

เอกสารแนบที่ 9
บันทึกการตรวจสอบระบบ Dry Low NOx Combustor



E1B101482648

Inspection Report

Subject / Title:
BD000166U02 SSUT, MO-60 KEOH, 2024, Inspection report

Thailand
Location

1 July 2024
Date

Project:
Customer Name:
Orderer's File Ref:
Order No Internal:
Account No Internal:
Report No Internal:

SSUT
SSUT Bangpoo
E1B101247395: A
4334780
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Author(s)

Somdej Arunplod

Released technically

Released for external use

Classification:

Confidential

Codeword

Equipment No

Product Type

Mobilization Date

Demobilization Date

Client Contact Name

: SSUT Bangpoo GT12

: BD000166U02

: SGT-800

: 2024-07-01

: 2024-07-17

: Charothon Yothiswong

Executive Summary:

Purpose of this visit is to perform a level M60-inspection of unit BD000166U02 SSUT. Compressor wash was performed prior to inspection. The inspection was performed according to the maintenance Activity List **E1B101250086 rev. B**

- The Leeb hardness and FSET conductivity test performed on turbine disc stage 2. Conductivity testing was performed on Turbine disc 2 in this specific area and results indicates that the testing of the disc 2 material is within expectations. The conclusion is that discs 2 is in serviceable condition for the upcoming maintenance cycle of 30 000 EOH.
- The gearbox bearing #11, #12 and #21 were replaced with NEW bearing condition.
- The wheel cogs erosion must follow up after 10,000 EOH. Depending upon the result of follow up, it may be required to grind the cogs. Considering that PAB/SGT-800/23-001 Flender gearbox recommendation regarding increased risk of wheel slippage is applicable for this gearbox, it is recommended that a spare wheel set be planned for contingency.
- The lube oil filter was replaced and lower the lube oil pressure to 170 kPa (to be verified with clean filters). The lube oil quality needs to be monitored regularly.
- Related to axial contact between stator and rotor parts, during MO60 inspection the engineering recommendation to replaced turbine flange, combustor diaphragm and sealing ring stage 1-2 (New design E1B101397808) see more detail in separate IFR.
- The compressor axial thrust pads were replaced complete set and reduce compressor bearing shim to 1.55 mm related to axial contact between stator and rotor issues.



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- The turbine guide vane stage 1 main inner ring has reviewed fretting condition by engineering and confirmed that main inner ring is serviceable condition but it close to limit so next HGP inspection found fretting mark progressive then main inner might have risk to unserviceable condition, it is recommended that spare main inner ring be planned for contingency.
- The compressor rotor was polishing repaired at spigot area. Replaced compressor coupling during C60 inspection.
- The machine has vibration after 1st startup and vibration engineer request to trim balancing at balancing plan 3 with 74 gram at hole position 14 and 74 gram at hole position 20. After trimmed balancing the vibration reduce into acceptance criteria.

Findings are report in this inspection report, any finding which could be rectified during the inspection schedule will be rectify/repair or replace with parts from customer stock and/or planned inspection parts.

Once all the recommendations have been implemented unit can return to service.

Copies To:

Erik Gregeborg
Kronrakt Ruengkijpa boon

Matilda Björkman Höglund

ID E1B101482648 Name: Inspection report Rev: A Protection: Confidential IP: R00 S00
Orderer: Andersson, 2004PK42 2024-08-13 Reviewer: Gregeborg, 2002EERN 2024-09-04 Approver: Liljeqvist, 2002BNWA 2024-09-13
ALN EOCNN ECL: US-COIN/KO CO:SE

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1 Summary of results

HG 4150 Air intake system

- Dust found collected on filter housing intake.
- Contamination noticed on fine filter element.
- Contamination found on ventilation filter elements.
- Dust found collected on intake louvers both filter housing and ventilation housing.
- The oxidation found on silencer units top half and bottom half found on support weld seams.
- New expansion joint was replaced since September 2023.

HG 4981 Starting gear

- Mild oil varnish found on SSS-clutch socket and thin layer of varnish on clutches mechanism.

HG 4980 Speed reduction gear

- Lube oil spray bar at bottom was misalign from engage point of gear teeth.
- Oil varnish deposit found on all 4 bearings surface.
- Observed bearing#21 surface changes at the bearing top surface in "push" direction. Some minor scratches were found.
- Observed bearing#12 surface changes at the bearing top surface in "push" direction. Overheated at loaded bearing area causing the babbitt metal to be starting melted. Bearing#12 clearance is out of criteria.
- Gearbox supervisor measurement bearing#11 clearance is out of criteria.
- Electro discharge marks observed at wheel and pinion cogs these marks have recorded.
- Erosion area observed at all wheel cogs active face drive end side. (Generator)
- The pitting defects was observed by FMT on erosion area.

HG 2405 Compressor inlet casing

- Observed thread insert nuts not flat with inlet plenum inspection hatch area.
- Observed damaged at rubber gasket at inspection hatch.

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HG 2410 Compressor inlet piece

- Found water trace mark between plenum and inlet piece joint.

HG 2441 Compressor bearing

- Observed scarp marks on radius pads.
- Observed pitting on axial thrust pads and overheated surface.

HG 2440 Compressor rotor

- Observed oxidation on compressor rotor between stage 5, 6, 7.
- Compressor rotor spigot grip (Turbine side) measurement within acceptance criteria.
- Observed high wear and loss material at compressor rotor spigot area and compressor coupling.
- Observed compressor rotor nuts threads were damaged during remove turbine module.

HG 2442 Compressor blades

- Observed some compressor blades stage 13-15 have nick on leading edge blade.

HG 2580 Combustor

- Based on dimension measurement protocol turbine flange and diaphragm out of criteria.

HG 2510 Central casing

- Observed flaked aluminum coating that applied in 2023 at compressor discharge casing.

HG 2640 Turbine rotor

- Observed turbine disc stage 2 wear and smearing on fir-tree active face at pressure and suction sides.
- Observed balancing weight at BP5 hole position 7, 9 and 11.

HG 2642 Turbine blades

- Turbine blade stage 1, 2 and 3 were replaced at FO September 2023.
- Observed rubbing mark at turbine blade tip stage 3.

HG 2650 Turbine stator stage no 1

- Inner/Outer vane plates found TBC minor oxidation.
- Observed wear on honeycomb area and fretting mark on contact surface with combustor at main inner ring.

HG 2651 Turbine stator stage no 2&3

- Minor oxidation on GV2 stator heat shields.
- Observed GV2 1 flexible hoses are deformation.
- Observed fretting mark on GV3 locking ring.

HG2361 Cooling air manifold

- Observed 1 support bracket on cooling manifold square pipes broken.

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HG 2665 Outlet casing

- Observed 6 rear inner insulation cassettes crack.
- Minor wear mark on sealing ring 1, 2, 3 area and front L-profile.
- Observed initial crack around rear L-profile at connecting joint segment.

HG 2660 Exhaust diffuser

- Cracks observed on the front and rear support weld seams, noticed in previous inspection report.
- Observed bolts and nuts around exhaust diffuser and inner cone were damaged.

HG 2132 Insulation

- Insulation found teared at cooling sealing and bleeding pipe.
- Insulation pillows around turbine exhaust cone area found tear and damages.

Inspection Report

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2 Personnel on site

Personnel on site :	Date for the visit
Samix Chaiyana, Site manager	240701-240722
Wasin Satitree, Field service supervisor (Shift lead Day shift)	240701-240708
Wanna Rukrabarb, Field service supervisor (Shift lead Day shift)	240708-240722
Udomsil Kerdmongkol, Field service technician (Day shift)	240701-240722
Wee Boon Heng, Field service technician (Day shift)	240701-240722
Withawat Watthanathunyakram, Field service technician (Day shift)	240701-240712
Nattapon Taptim-On, Field service technician (Day shift)	240712-240722
Leif Salama, Gearbox supervisor. (Day shift)	240701-240722
Kittikun Chanchaoren, Commissioning lead. (Day shift)	240701-240722
Nipon Rattanathawornkiti, Commissioning engineer. (Day shift)	240701-240722
Somdej Arunplod, Quality Inspector. (Day shift)	240701-240716
Nataphat Pattamadilok, NDT engineer. (Day shift)	240706-240713
Thanawach Nilnarong, NDT engineer (Day shift)	240706-240713
Nikorn Jodejone, Field service supervisor (Shift lead Night shift)	240701-240722
Athapol Thonghiang, Field service technician (Night shift)	240701-240722
Theerasak Lalu, Field service advisor (Night shift)	240701-240722
Sawit Supatthamanon, Field service advisor (Night shift)	240701-240722

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3 General data / Operating statistics

Site:	SSUT Bangpoo GT12
B-number:	BD000166U02
Project manager:	Matilda Björkman Högland
Application engineer:	Erik Gregeborg
Activity list:	E1B101247395: A
Owner:	SSUT Co Ltd (Bangkok)
Owner representative:	Charothon Yotthiwong
Order number:	4334780
Gas turbine: Siemens	Type: SGT-800B1
Main gear: Flender	Type: TX112/4C
Generator: ABB	Type: AMS1240 ALK
Configuration:	Combine cycle
Site:	Power plant
Fuel:	Natural gas
Operating profile:	Base load
Compressor washing system/wash interval	Offline 10,000 hours
Site address or GPS coordinates	13.532603, 100.651876

Fuel: Gas: ☒ Liquid: ☐ Dual fuel: ☐

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Digital counter readings	Installation	GT
Date: 20240701	55202 h	
Operating hours:	59335 h	
Operating hours equivalent:	669	
Starts:	N/A	
Fast starts:	824 h	
Equivalent operating cycles:	1874582	
Total production of MWh:	365659	
Total production of MVAr+:	12	
Total production of MVAr-:		

Mechanical counter readings	Installation	GT
Date: 20240701	55202 h	
Operating hours:	59335 h	
Operating hours equivalent:	669	
Starts:	N/A	
Fast starts:	824 h	
Equivalent operating cycles:	N/A	
Total production of MWh:	N/A	
Total production of MVAr+:	N/A	
Total production of MVAr-:	N/A	

Swap information	B-number	Date:
Removed Gas turbine:	N/A	
Installed Gas turbine:	N/A	

Location of Gas turbine overhaul:

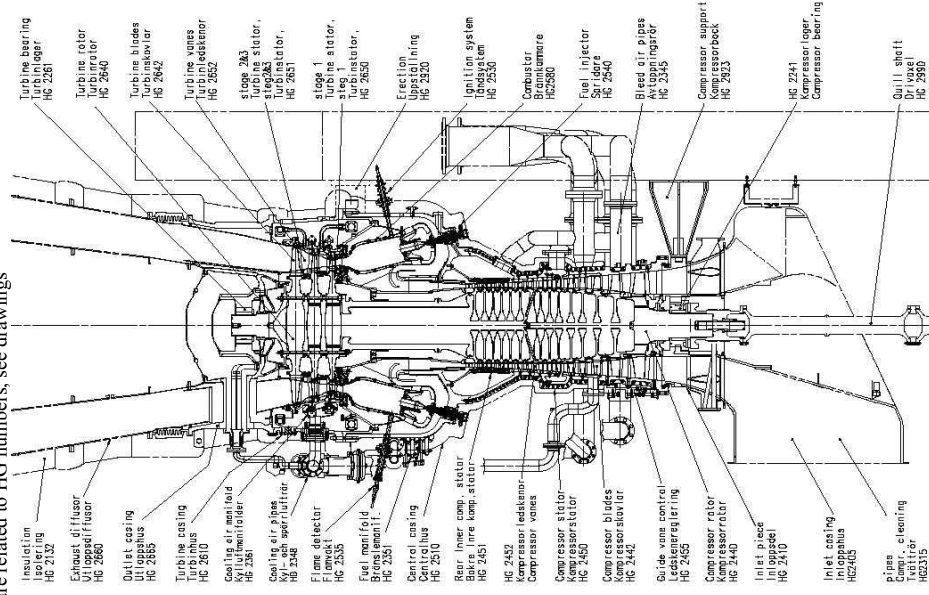
☒ Inside enclosure ☐ On-site Workshop ☐ External Non-Siemens-Energy workshop
☐ Local Siemens-Energy workshop ☐ Siemens-Energy workshop Sweden
Other information:

Date	Report no	Reason	Author
2023-09-30	E1B101326201	FO	Chawatrat
2023-02-23	E1B101230727	A inspection	Watanapreechapat
2022-07-10	E1B101075655	GV1 Inspection	Somdej Anuplod
2021-11-22	E1B100966014	FO to replace GV1	Chakapong
2021-11-12	E1B100962784	A-inspection	Singharatanon
			Krit Plumsab
			Somdej Anuplod
			~40 kEOH
			~39 kEOH

