

Conditions:
- Activities have to be performed under HV safety conditions
- Installation is out duty

Activities to perform

1. External

- Check drive and functioning
- Check extinguish rooms (vidar testing)
- Visual inspection
- Cleaning

2. Measurements

- Time to switch main switches
- Resistance measurement main switches

3. Inward

- Control the coils of the switchgear
- Visual inspection of the switchgear
- Cleaning

4. Protection and Controls

- Check current and voltage sensors
- Check control equipment distance control

Report
- Fill up the maintenance report
- Check reporting distance control and fill in measurements

TBM TRANSFORMER

Frequency: Yearly

Conditions:

- Activities have to be performed under HV safety conditions
- Installation is out duty

Activities to perform

1. External

- Check for leakage
- Check for corrosion
- Visual inspection

2. Inward

- Control the accessible primary junctions (if appl. tighten)
- Id secondary
- Cleaning of the junctionboxes
- Cleaning of the insulator bodies

3. Protection and Controls

- Check of the Buchholz relays
- Expand of the Buchholz relays
- Check temperature controls
- Check control equipment distance control

4. Oil

- Take oil samples for measurements (a.o. isolation)
- Establish the oil isolation factor
- Check silicagel
- If appl. change or fill up the silicagel
- Cleaning the gauge-glass in- and outside as applicable

Report

- Fill up the maintenance report
- Check reporting distance control and fill in measurements

TBM INSTALLATION
Frequency: Yearly

Conditions:
- Activities have to be performed under HV safety conditions
- Installation is out duty

Activities to perform

1. External

- Visual inspection esp. railsystem
- Check for corrosion and coating

2. Inward

- Inspection of the bushbars
- Cleaning and greasing of the ground switches
- Functional check ground switch
- Check of the blocking of the ground switches
- Measurement ground resistance
- Measurement of torque bolts

3. Protection and Controls

- Check control and measurement
- Check control equipment distance control

Report
- Fill up the maintenance report
- Check reporting distance control and fill in measurements

TBM PROTECTION DEVICES
Frequency: Yearly

Conditions:
- Activities have to be performed under HV safety conditions
- Installation is out duty

Activities to perform

1. External

- Visual inspection esp. railsystem
- Check for corrosion and coating

2. Inward

- Secundair current test at rated value
- Functional check ground switch at rated value

3. Protection and Controls

- Check control and measurement
- Check control equipment distance control

Report
- Fill up the maintenance report
- Check reporting distance control and fill in measurements

TBM UPS HV STATION

Frequency: Yearly
During start-up and construction phase Quarterly

Conditions:
- Activities have to be performed under applicable safety conditions
- UPS Installation is out duty

Activities to perform

1. Housing and general condition equipment

- Check for actual nameplates, functional schemes
- Check for corrosion
- Check for cleaning and accessibility according design rules
- Operation panel condition and working of signs
- Signals of shutters

2. Accumulators

- Visual check
- Measurement of I,V curves per element

3. No break engine

- Visual inspection
- Baffiers
- Check filters (air, oil)
- Take oil sample
- Measure tolerances of coupling
- Functional check (start, stop)
- Check the connections and check resistance's of parts and junctions
- Check control box
- Check control signals measured off shore

4. Generator

- Visual inspection
- Cleaning and control contactors
- Adjust bearings
- Clean filter
- Measurement of I,V curves

Report
- Fill up the maintenance report
- Check reporting distance control and fill in measurements

6.10 Onderhoud 10 Traditioneel onderhoudsprogramma

Traditional Maintenance Program
Note: we foresee a reduction of the EG Maintenance after the construction period

Execution year	2006/11				2007/12				2008/13				2009/14				2010/15			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Offshore plant																				
Main switchboard		I				I				I				I				P		
Transformer		I				I				I				I				P		
150 kV switchgear		I				I				I				I				P		
Low voltage switchgear		I				I				I				I				P		
No-Break (UPS)		I				I				I				I				P		
Micro Scada Control System		I				I				I				I				P		
Fire detection		I				I				I				I				P		
Emergency generator	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	P	I	I
HVAC installation		I				I				I				I				P		
Electrical infrastructure		I				I				I				I				P		
Infrared inspection		I				I				I				I				I		

I = Inspection
P = Preventive maintenance