Inspection Report

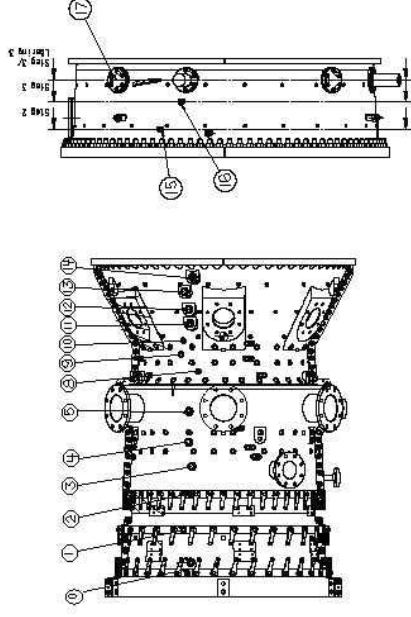
4 HG-list SGT-800

Activities are related to HG numbers, see drawings



Inspection Report

5 Borescope inspection SGT-800



Plan B0 Compressor rotor stage 1, stator stage 0
Plan B1 Compressor rotor stage 1 and 2, stator stage 1
Plan B2 Compressor rotor stage 2 and 3, stator stage 2
Plan B3 Compressor rotor stage 3 and 4, stator stage 3
Plan B4 Compressor rotor stage 4 and 5, stator stage 4
Plan B5 Compressor rotor stage 5 and 6, stator stage 5
Plan B8 Compressor rotor stage 8 and 9, stator stage 8
Plan B9 Compressor rotor stage 9 and 10, stator stage 9
Plan B10 Compressor rotor stage 10 and 11, stator stage 10
Plan B11 Compressor rotor stage 11 and 12, stator stage 11
Plan B12 Compressor rotor stage 12 and 13, stator stage 12
Plan B13 Compressor rotor stage 13 and 14, stator stage 13
Plan B14 Compressor rotor stage 14 and 15, stator stage 14
Plan B15 Turbine rotor stage 1 and 2, stator stage 2
Plan B16 Turbine rotor stage 2 and 3, stator stage 3
Plan B17 Turbine rotor stage 3, stator stage 3

Inspection Report

6 Inspection activities

6.1 Planned inspection

6.1.1 Activities according to maintenance plan

#	HG/System/KKS	Activity	Field Service Remark
1	/Air intake system/MBL	Visual inspection in air intake housing, ductings, silencer and plenum. Check for obstructions, cleanliness, leakages and for foreign objects. Check flanges, inspection hatches, sealings and gaskets.	Performed
2	/Air intake system/MBL	Visual inspection of filters for obstruction and contamination.	Performed
3	2132/Insulation/	Visual inspection.	Performed
4	2241/Compressor bearing/	Visual inspection.	Performed
5	2261/Turbine bearing/	Visual inspection.	Performed
6	2310/Lubricating Oil Pipes Gas Turbine/	Visual inspection.	Performed
7	2315/Compressor cleaning pipes/	Visual inspection.	Performed
8	2320/Drain pipes/	Visual inspection.	Performed
9	2345/Bleed air pipes/	Visual inspection.	Performed
10	2348/Cooling/sealing air pipes/	Check strainers for contamination	Performed
11	2361/Cooling air manifold/	Visual inspection.	Performed
12	2405/Compressor air inlet casing/	Visual inspection.	Performed
13	2410/Inlet Piece/	Visual inspection.	Performed
14	2530/ignition system/	Visual inspection.	Performed
15	2535/Flame detector/	Visual inspection.	Performed
16	2610/Turbine casing/	Visual inspection.	Performed
17	2920, 2925/Assembly material/Erection exhaust diffuser at site/	Visual inspection of the supports.	Performed
18	2140/Compressor and turbine rotor assy/	Diametrical measurement of turbine disc 1.	Performed
19	2440/Compressor rotor/	Visual inspection.	Performed
20	2440/Compressor rotor/	Measuring control of the central sealing	Performed
21	2440/Compressor rotor/	Measuring control of sealing between discs	Performed
22	2440/Compressor rotor/	Corrosion control	Performed
23	2442/Compressor blades/	Penetrant testing of compressor blades. Cleaning to be carried out by Purchaser acc to contract	Performed
24	2442/Compressor blades/	Documentation of corrosion compressor	No corrosion on

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#	HG/System/KKS	Activity	Field Service Remark
25	2442/Compressor blades/	Corrosion control	compressor blades
26	2452/Compressor vanes/	Penetrant testing of compressor vanes, Cleaning to be carried out by Purchaser acc to contract	Performed
27	2452/Compressor vanes/	Corrosion control	Performed
28	2455/Guide vane actuator/	Visual inspection and control of the variable guide vanes mechanism.	Performed
29	2510/Central casing/	Visual inspection.	Performed
30	2640/Turbine rotor (incl. Blades)/	Visual inspection of rotor hub	Performed
31	2640/Turbine rotor (incl. Blades)/	Measurement check of rotor hub	Performed
32	2640/Turbine rotor (incl. Blades)/	Penetrant testing of rotor hub	Performed
33	2640/Turbine rotor (incl. Blades)/	Visual inspection of turbine blade 1.	Performed
34	2640/Turbine rotor (incl. Blades)/	Visual inspection of turbine blade 2.	Performed
35	2640/Turbine rotor (incl. Blades)/	Visual inspection of turbine blade 3.	Performed
36	2650/Turbine stator, stage 1/	Visual inspection of guide vanes stage 1.	Performed
37	2650/Turbine stator, stage 1/	Visual inspection of guide vanes stage 2.	Performed
38	2650/Turbine guide vanes/	Visual inspection of guide vanes stage 3.	Performed
39	2650/Turbine stator, stage 1/	Visual inspection of turbine heat shield 1.	Performed
40	2650/Turbine stator, stage 1/	Visual inspection guide vane 1 outer vane plate.	Performed
41	2650/Turbine stator, stage 1/	Visual inspection guide vane 1 inner vane plate.	Performed
42	2650/Turbine stator, stage 1/	Visual inspection of front outer segment	Performed
43	2650/Turbine stator, stage 1/	Visual inspection of front inner segment	Performed
44	2650/Turbine stator, stage 1/	Visual inspection of stator ring 1.	Performed
45	2650/Turbine stator, stage 1/	Visual inspection of vane carrier 1.	Performed
46	2650/Turbine stator, stage 1/	Visual inspection of rear hook segment 1.	Performed
47	2651/Turbine stator, stage 2 and 3/	Visual inspection of turbine heat shield 2.	Performed
48	2651/Turbine stator, stage 2 and 3/	Visual inspection of turbine heat shield 2 carrier.	Performed
49	2651/Turbine stator, stage 2 and 3/	Visual inspection of stator ring 2.	Performed
50	2651/Turbine stator, stage 2	Visual inspection of rear hook segment 2.	Performed
51	2665/Outlet casing/	Internal visual inspection of outlet casing.	Performed
52	2665/Exhaust casing/	Visual inspection of outlet below, metallic parts	Performed

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5.2 #	HG/System/KKS	Activity	Field Service Remark
53	2665/Exhaust casing/	Visual inspection of outlet bellow, soft parts	Performed
54	2660/Exhaust diffuser/	Visual inspection.	Performed
7 #	HG/System/KKS	Activity	Field Service Remark
1	4980, 4995/Main gear/Alignment instruction/	Visual inspection of tooth mesh through inspection cover. Main gear.	Performed
2	4980, 4995/Main gear/Alignment instruction/	Visual inspection of tooth mesh through inspection cover. Starting gear.	Performed
3	4980, 4995/Main gear/Alignment instruction/	Visual inspection of all gear parts with regards to wear, cracks, damages, leakage, deposits, dirt, burned oil and other signs of abnormalities (dismantling required).	Performed
6	4980, 4995/Main gear/Alignment instruction/	Inspection of SSS-clutch.	Performed

ID:E1B101482648 Name:Inspection report Rev:A Protection:Confidential IP:R00 S00
Created:Andersson, 2024-08-13 Reviewed:Chengdong, 2024-08-13 Approver:Liljenc, 2024-09-04
ALN ECKN ECL US-CKNKO C00 SE

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6.1.2 Activities outside maintenance plan

9 #	HG/System/KKS	Activity	Field Service Remark
2	/Gas fuel system. General/MBP	PSW/SGT-800/18-004 Safety Warning check	Performed
8	2515/Combustor casing/	Gas fuel hoses Perform C & D measurement on combustor diaphragm	Performed
12	/Gear system. General/MBK	Continue to monitor flex coupling flex plate bundle condition during next inspection.	Performed
13	/Gear system. General/MBK	Continue to monitor for the progression of the white marks pattern on wheel gear.	Performed
14	/Gear system/MBK	Continue to monitor for the progression of the electrical discharge pattern on wheel gear.	Performed
17	4093/Enclosure/	Enclosure rules expansion hatches on MTB/HGS Check dimensions for blow outdoors regarding the doors versus EG enclosure	Performed
24	2640/Turbine Discs & Stator stage 2 and 3/	Inspect Turbine blade set #3 and Guide Vane set # 3 that were removed during FO in September 2023	Performed

ID:E1B101482648 Name:Inspection report Rev:A Protection:Confidential IP:R00 S00
Created:Andersson, 2024-08-13 Reviewed:Chengdong, 2024-08-13 Approver:Liljenc, 2024-09-04
ALN ECKN ECL US-CKNKO C00 SE

6.2 Unplanned inspection

Activity	HG-no/system	Remark
- Insulation cassettes replacement at outlet casing	HG2665	See detail in section 7.32
- FMT require on wheel gear cogs based on erosion that found on active face.	HG4980	See detail in section 7.3
- Additional inspection of SGT-800 turbine disc 2 (E1B101244086 Rev. D)	HG2640	See detail in section 7.24
- Measurement turbine flange and combustor diaphragm according to recommendation from engineering.	HG2580	See detail in section 7.18

Inspection Report

7 Inspection result

7.1 HG 4150 Air intake system

Performed work:

- Visual inspection.

Result:

- Dust found collected on filter housing intake.
- Contamination noticed on fine filter element.
- Contamination found on ventilation filter elements.
- Dust found collected on intake louvers both filter housing and ventilation housing.
- The oxidation found on silencer units top half and bottom half found on support weld seams.
- New expansion joint was replaced since September 2023.



Intake filter housing seen from the ground condition. Intake filter housing elbow duct condition.



Intake filter housing wall inside overall condition.



New expansion joint replaced since 2023.

Inspection Report



Intake filter housing instrument panel condition.



Weather hood intake side overall condition.



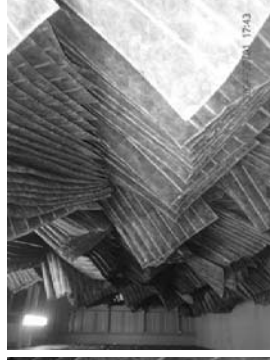
Inside filter housing overall condition.



Cleanliness condition on intake housing floor.



Pre-filter current condition during this outage.



Pre-filter overall conditions.

Inspection Report



Rubber door seal good condition.



Emergency door release was in good condition.



Fine filter intake side overall condition.



Fine filter element type 3V-600-E12 installed on site.



Drain port between pre and fine filter.



Drain port after fine filter.



Inspection Report



Damper ventilation outside condition.



Ventilation filter housing overall condition.



Exit ventilation found contamination condition.



Inlet ventilation to enclosure ducting condition.

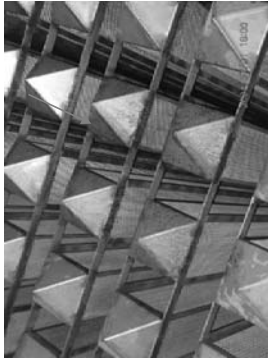


External existing modified silencer duct condition.



Inside existing silencer duct.

Inspection Report



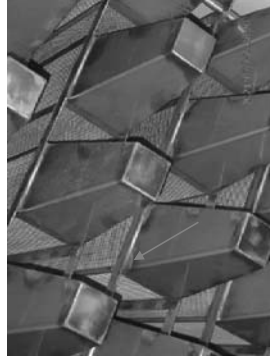
Oxidation was observed at silencer units. (Top view).



No water trace run from expansion joint at inner wall.



Inside existing silencer duct seen from inlet plenum.



Close up existing silencer that oxidation (Bottom view).

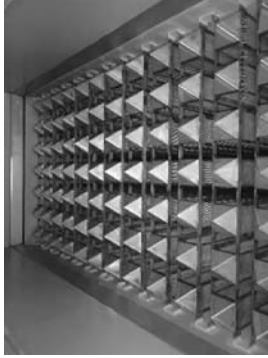


Ventilation filter as found condition.



Ventilation filter housing floor condition.

Inspection Report



Example silencer units top and bottom side after removed oxidation.

Recommendation/Action:

- Cleaned filter housing, intake louvers and ventilation filter housing intake louvers.
- When replacing filters elements check for an open gap between filter element rubber seal and filter housing to ensure no unfiltered air can enter.
- Apply rusty protection lubricant on emergency door release mechanism.
- Active exit ventilation damper and monitoring damper condition in every 6 months.
- Removed oxidation on silencer units at top and bottom side by customer.
- Pre and fine filters were replaced during MO'60 inspection.

Air intake system is serviceable after recommendations has been performed.

Inspection Report

7.2 HG 4981 Starting gear

Performed work:

- Visual inspection.

Result:

- Mild oil varnish found on SSS-clutch socket and thin layer of varnish on clutches mechanism.



Starter motor overall condition.



Flexible coupling overall condition.



Shim pack at starter motor side condition.



Shim pack at gearbox side condition.

Inspection Report



SSS-Clutch overall condition.



Sliding splines socket after cleaning condition.



Ratchet side teeth cleaned condition.



Starter motor clutch paw jaw as found condition.



SSS-clutch lube oil chamber varnish condition.



SSS-clutch lube oil chamber cleaned condition.

Inspection Report



SSS clutch at back up motor side engage function improper.

Recommendation/Actions:

- During re-assembly oil varnish found on SSS-Clutch has been cleaned.
- Monitoring lube oil varnish level and upgrade the VRU unit to include particle filtration.

Starting gear system is serviceable after all recommendations has been performed.

Inspection Report

7.3 HG 4980 Speed reduction gear

7.3.1 Casing

Performed work:

- Visual inspection.
- Adjust lube oil nozzle spray bar angle at bottom side.

Result:

- Lube oil spray bar at bottom was misalign from engage point of gear teeth.



Gearbox casing condition seen from generator.



Gearbox casing condition seen from backup barring motor.



Gearbox casing condition seen from starter motor.



Lube oil supply line.

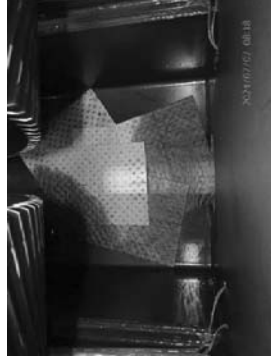
Inspection Report



Example of foundation support and keys condition.



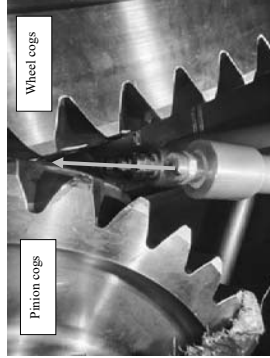
Oil seal with casing as found condition.



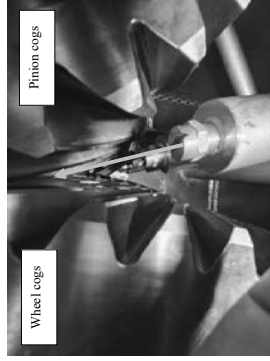
Internal wall of bottom lid gearbox.



Oil spray bar previous angle incorrect position.



Adjusted oil spray bar angle away from erosion area about 1-2 mm and center of engage teeth position.



Recommendation/Actions:

- Clean bottom casing section of the gear casing before reassembly.
- Replaced 4 jacking oil hoses.
- Adjusted lube oil spray bar to correct position according to engineering recommendation.

Gearbox casing is serviceable after all recommendations has been performed.

Inspection Report

7.3.2 Bearings

Performed work:

- Visual inspection.

Result:

- Oil varnish deposit found on all 4 bearings surface.
- Observed bearing#21 surface changes at the bearing top surface in "push" direction.
- Some minor scratches were found.
- Observed bearing#12 surface changes at the bearing top surface in "push" direction.
- Overheated at loaded bearing area causing the babbit metal to be starting melted.
- Bearing#12 clearance is out of criteria.
- Gearbox supervisor measurement bearing#11 clearance is out of criteria.



Bearing 11 overall condition before clean.



Bearing 11 bottom-half with varnish condition.

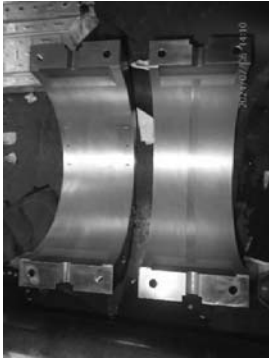


Bearing 12 overall condition before clean.



Bearing 12 bottom half with varnish condition.

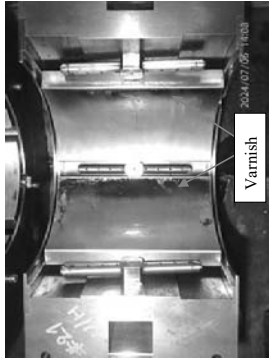
Inspection Report



Bearing 12 overall condition after cleaned.



Bearing 12 bottom half found unsmooth surface.



Bearing 21 top half overall condition before clean.



Bearing 21 bottom half overall condition before clean.



Bearing 21 top half varnish condition.



Bearing 21 top half varnish condition.

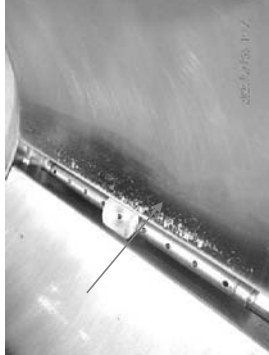
Inspection Report



Bearing 22 top half overall condition before clean.



Bearing 22 bottom half overall condition before clean.



Bearing 22 top half after cleaned condition.



Bearing 22 bottom half cleaned condition.



Low speed journal area on wheel shaft as found condition.

Recommendation/Actions:

- All bearings surfaces have been cleaned from oil varnish film.
- Replaced bearing# 11 (ICSA21751-1), #12 (ICSA21763-1) with new condition.

Gearbox bearings are serviceable after recommendations has been performed.

Inspection Report

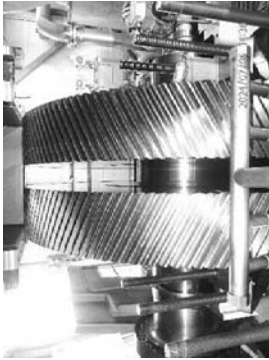
7.3.3 Cogs

Performed work:

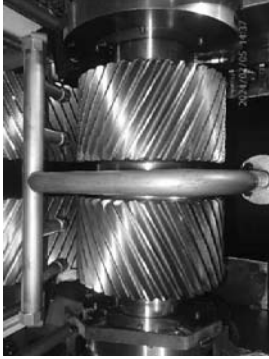
- Visual inspection.
- Fluorescent Magnet Particle Testing. (Additional requirement from engineering)

Result:

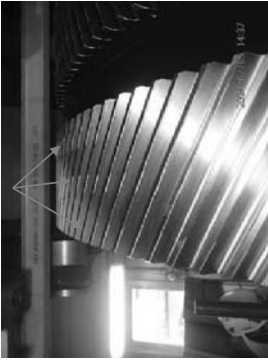
- Electro discharge marks observed at wheel and pinion cogs these marks have recorded.
- Erosion area observed at all wheel cogs active face drive end side. (Generator)
- The pitting defects was observed by FMT on erosion area.



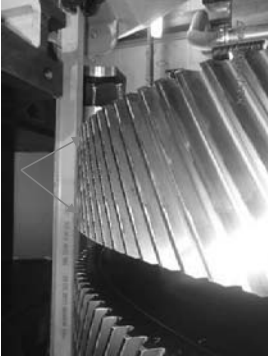
Wheel cogs as found condition.



Pinion cogs as found condition.

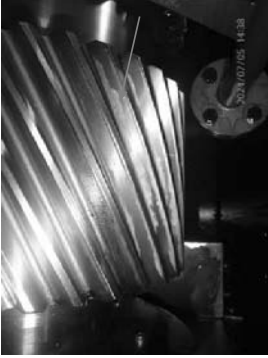


Close up on wheel generator side active cogs.

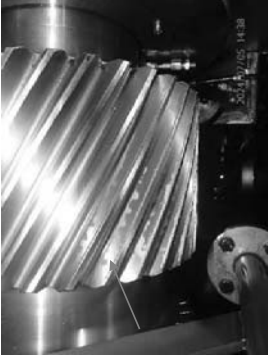


Close up on wheel turbine side active cogs.

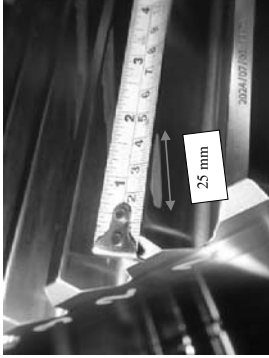
Inspection Report



Pinion cogs generator side active side cogs.



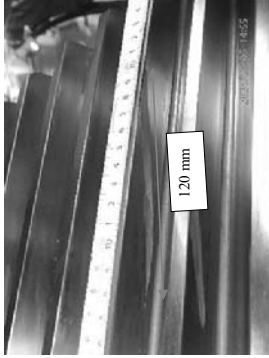
Pinion cogs turbine side active side cogs.



Ref#1 electro discharge on wheel cogs (Gen side)



Ref#2 electro discharge on wheel cogs (Gen side)

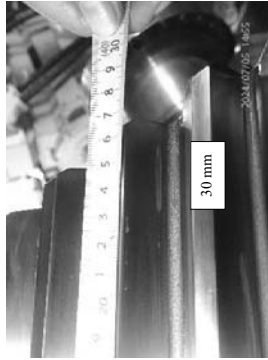


Ref#3 electro discharge on wheel cogs (Gen side)

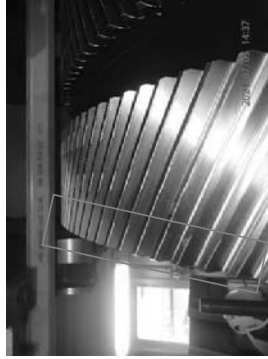


Ref#4 electro discharge on wheel cogs (Gen side)

Inspection Report



Ref#5 electro discharge on wheel cogs (Gen side).



Erosion area in active face at wheel gear (Gen side).



Example corrosion area depth about 0.28 mm.



Example corrosion area length about 19 mm.



Example FMT photos on suspect wheel cogs area that shown relevant indications (Pitting)



Inspection Report



Reference location 6 positions at wheel cog are same erosion and electro discharge.



Reference position 0 with macro photos that use to follow up next 10,000 EOH.



Reference position 1 with macro photos that use to follow up next 10,000 EOH.

Inspection Report



Reference position 2 with macro photos that use to follow up next 10,000 EOH.



Reference position 3 with macro photos that use to follow up next 10,000 EOH.



Reference position 4 with macro photos that use to follow up next 10,000 EOH.



Reference position 5 with macro photos that use to follow up next 10,000 EOH.



Reference position 6 with macro photos that use to follow up next 10,000 EOH.



Reference position 7 with macro photos that use to follow up next 10,000 EOH.

Inspection Report



Reference position 8 with macro photos that use to follow up next 10,000 EOH.

Recommendation/Actions:

- Keep monitor electro discharge mark at wheel and pinion cogs turbine sides every next RMI inspection.
- Change the lube oil filters and lower the lube oil pressure to 170 kPa (to be verified with clean filters). The lube oil quality needs to be monitored regularly.
- A follow up inspection is required after 10000 OH where the progression of erosion on the marked cogs needs to be documented using macro pictures. Depending upon the result of the follow up, it may be required to grind the cogs.
- Considering that PAB/SGT-800/23-001 Flender gearbox recommendation regarding increased risk of wheel slippage is applicable for this gearbox, it is recommended that a spare wheel set be planned for contingency.

Gearbox cogs is serviceable.

Inspection Report

7.4 HG 2405 Compressor inlet casing

Performed work:

- Visual inspection.

Result:

- Observed thread insert nuts not flat with inlet plenum inspection hatch area.
- Observed damaged at rubber gasket at inspection hatch.



Inlet casing seen from left turbine side.



Inlet casing seen from right turbine side.



Inlet casing drain overall condition.



Rubber seal was damaged condition.

Inspection Report



Inlet casing drain area seen from inside.



Compressor washing nozzle are good condition.



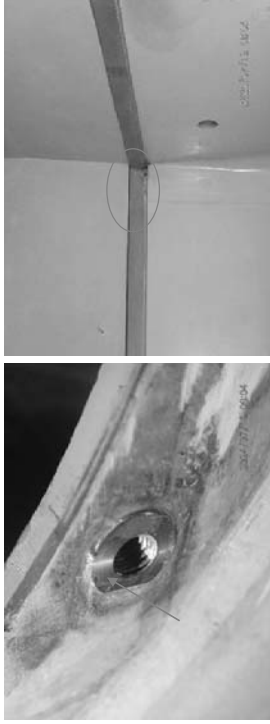
Example threaded insert nuts as found condition not flat with casing.



Example rusty observed inside inlet plenum at connecting joint duct between silencer and plenum.



Inspection Report



Recommendation/Actions:

- Clean and remove rusty inside of inlet plenum casing before unit back to operation.
- Replaced new rubber gasket at inspection hatch.
- Repaired thread inserts nuts according to instruction ICS167727.

Compressor inlet casing is serviceable after all recommendation has been performed.

Inspection Report

7.5 HG 2410 Compressor inlet piece

Performed work:

- Visual inspection.

Result:

- Found water trace mark between plenum and inlet piece joint.

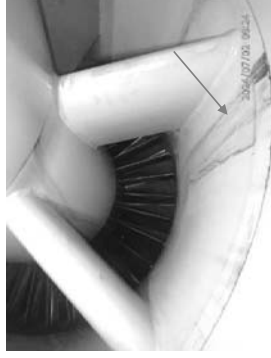


Inlet piece external condition seen from left side.



Inlet piece external condition seen from right side.

Re-tighten inlet pieces flange.



Example water trace inside inlet pieces.



Recommendation/Actions:

- Clean inside inlet piece inner and outer wall and continue to monitor for any traces of water ingress into compressor every 6 months.
- Check tight mounting flange between inlet piece and inlet casing.

Compressor inlet piece is serviceable after all recommendation has been performed.

Inspection Report

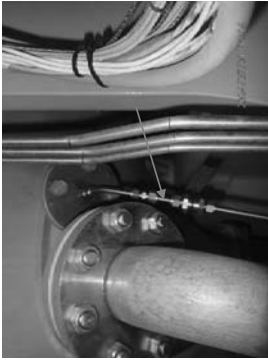
7.6 HG 2310 Lubricating oil pipes GT

Performed work:

- Visual inspection.

Result:

- No remark.



Lube oil supply line and jacking oil to bearing 1.



Lube oil supply line and return line at bearing 1.



Jacking oil check valve to bearing 2 condition.



Lube oil supply to bearing 2 overall condition.

Recommendation:

- None.

Lubricating oil pipes is serviceable condition.

Inspection Report

7.7 HG 2315 Compressor cleaning pipes

Performed work:

- Visual inspection.

Result:

- No remark.



Compressor wash filter housing overall condition.



Compressor washes manifold overall condition.

Recommendation:

- None.

Compressor cleaning pipes is serviceable condition.

Inspection Report

7.8 HG 2320 Drainpipes

Performed work:

- Visual inspection.

Result:

- No remark.



Drain ports control valves overall condition.



Recommendation:

- None.

Drainpipes are serviceable condition.

Inspection Report

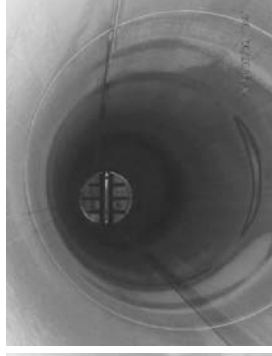
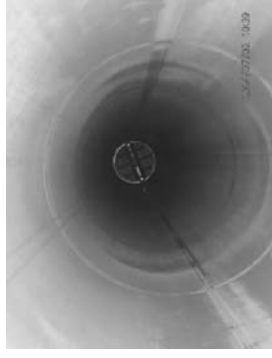
7.9 HG 2345 Bleed pipes

Performed work:

- Visual inspection.

Result:

- No remark.



Right bleed pipe and valve exit at exhaust diffuser.

Left bleed pipe and valve exit at exhaust diffuser.



Example bleed pipes and valve outside condition with insulation.

Recommendation:

- None.

Bleed pipes is in serviceable condition.

Inspection Report

7.10 HG 2348 Cooling/sealing air pipes

Performed work:

- Visual inspection.

Result:

- No remark.



Cooling sealing air pipes around turbine section.



Example of cooling sealing air valve overall condition.

Recommendation:

- None.

Cooling/sealing air pipes is in serviceable condition.

Inspection Report

7.11 HG 2241 Compressor bearing

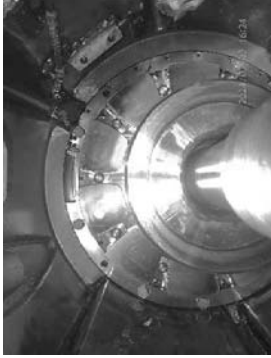
Performed work:

- Visual inspection.

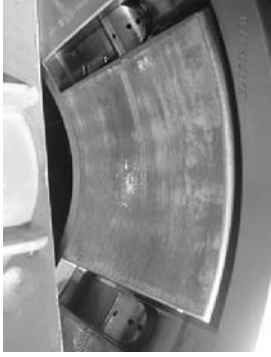
- Adjusted spacer shim to 1.55 mm.
- Performed PT on axial thrust pads.

Result:

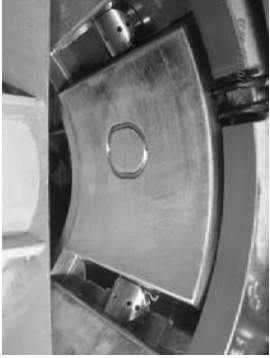
- Observed scarp marks on radius pads.
- Observed pitting on axial thrust pads and overheated surface.



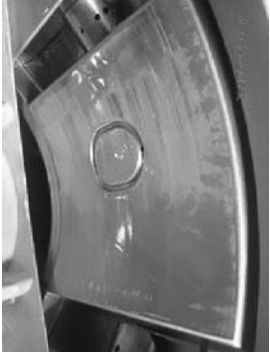
Overall bearing as found condition.



Example of top radius pad as found condition.



Bottom radius pad as found condition.



Another bottom radius pad as found condition.

Inspection Report



Axial thrust pads#3 over-heated area.



Example axial thrust pad#4 scratched mark.



Example axial thrust pad #9 pitting damaged.



Example axial thrust pad #7 scratch mark.



Closeup scratch mark on pad#4.



Example closeup reverse thrust pads condition.

Inspection Report



Example PT were performed on axial thrust pads and no relevant indication.



New axial thrust pads were provide by SSUT.



Installed new axial thrust pads during MP 60 inspection.



New spacer shim thickness is 1.55 mm.



Installed new shim 1.55 mm in place behind bearing#1.

Inspection Report

Recommendation:

- The recommendation from product support related to core engine axial distance, the spacer shim behind compressor bearing would like adjusted to 1.55 mm.
- The recommendation is to replace the axial thrust bearing pads. The radial pads seem to only have scratches which should be smoothed. It is also recommended to take an oil sample for analysis.
- The lube oil quality needs to be monitored regularly.

Compressor bearing is in serviceable condition.

7.12 HG 2455 Guide vane control

Performed work:

- Visual inspection.

Result:

- No remark.



GV Actuator support bracket overall condition.



GV Actuator cable overall condition.



GV mechanism overall condition seen from left side. GV mechanism overall condition seen from right side.



Inspection Report



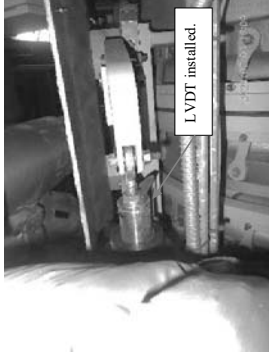
GV link arm control dismantling and shim replaced.



Inner ring was cleaned and installed back.



GV link arms dismantled and LYDT was installed.



Recommendation:

- None.

Guide vane control is in serviceable condition.

Inspection Report

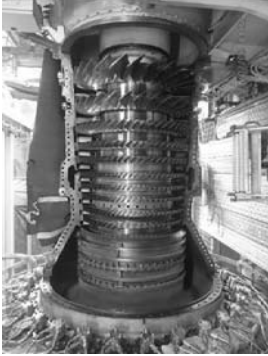
7.13 HG 2440 Compressor rotor

Performed work:

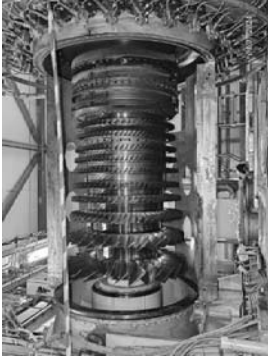
- Visual inspection and measure rotor spigot.
- Measurement compressor coupling caulked seal, intermediate shaft turned seal height and compressor turned seal height between stage.
- Dye ice blasting on compressor rotor.
- Performed PT on compressor intermediate shaft coupling.

Result:

- Observed oxidation on compressor rotor between stage 5, 6, 7.
- Compressor rotor spigot grip (Turbine side) measurement within acceptance criteria.
- Observed high wear and loss material at compressor rotor spigot area and compressor coupling.
- Observed compressor rotor nuts threads were damaged during remove turbine module.



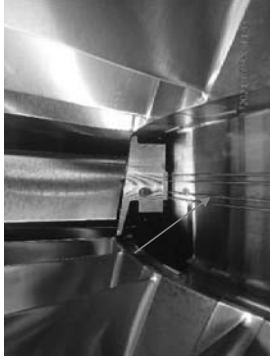
Compressor rotor after removed left casing.



Compressor rotor after removed right casing.



Compressor rotor stage 1 as found condition.



Turned seal condition between stage 1 and 2.

Inspection Report



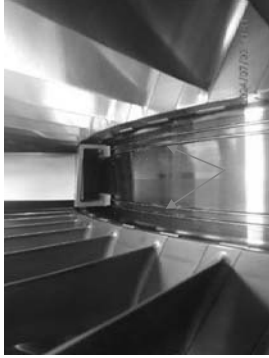
Compressor rotor stage 2 as found condition.



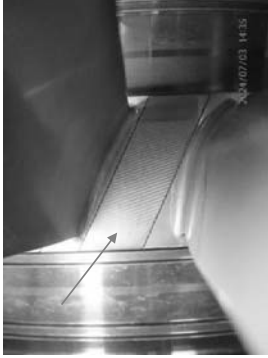
Turned seal condition between stage 2 and 3.



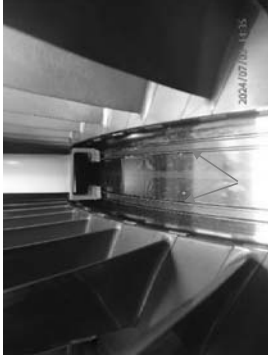
Compressor rotor stage 3 as found condition.



Turned seal condition between stage 3 and 4.



Compressor rotor stage 4 as found condition.

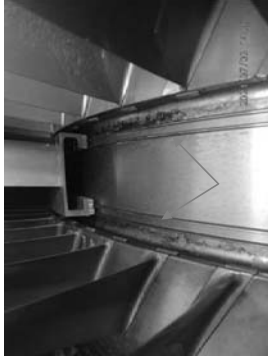


Turned seal condition between stage 4 and 5.

Inspection Report



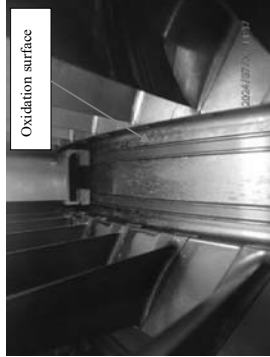
Compressor rotor stage 5 as found condition.



Turned seal condition between stage 5 and 6.



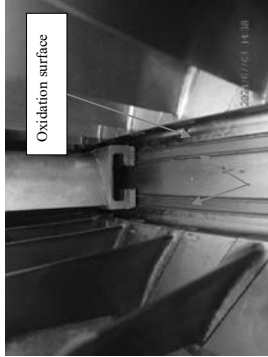
Compressor rotor stage 6 as found condition.



Turned seal condition between stage 6 and 7.



Compressor rotor stage 7 as found condition.



Turned seal condition between stage 7 and 8.

Inspection Report



Compressor rotor stage 8 as found condition.



Turned seal condition between stage 8 and 9.



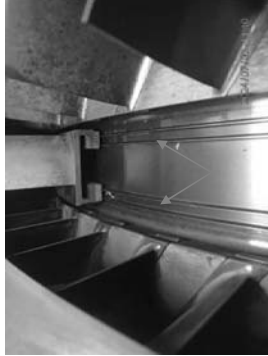
Compressor rotor stage 9 as found condition.



Turned seal condition between stage 9 and 10.



Compressor rotor stage 10 as found condition.



Turned seal condition between stage 10 and 11.

Inspection Report



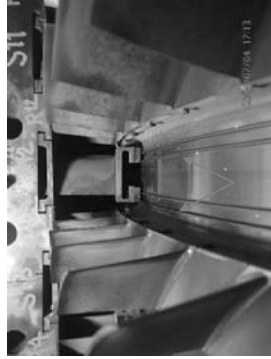
Compressor rotor stage 11 as found condition.



Turned seal condition between stage 11 and 12.



Compressor rotor stage 12 as found condition.



Turned seal condition between stage 12 and 13.



Compressor rotor stage 13 as found condition.



Turned seal condition between stage 13 and 14.

Inspection Report



Compressor rotor stage 14 as found condition.



Turned seal condition between stage 14 and 15.



Compressor rotor stage 15 as found condition.



Vibration sensors and speed sensors before dismantled.



Compressor coupling caulked sealing edge.



Caulked seal edge cleaned condition.

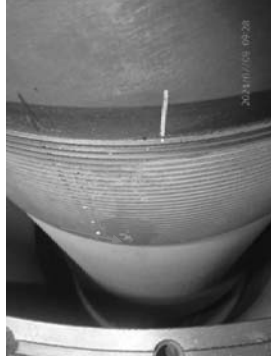
Inspection Report



Compressor coupling spline overall as found.



Closeup spline cleaned condition.



Intermediate shaft central sealing as found condition.



Close up turned central seal edge as found condition.



Intermediate shaft coupling.

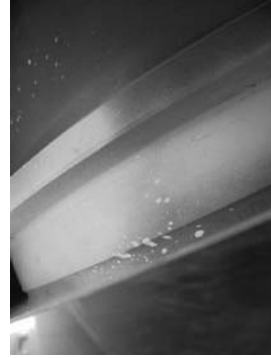


Spigot area as found condition.

Inspection Report



Applied PT on compressor rotor nuts area that found lacking mark from removal turbine module process.



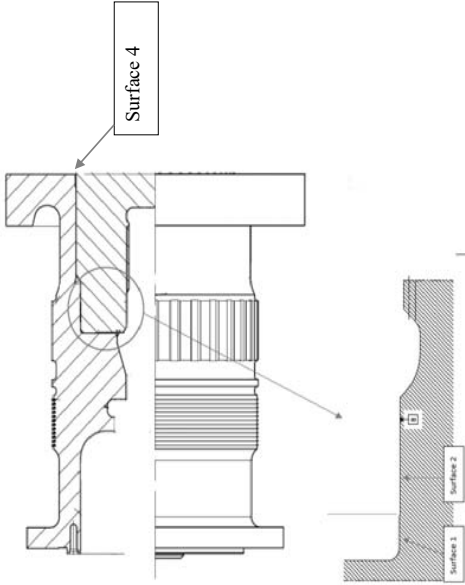
No indication found on rotor nut area.



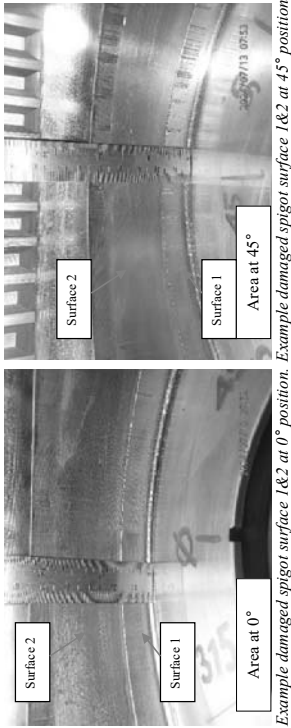
New rotor tie nuts were replaced during this outage.

Inspection Report

Example compressor coupling scoring condition after removal for replacement new thickness shim beg

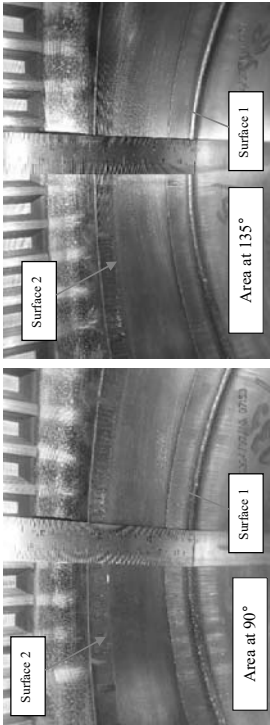


Spigot surface 1 and 2 as found condition.

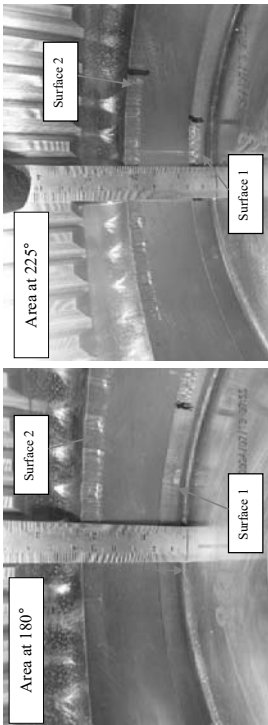


Example damaged spigot surface 1&2 at 0° position. Example damaged spigot surface 1&2 at 45° position.

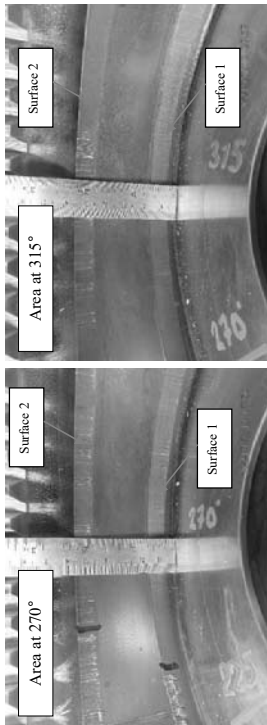
Inspection Report



Example damaged spigot surface 1&2 at 90° position. Example damaged spigot surface 1&2 at 135° position.



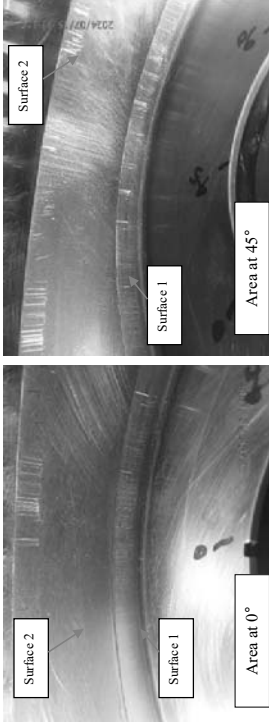
Example damaged spigot surface 1&2 at 180° position. Example damaged spigot surface 1&2 at 225° position.



Example damaged spigot surface 1&2 at 270° position. Example damaged spigot surface 1&2 at 315° position.

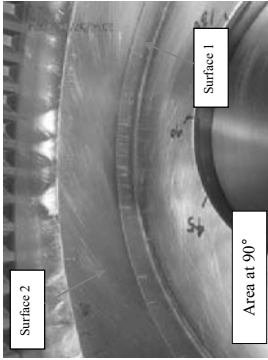
Inspection Report

Spigot surface 1 and 2 after polishing condition.



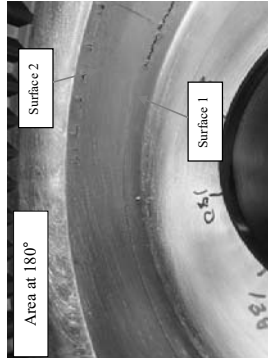
After polishing spigot surface 1&2 at 0° position.

After polishing spigot surface 1&2 at 45° position.



After polishing spigot surface 1&2 at 90° position.

After polishing spigot surface 1&2 at 135° position.



After polishing spigot surface 1&2 at 180° position.

After polishing spigot surface 1&2 at 225° position.

Inspection Report

After polishing spigot surface 1&2 at 270° position.

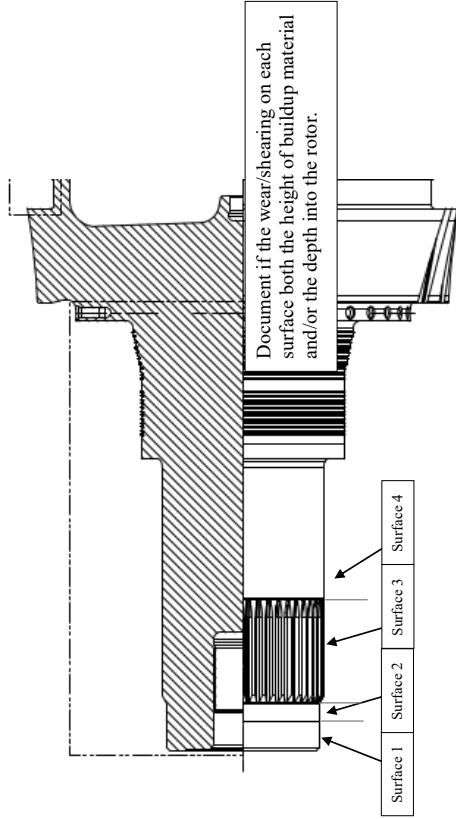


After polishing spigot surface 1&2 at 270° position.

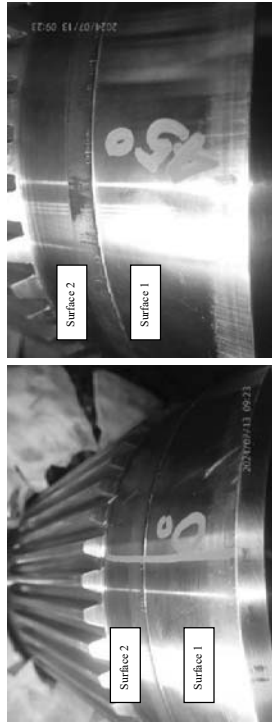
After polishing spigot surface 1&2 at 315° position.

Inspection Report

Example compressor rotor scoring condition after removal for replacement new thickness shim behind compressor bearing.

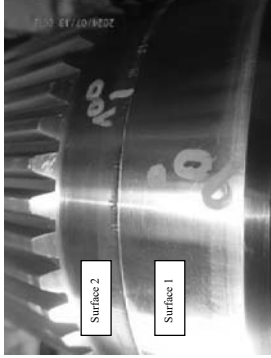


Spigot surface 1 and 2 as found condition.

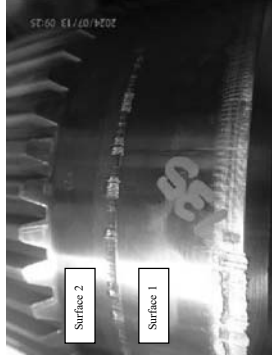


Example damaged spigot surface 1&2 at 0° position. Example damaged spigot surface 1&2 at 45° position.

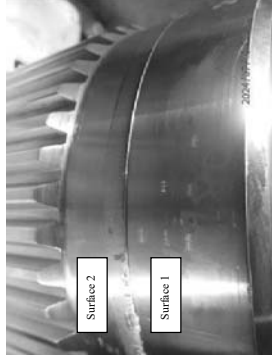
Inspection Report



Example damaged spigot surface 1&2 at 90° position. Example damaged spigot surface 1&2 at 135° position.

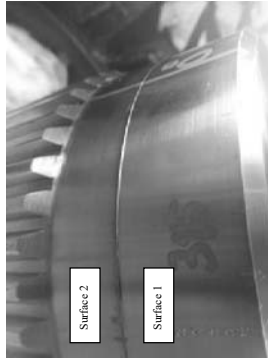


Example damaged spigot surface 1&2 at 135° position. Example damaged spigot surface 1&2 at 180° position.



Example damaged spigot surface 1&2 at 225° position. Example damaged spigot surface 1&2 at 230-270° position.

Inspection Report



Example damaged spigot surface 1&2 at 31.5° position. PT was performed after polishing finish to confirm defect.



After polishing condition at 0° with PT acceptance. After polishing condition at 45° with PT acceptance.



After polishing condition at 90° with PT acceptance. After polishing condition at 135° with PT acceptance.



Inspection Report



After polishing condition at 180° with PT acceptance. After polishing condition at 225° with PT acceptance.



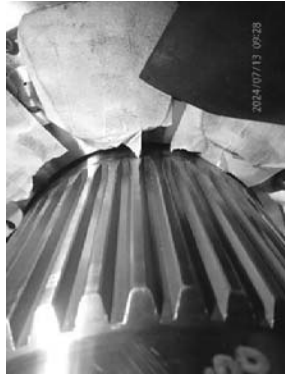
After polishing condition at 315° with PT acceptance.

Inspection Report

Spline surface 3 as found condition.



Example overview spline condition at 0° (CW)



Example overview spline condition at 90° (CW)



Example overview spline condition at 180° (CW)



Example overview spline condition at 270° (CW)

The surface 4 as found condition.

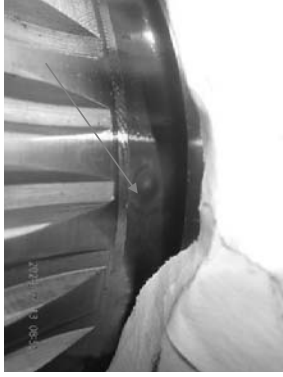


Example surface 4 area 0° (CW)

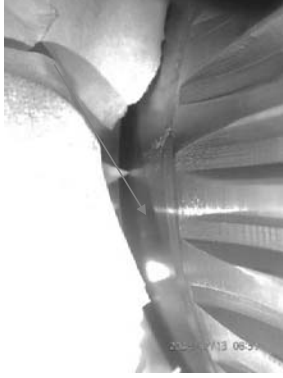


Example surface 4 area 90° (CW)

Inspection Report



Example surface 4 area 180° (CW)



Example surface 4 area 270° (CW)

Recommendation:

- Replaced new rotor tie nuts and jack bolts.
- Polishing intermediate shaft spigot surface that installing with turbine disc stage 1.
- Monitoring compressor rotor oxidation surface at stage between 5, 6 and 7 during next major '120 inspection.
- Replaced of the new coupling. The damages are on the grip surface and there is a risk that there could be issues related to vibration when the Unit is started. A new coupling will give the best chance to start the machine without requiring machining the rotor and install an undersized coupling.
- The new compressor coupling and fretting marked on spigot area rotor need to follow up at next major inspection.
- After installing the new coupling, measure the M5, run out and axial clearances in the rear compressor to confirm that the reduction in shim thickness has resulted in expected adjustment of the rotor position.

Compressor rotor is in serviceable condition.

Inspection Report

7.14 HG 2442 Compressor blades

Performed work:

- Visual inspection.
- PT on compressor blades stage 1-15.
- Dye ice blasting on compressor blades.
- Core engine was upgrade from BI-B3 package that were replace new compressor blade stage 1-4 with new design.

Result:

- Observed some compressor blades stage 13-15 have nick on leading edge blade.



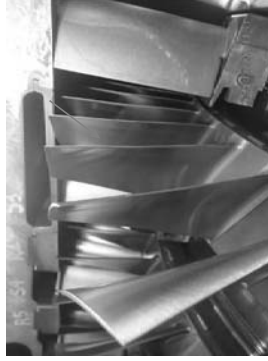
Compressor blades overall condition.



Compressor blades stage 1 as found conditions.



Compressor blades stage 2 as found conditions.



Compressor blades stage 3 as found conditions.

Inspection Report



Compressor blades stage 4 as found conditions.



Compressor blades stage 5 as found conditions.



Compressor blades stage 6 as found conditions.



Compressor blades stage 7 as found conditions.



Compressor blades stage 8 as found conditions.



Compressor blades stage 9 as found conditions.

Inspection Report



Compressor blades stage 10 as found conditions.



Compressor blades stage 11 as found conditions.



Compressor blades stage 12 as found conditions.



Compressor blades stage 13 as found conditions.



Compressor blades stage 14 as found conditions.



Compressor blades stage 15 as found conditions.

Inspection Report



Compressor blades stage 13-15 found nicks



Removed first 4 stages blade to upgrade to B3 package.



PT were performed on all compressor blades stage 5-15. No relevant indications



PT were performed on all compressor blades stage 5-15. No relevant indications

Recommendation/Actions:

- Removed nick at leading-edge blades from stage 13-15 polishing by hand with scotch Brite pads and sandpaper no. 800.

Compressor blades are in serviceable condition after following up recommendation.

Inspection Report

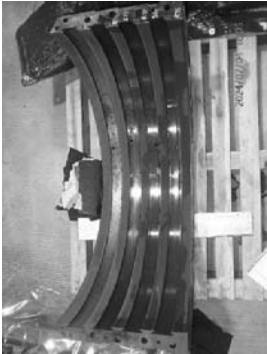
7.16 HG 2451 Rear compressor stator

Performed work:

- Visual inspection.

Result:

- No remark.



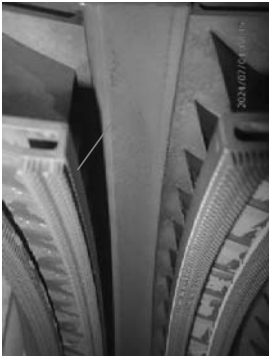
Rear inner casing (left side) as found overview.



Rear inner casing (right side) as found overview.

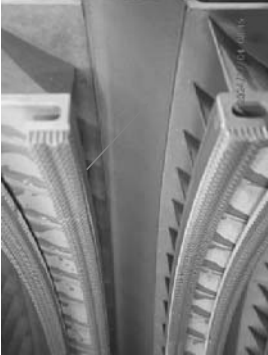


Abradable seal stage 11 as found condition.



Abradable seal stage 12 as found condition.

Inspection Report



Abradable seal stage 13 as found condition.



Abradable seal stage 14 as found condition.



Abradable seal stage 15 as found condition.

Recommendation:

- None.

Rear compressor stator is in serviceable condition.

Inspection Report

7.17 HG 2452 Compressor vanes

Performed work:

- Visual inspection.
- PT (water washable method) on compressor vanes stage 0-15.
- Dye ice blasting on compressor vanes.
- Measurement wear of honeycomb on compressor vanes.
- Core engine was upgrade from B1-B3 package that were replace new compressor vanes stage 1, 2, 4 and 5 with new design and corrective circumference gaps at new vanes stage 4 and 5 before installation.

Result:

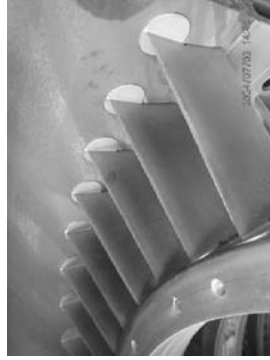
- No remark.



VGV stage 0 overall condition.



VGV stage 1 overall condition.



VGV stage 2 overall condition.



Overall GV stage 3 condition.

Inspection Report



Overall GV stage 4 condition.



Overall GV stage 5 condition.



Overall GV stage 6 condition.



Overall GV stage 7 condition.

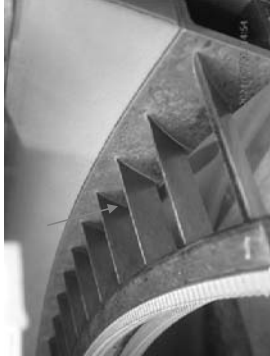


Overall GV stage 8 condition.



Overall GV stage 9 condition.

Inspection Report



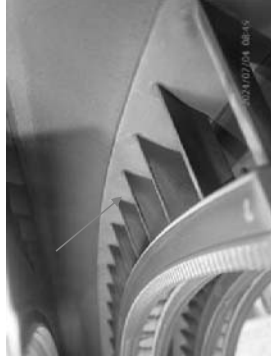
Overall GV stage 10 condition.



Overall GV stage 11 condition.



Overall GV stage 12 condition.



Overall GV stage 13 condition.



Overall GV stage 14 condition.



Overall GV stage 15 condition.

Recommendation:

- Perform compressor wash every 10,000 hours to keep compressor at their best possible performance condition.

Compressor vanes are in serviceable condition.

Inspection Report

7.18 HG 2580 Combustor

Performed work:

- Visual inspection.
- Measurement dimension protocol original turbine flange and diaphragm by ROSE.

Result:

- Based on dimension measurement protocol turbine flange and diaphragm out of criteria.



Combustor unit overall condition.



Inner heatshield overall condition.



Overall inner outlet ring and diaphragm condition.



Overall outer outlet ring and diaphragm condition.

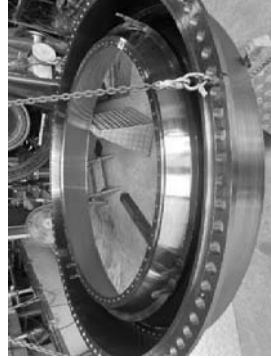
Inspection Report



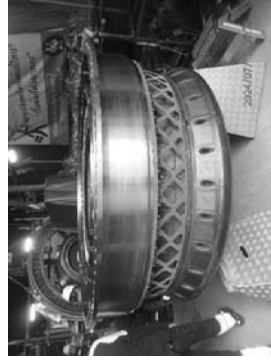
As condition flame detector hole was fretting.



Original diaphragms have measurement by ROSE.



New turbine flange and diaphragm have measurement and assemble to old combustor.



Recommendation:

- Replaced new turbine flange and diaphragm during this major inspection. (More detail in IFR from ROSE team)

Combustor is in serviceable condition.

Inspection Report

7.19 HG 2535 Flame detector

Performed work:

- Visual inspection.

Result:

- No remark.



Flame detector at left and right side machine dismantled.



Recommendation:

- None.

Flame detector will be inspected by commissioning team before released them back to service.

Inspection Report

7.20 HG 2530 Ignition system

Performed work:

- Visual inspection.

Result:

- No remark.



Ignitor body overall after dismantled.

Recommendation:

- None.

Spark plug will be inspected by commissioning team before released it back to service.

Inspection Report

7.21 HG 2351 Fuel manifold

Performed work:

- Visual inspection.

Result:

- No remark.



Main gas fuel supply tie-in overall condition.



Ignition valves overall condition.

Recommendation:

- None.

Fuel manifold is in serviceable condition.



Fuel manifold around central casing left side condition.

Inspection Report

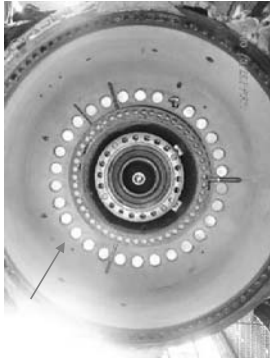
7.22 HG 2510 Central casing

Performed work:

- Visual inspection.

Result:

- Observed flaked aluminum coating that applied in 2023 at compressor discharge casing.



Central casing overall outside condition.



Rotor blocking bar as found condition.

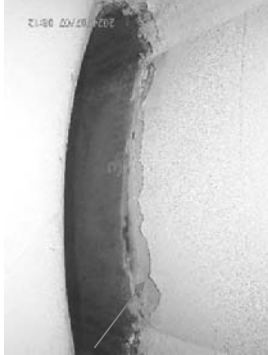


Aluminum coating peel off at overlap joint.

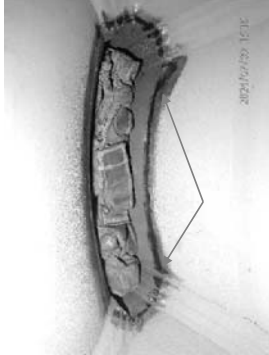


The sealers coating as found condition.

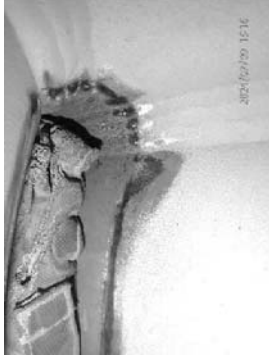
Inspection Report



Example visual inspection connecting area between NEW coating and existing coating.



Blending removed flake coating all slots discharge.



Example central seal segments before dismantling, no bolts damage.



Recommendation/Actions:

- Blend removed flake aluminum coating at between new and existing coating.
- Follow up aluminum coating condition at next HGP'90 inspection.

Central casing is in serviceable condition.

Inspection Report

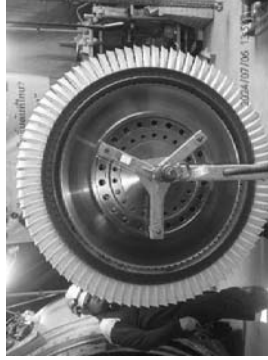
7.23 HG 2640 Turbine rotor

Performed work:

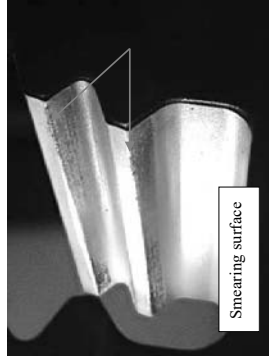
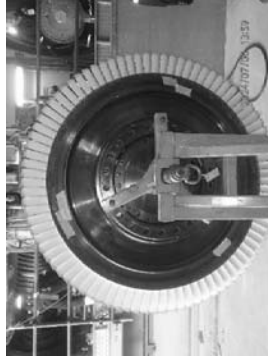
- Visual inspection for rotor disc stage 2, 3 and Rotor hub.
- Visual inspection for intermediate rings sealing rings between disc 1-2 and 2-3.
- Visual inspection for turbine module bolts and turbine nuts.
- Performed conductivity and hardness test on turbine disc stage 2.

Result:

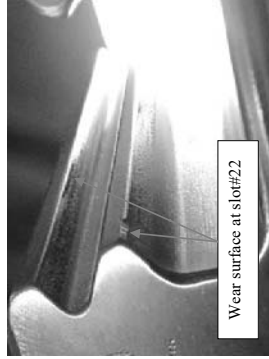
- Observed turbine disc stage 2 wear and smearing on fir-tree active face at pressure and suction sides.
- Observed balancing weight at BP5 hole position 7, 9 and 11.



Turbine disc stage 2 before dismantling blade.



Disc 2 pressure side fir-tree active side condition.



Disc 2 suction side fir-tree active side condition.

Inspection Report



Installed weight on BP5 hole position 7.



Installed weight on BP5 hole position 11.



Closeup on journal area and condition.



Turned sealing edges inner as found condition.



Caulked sealing edges overall condition.



PT applied to rotor hub.

Inspection Report



PT on rotor hub by water washable method, no relevant indication.

Recommendation/Actions:

- All snearing surface at turbine disc stage 2 fir tree are removed by oil stone polishing.
- Conductivity testing was performed on Turbine disc 2 in this specific area and results indicates that the testing of the disc 2 material is within expectations. The conclusion is that discs 2 is in serviceable condition for the upcoming maintenance cycle of 30 000 EOH.
- As a complement to the above solutions to improve the lifting of turbine disc 2 a new sealing ring 1 has been developed. The new sealing ring has an improved axial position and height of the seal fins. The new design was recently released and has been implemented on a few units the last month. When analyzing those units at re-commissioning they have indicated positive improvements in terms of turbine secondary air temperatures.

Turbine rotor is in serviceable condition.

Inspection Report

7.24 HG 2642 Turbine blades

Performed work:

- Visual inspection.
- Turbine blade stage 1 not dismantling according to activities list.

Result:

- Turbine blade stage 1, 2 and 3 were replaced at FO September 2023.
- Observed rubbing mark at turbine blade tip stage 3.



Example of blade 2 upstream overall condition.



Example of blade 2 downstream overall condition.

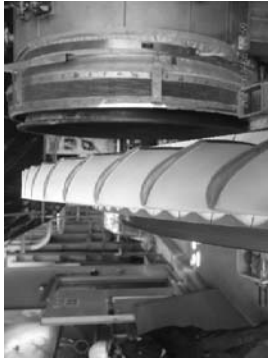


Example blade 2 leading edge overall condition.



Example blade 2 trailing edge cooling passages condition.

Inspection Report



Example of blade stage 2 tip overall condition.



Example of downstream blade stage 3.



Example of turbine blades 3 trailing edge side.



Example of turbine blades 3 tip condition.



Example of blades 3 minor rubbing at leading edge.

Recommendation:

- None.

Turbine blades stage 1, 2 and 3 can return to serviceable condition.

Inspection Report

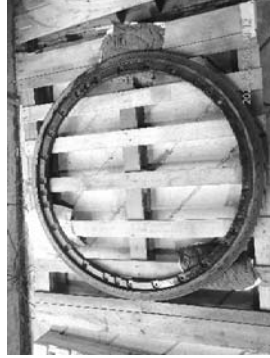
7.25 HG 2650 Turbine stator stage no 1

Performed work:

- Visual inspection.
- Turbine stator stage 1 not dismantling according to activities list.

Result:

- Inner/Outer vane plates found TBC minor oxidation.
- Observed wear on honeycomb area and fretting mark on contact surface with combustor at main inner ring.



Swirl generator overall condition.



Swirl generator honeycomb is good condition..



Turbine G1 stage 1 overall condition.

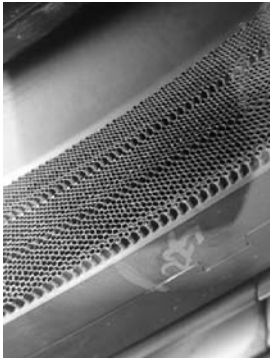


G1/1 overall condition before dismantling.

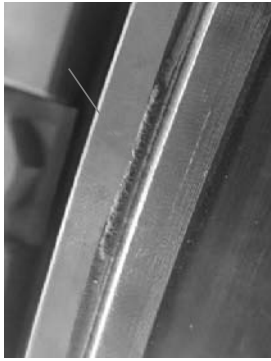
Inspection Report



Main inner ring honeycomb as found wear condition.



Main inner ring fretting mark were close to limit of serviceable condition.



Recommendation/Actions:

- The main inner ring needs to follow wear of honeycomb and fretting mark at contact area with combustor at next HGP'90 inspection.

Turbine stator stage no 1 is in serviceable condition.

Inspection Report

7.26 HG 2651 Turbine stator stage no 2&3

Performed work:

- Visual inspection.
- Turbine stator stage 2&3 not dismantling according to activities list.

Result:

- Minor oxidation on GV2 stator heat shields.
- Observed GV2 1 flexible hoses are deformation.
- Observed fretting mark on GV3 locking ring.



Guide vane stage 2 assembly overall condition.



Rear hook GV2 condition.



Heat shield as found condition.

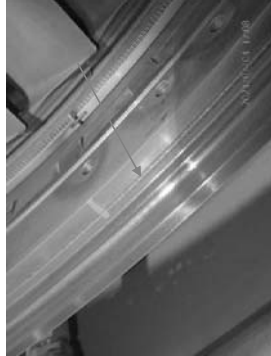
Inspection Report



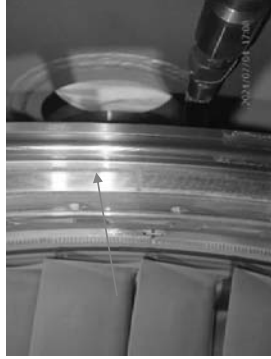
Flexible hoses was replaced 1 hose.



No axial contact mark on G12.



Fretting mark at e-sealing seating area. On guide vane stage 3 locking ring.



Recommendation/Actions:

- Replaced 1 flexible hoses for guide vane stage 2.

Turbine stator stage no 2 and 3 are in serviceable condition after follow recommendation.

Inspection Report

7.27 HG 2610 Turbine casing

Performed work:

- Visual inspection.

Result:

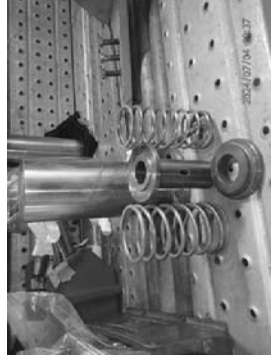
- No remark.



Temperature sensor housings overall condition.



C1 probe end thread as found condition.



T-bar suspension housing overall condition.



Instrument housing as found condition.

Recommendation:

- None.

Turbine casing is in serviceable condition.

Inspection Report

7.28 HG 2361 Cooling air manifold

Performed work:

- Visual inspection.

Result:

- Observed 1 support bracket on cooling manifold square pipes broken.



Big round pipes flanged as found condition.



Small round pipe bottom side as found condition.



Support square brackets were broken.



PT weld seal on big square pipe.

Inspection Report



Support ESC brackets were broken.



Replaced new gasket on big roll pipe.

Recommendation/Actions:

- Welded repair broken 1 square support cooling pipe brackets during this outage.

Cooling air manifold is in serviceable condition.

Inspection Report

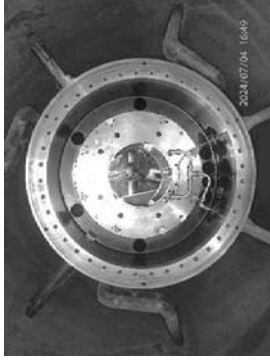
7.29 HG 2261 Turbine bearing

Performed work:

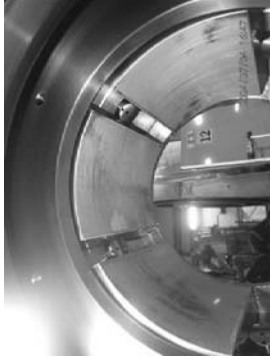
- Visual inspection.

Result:

- No remark.



Overall turbine bearing housing condition.



Example radial top pad before clean condition.



Example radial pads at bottom side.



Jacking oil tubing that connect to bottom pads.

Recommendation/Actions:

- Cleaned oil varnish from bearing surface.

Turbine bearing is in serviceable condition.

Inspection Report

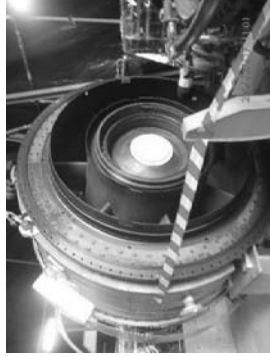
7.30 HG 2665 Outlet casing

Performed work:

- Visual inspection.

Result:

- Observed 6 rear inner insulation cassettes crack.
- Minor wear mark on sealing ring 1, 2, 3 area and front L-profile.
- Observed initial crack around rear L-profile at connecting joint segment.



Outlet casing overall condition.



Sealing ring 1,2,3 area overall condition.



Inner sealing ring honeycomb overall condition.



Outer sealing ring honeycomb overall condition.

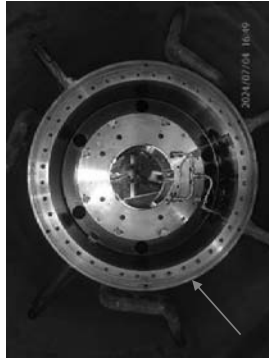
Inspection Report



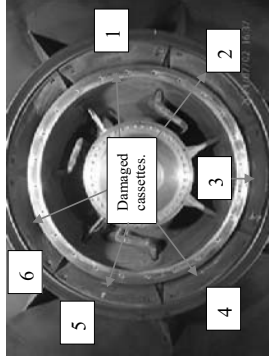
Front lip of outer heatshield overall condition.



Front L-profile wear mark around circumference.



Central bearing housing overall condition.



6 Rear inner insulation cassettes damaged.



Insulation cassettes at top side not damage.



Insulation cassettes damaged at position 1.

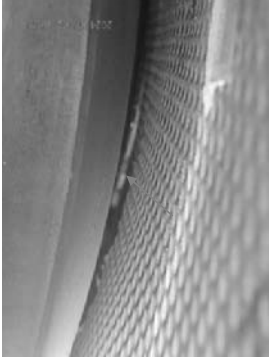
Inspection Report



Insulation cassettes damaged at position 2.



Insulation cassettes damaged at position 3.



Insulation cassettes damaged at position 4.



Insulation cassettes damaged at position 5.



Insulation cassettes damaged at position 6.



Rear L-profile damaged at position J1.

Inspection Report



Rear L-profile damaged at position J2.



Rear L-profile damaged at position J3.



Rear L-profile damaged at position J4.



No damage on weld seam behind bearing housing.



Outlet cone overall condition.



No fretting mark on contact area with rear L-profile.

Inspection Report



As found fabric bellow is good condition.



The outlet bellow bolts were good condition.

Recommendation/Actions:

- Replaced 4 insulation cassettes rear inner with new cassettes 2424558-1.
- Insulation cassettes at position 1 and 2 repaired by spot welding.
- Follow 2 rear inner insulation cassettes during next HGP'90 inspection.
- Weld repair rear L-profile 4 joints completed.

Outlet casing is in serviceable condition after following up recommendation complete.

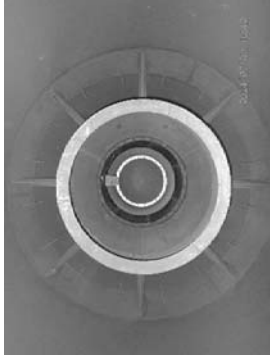
7.31 HG 2660 Exhaust diffuser

Performed work:

- Visual inspection.

Result:

- Cracks observed on the front and rear support weld seams, noticed in previous inspection report.
- Observed bolts and nuts around exhaust diffuser and inner cone were damaged.

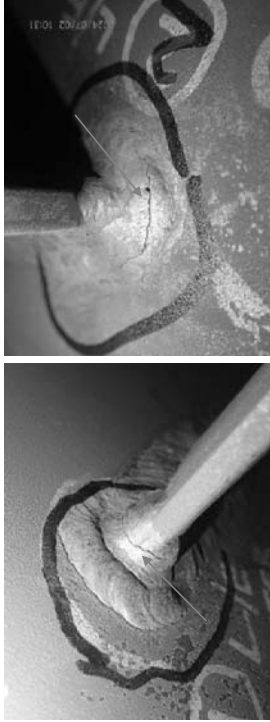


Exhaust diffuser seen against flow direction.



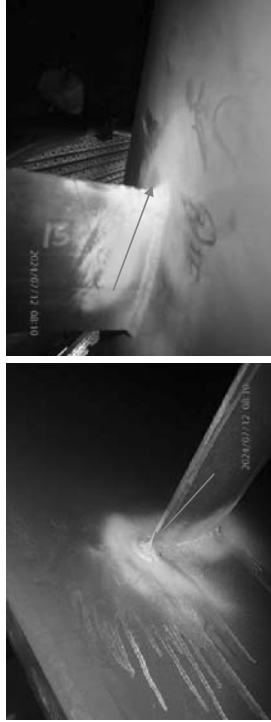
All front struts observed crack at inner/outer weld seam.

Inspection Report



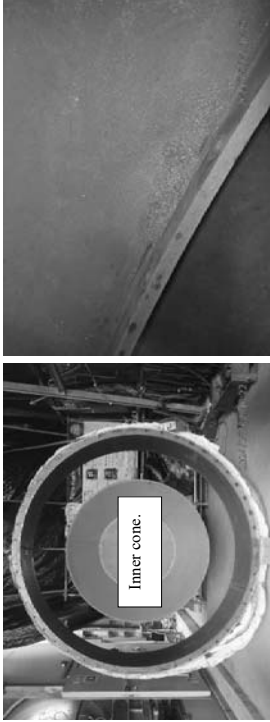
Example crack at front leading-edge struts.

Another crack at front leading-edge strut.



Example cracking after repaired by crack removal and re-welding.

Damaged bolts and nuts inside inner cone.



Intermediate cone overall condition.

Recommendation:

- Front support struts weld seams had been repaired by customer.
- Replaced new bolts and nuts according to E1B101059154M.

Exhaust diffuser is in serviceable condition after following up recommendation complete.

Inspection Report

7.32 HG 2132 Insulation

Performed work:

- Visual inspection.

Result:

- Insulation found teared at cooling sealing and bleeding pipe.
- Insulation pillows around turbine exhaust cone area found tear and damages.



Example insulation around compressor area.



Example insulation on turbine and exhaust area.



Example of insulation as found condition.



Recommendation/Actions:

- Customer schedule repairs on the severely damages insulations during this major inspection maintenance period.

After repaired, insulation will return to serviceable condition.

Inspection Report

7.33 HG 2920 Skid erection, GT

Performed work:

- Visual inspection.

Result:

- No remark.



Front support condition on the right side.



Front support condition on the left side.



Left central casing side support condition.



Left central casing side support foundation.

Recommendation:

- None.

Skid erection, GT is in serviceable condition.

Inspection Report

7.34 HG 2925 Erection, exhaust diffuser

Performed work:

- Visual inspection.

Result:

- No remarks.



Left side support connection.



Left side support foundation condition.



Right side support connection.



Right side support foundation condition.

Inspection Report



Right side support connection.

Recommendation:

- None.

Erection, exhaust diffuser is in serviceable condition.

Inspection Report

8 Recommendations

8.1 Future activities

HG 4150 Air intake system

- Cleaned filter housing, intake louvers and ventilation filter housing intake louvers.
- When replacing filters elements check for an open gap between filter element rubber seal and filter housing to ensure no unfiltered air can enter.
- Apply rusty protection lubricant on emergency door release mechanism.
- Active exit ventilation damper and monitoring damper condition in every 6 months.
- Removed oxidation on silencer units at top and bottom side by customer.
- Pre and fine filters were replaced during MO'60 inspection.

HG 4981 Starting gear

- During re-assembly oil varnish found on SSS-Clutch has been cleaned.
- Monitoring lube oil varnish level and upgrade the VRU unit to include particle filtration.

HG 4980 Speed reduction gear

- Clean bottom casing section of the gear casing before reassembly.
- Replaced 4 jacking oil hoses.
- Adjusted lube oil spray bar to correct position according to engineering recommendation.
- All bearings surfaces have been cleaned from oil varnish film.
- Replaced bearing#11 (ICSA21751-1), #12 (ICSA21763-1) with new condition.
- Keep monitor electro discharge mark at wheel and pinion cogs turbine sides every next RMI inspection.
- Change the lube oil filters and lower the lube oil pressure to 170 kPa (to be verified with clean filters). The lube oil quality needs to be monitored regularly.
- A follow up inspection is required after 10,000 EOH where the progression of erosion on the marked cogs needs to be documented using macro pictures. Depending upon the result of the follow up, it may be required to grind the cogs.
- Considering that PAB/SGT-800/23-001 Flender gearbox recommendation regarding increased risk of wheel slippage is applicable for this gearbox, it is recommended that a spare wheel set be planned for contingency.

HG 2405 Compressor inlet casing

- Clean and remove rusty inside of inlet plenum casing before unit back to operation.
- Replaced new rubber gasket at inspection hatch.
- Repaired thread inserts nuts according to instruction ICS167727.

HG 2410 Compressor inlet piece

- Clean inside inlet piece inner and outer wall and continue to monitor for any traces of water ingress into compressor every 6 months.
- Check tight mounting flange between inlet piece and inlet casing.

Inspection Report

HG 2241 Compressor bearing

- The recommendation from product support related to core engine axial distance, the spacer shim behind compressor bearing would like adjusted to 1,55 mm.
- The recommendation is to replace the axial thrust bearing pads. The radial pads seem to only have scratches which should be smoothed. It is also recommended to take an oil sample for analysis.
- The lube oil quality needs to be monitored regularly.

HG 2440 Compressor rotor

- Replaced new rotor tie nuts and jack bolts.
- Polishing intermediate shaft spigot surface that installing with turbine disc stage 1.
- Monitoring compressor rotor oxidation surface at stage between 5, 6 and 7 during next major 120 inspection.
- Replaced of the new coupling. The damages are on the grip surface and there is a risk that there could be issues related to vibration when the Unit is started. A new coupling will give the best chance to start the machine without requiring machining the rotor and install an undersized coupling.
- The new compressor coupling and fretting marked on spigot area rotor need to follow up at next major inspection.
- After installing the new coupling, measure the M5, run out and axial clearances in the rear compressor to confirm that the reduction in shim thickness has resulted in expected adjustment of the rotor position.

HG 2442 Compressor blades

- Removed nick at leading-edge blades from stage 13-15 polishing by hand with scotch Brite pads and sandpaper no. 800.

HG 2452 Compressor vanes

- Perform compressor wash every 10,000 hours to keep compressor at their best possible performance condition.

HG 2580 Combustor

- Replaced new turbine flange and diaphragm during this major inspection. (More detail in IFR from ROSE team)

HG 2510 Central casing

- Blend removed flake aluminum coating at between new and existing coating.
- Follow up aluminum coating condition at next HGP'90 inspection.

HG 2640 Turbine rotor

- All smearing surface at turbine disc stage 2 fir tree are removed by oil stone polishing. Conductivity testing was performed on Turbine disc 2 in this specific area and results indicates that the testing of the disc 2 material is within expectations. The conclusion is that discs 2 is in serviceable condition for the upcoming maintenance cycle of 30 000 EOH.

Inspection Report

- As a complement to the above solutions to improve the lifting of turbine disc 2 a new sealing ring 1 has been developed. The new sealing ring has an improved axial position and height of the seal fins. The new design was recently released and has been implemented on a few units the last month. When analyzing those units at re-commissioning they have indicated positive improvements in terms of turbine secondary air temperatures.

HG 2650 Turbine stator stage 1

- The main inner ring needs to follow wear of honeycomb and fretting mark at contact area with combustor at next HGP'90 inspection.

HG 2651 Turbine stator stage 2&3

- Replaced 1 flexible hoses for guide vane stage 2.

HG 2361 Cooling air manifold

- Welded repair broken 1 square support cooling pipe brackets during this outage.

HG 2261 Turbine bearing

- Cleaned oil varnish from bearing surface.

HG 2665 Outlet casing

- Replaced 4 insulation cassettes rear inner with new cassettes 2424558-1.
- Insulation cassettes at position 1 and 2 repaired by spot welding.
- Follow 2 rear inner insulation cassettes during next HGP'90 inspection.
- Weld repair rear L-profile 4 joints completed.

HG 2660 Exhaust diffuser

- Front support struts weld seams had been repaired by customer.
- Replaced new bolts and nuts according to E1B101059154M.

HG 2132 Insulation

- Customer schedule repairs on the severely damages insulations during this MO60 maintenance period.

8.2 Spare parts (High potential replacement parts next major inspection)

HG	Name	Assy. drawing	Item	Qty	Address/Component designation	Article No.
2241	Compressor bearing	2423190-1	1	1	Bearing#1 completed	2423190-1
2650	Main inner ring	2424525	13	1	Turbine GV1	2424514-A
4980	Wheel gear	1CS135416	A100	1	Flender gearbox	1CS141586-2
2665	Insulation cassettes	2423642	13	2	Outlet casing	2424538
2665	Repair stud	2421482		10	Outlet casing	2421481-1



E1B101485331

Inspection Report

Subject / Title:
BD000166U01 SSUT, MO-60 KEOH, 2024, Inspection report

Thailand
Location

2024.07.16
Date

Project:
SSUT GT11

Customer Name:
SSUT Bangpoo

Orderer's File Ref:
E1B101247263-A

Order No Internal:
4334739

Account No Internal:
EA256471U01A112611

Report No Internal:
RTSOFL 476/24

Classification:
Confidential

Released technically

Released for external use

Codeword
Equipment No
Product Type
Mobilization Date
Demobilization Date
Client Contact Name

:
: BD000166U01
: SGT-800
: 2024-07-01
: 2024-07-18
: Mr. Charothon Yotthiwong

Executive Summary:

Purpose of this visit is to perform a level C60-inspection of unit BD000166U01 SSUT GT11. Compressor wash was performed prior to inspection. The inspection was performed according to the document, maintenance Activity List **E1B101247263: A**

Siemens Energy has been performed for core engine upgrade from B1 to B3, Performance Enhancement from 50.5 MW. to 54 MW during this MO-60 KEOH inspection.

Metalization additional coating at the inner of the central casing, was performed during MO 60 inspection.

EC conductivity test and Hardness test by Siemens energy during MO 60 inspection.

All NDT activities performed by external company (Bureau Veritas). The external company will also make the NDT reports.

Pre-filter elements on air intake filter house has been changed by customer during this MO 60 inspection. Re-conditions around intake inlet duct, Inlet plenum for clean air path and rust removal around the support silencer were done by customer as well.

Outlet casing was repaired by customer during this MO 60 inspection such as, cracks around fabrics below, Fretting and contact marks around front L-profile and front lip outlet. Furthermore, any finding on previous repaired of insulation cassettes, at cassette no. 3,4,5,6 (clockwise). Those cassettes have been changed during this MO 60 inspection.

Any replacement parts base on finding conditions which following are, 2 pieces of flexible hoses for cooling air turbine GV#2, GV#1 split e-seal, GV segments compressor stator stage #3, stage#10 and stage #15, combustion diaphragm and Turbine flange.



E1B101485331

Inspection Report

The reason for changed combustion diaphragm and Turbine flange, because of geometrical changes first noticed from measurement of the relative position between stator stage 1 and intermediate shaft of the rotor (C & D). The result from measurement of C and D was found out of criteria.

After further evaluation by Siemens Energy expertise, the conclusion for reduce the risk of overheating on turbine disc#2 was recommended to perform for geometrical measurement on combustor diaphragm and turbine flange. The result from measurement had submitted to Finspang engineering team for evaluation, SE engineering support confirmed that, both of combustor diaphragm and turbine flange were geometrical deformations which lead to the deviation of relative rotor to stator position from normal operating values.

The additional recommendation from engineering support team, is to adjust this relative rotor to stator position to reduce the risk in axial contact between turbine stator and rotor parts, and to improve the turbine rotor seal efficiency, reduce the risk for turbine disc 2 exposure to higher temperature by replacing both combustor diaphragm ring and turbine flange. Adjustment of shim thickness behind bearing 1, reduced from 1,75mm. to 1,5 mm also recommend from SE engineering support and replace sealing ring#1 with new design.

Exchanged parts that, subject to be replaced as according to the Maintenance activities list (E1B101247263: A) which are, Compressor blades stage #1, #2,#3, #4 , Compressor guide vane stage #1, #2,#4, #5, Turbine Blades stage#1, Turbine blades stage#2, Combustor, Fuel injector burners, Turbine GV#1, Turbine GV#2, Heat shield#1, Heat shield#2, Rear hooks#1, GV#1 Outer vane plates and GV#1 Inner vane plates , Sealing ring#1 (New design: E1B101397808).

Findings are reported in this inspection report, any finding which could be rectified during the inspection schedule will be rectify/repair or replace with parts from customer stock and/or planned inspection parts.

Once all the recommendations have been implemented unit can return to service.

Copies To:
Erik Gregeborg
Kronrakit Ruengkijpalboon
Matilda Björkman Höglund

Inspection Report

1 Summary of results

HG 4150 Air intake system

- Dust collected on weather louvers both intake filter and ventilation filter.
- Found door rubber seal at filter housing entrance room was damaged.
- The customer has been replaced prefilter filter elements.
- Contamination conditions noticed on final filter elements.
- Observed rust and corrosion around flat bar plate of fabric bellow expansion joint seen inside the clean air path internal wall upper side of inlet silencer.
- Condensing conditions noticed on clean air side after final filters.
- Ventilation filter housing intake louvers found dust collected.

HG 4981 Starting gear

- Observed oil varnish and sludge inside the lube oil chamber, clutches socket of SSS-clutches.

HG 4980 Speed reduction gear

- Observed minor burnt marks on babbit bearing surface for lower halves of bearing #11 and #12.
- Minor floating surface and pitting marks were observed after cleaning for lower halves of bearing#11 and #12.
- Observed overheated area on bearing pads surface for upper halves of bearing#21 and#22.
- Light varnish found over gear cogs surface.
- White marks have been observed on wheel and pinion cogs both generator and turbine side. No propagation on those marks when compared to previous inspections.
- Observed nozzle sprays tip on top manifolds were incorrect for spray direction.
- Jacking oil supply rubber hoses to all bearings were found degraded.

HG 2405 Compressor inlet casing

- Found dirt collected at inlet casing drain area.
- Observed rust and corrosion around flat bar plate of fabric bellow expansion joint seen inside the clean air path internal wall bottom side of inlet silencer.
- Found insert nuts loose several locations around inlet casing manhole.

HG 2410 Compressor inlet piece

- Minor contamination stain was observed on compressor inlet piece go into compressor inlet guide vane.
- Oil seal bearing# 1 cover found dirty from mist oil.

Inspection Report

HG 2241 Compressor bearing

- Axial and radial bearing pads found minor scratches marked on some pads.
- Light oil varnish deposit noticed on bearing surface.

HG 2440 Compressor rotor

- Measure height of sealing edges on coupling 1 and visual inspection on splines. No remarks found.
- Minor red deposits have been observed at the compressor rotor stage#12 to stage #15.

HG 2442 Compressor blades

- Minor red deposits have been observed at the compressor blades stage#12 to stage #15.

HG 2450 Compressor stator

- Minor wear marks noticed on all stages of abradable seals.

HG 2451 Rear compressor stator

- Minor wear marks noticed on all stages of abradable seals.
- Found damaged spacer ring front liner rear inner stage#14.

HG 2452 Compressor vanes

- Honeycomb wears within tolerance limit observed on all stages.
- Relevant cracks indication found by PT on guide vane segments compressor stator stage #3, #10 and #15.

HG 2580 Combustor

- Fretting from contact with main inner ring at inner diaphragm sealing.
- Observed debris deposit inside combustion chamber and turbine flange.
- Combustor has been replaced with the new part as according to the document for MO 60 maintenance plan.
- Combustor diaphragm and turbine flange were geometrically deformations which lead to the deviation of relative rotor to stator position from normal operating values.

HG 2540 Fuel burner

- Minor deformed of outer bellow noticed.
- Fretting at hood sealing and at pilot flame piston ring area.
- Fuel injector burner has been replaced during this MO 60 inspection.
- TBC loss at tip.

HG 2530 Ignition system

- Minor fretting found on the tip fitting sphere area.

HG 2510 Central casing

- Red skin spalling noticed on area around compressor exit flow area.
- Metallization additional coating at the inner of the central casing has been performed by external company (AST Local SE sub-contractor) during this MO 60 outage.

Inspection Report

HG 2640 Turbine rotor

- Found debris at front of turbine disc 1 cooling entrance to turbine blades 1 and debris has been collected for sampling checked.
- Found fine dark particles at front of turbine disc 1 blades cooling entrance.
- Found fine dark particles, debris in the root of disc #2 groove.
- Fretting observed on root of TD#2 root and groove.
- Found gap between locking plates and sealing plates of turbine blade stage #1 "X and Y" sides were over than acceptable range.
- Sealing ring 1 has been replaced during this inspection from reason new design, which following to maintenance activity list.

HG 2642 Turbine blades

- TBC coating loss condition noticed on leading edge, blades tip and trailing edge and some on trailing edge base platform stage 1.
- Oxidation found on leading edge cooling holes, blade tip and rear platform of turbine blades stage 1.
- Oxidation and discoloration found on Turbine blade stage#2.
- Minor rubbing marks have observed at leading edge tip turbine blade stage 3.
- Turbine blades stage#1 and #2 have been replaced during this MO 60 inspection.

HG 2650 Turbine stator stage no 1

- Inner/Outer vane plates noticed with TBC coating loss and oxidation/cracks found at the lip of Outer vane plate.
- Minor fretting observed on all inner cooling air pipes fitting diameter and on inner ring.
- Fretting mark noticed on main inner ring at combustor contact surface and wear grooves on honeycomb seal noticed but within inspection criteria.
- Noticed a honeycomb radial wear grooves on swirl generator.
- Split e-seal GV1 stator front found deformation.
- Replacement parts subject to change as according to MO 60 maintenance plan which are, Turbine GV#1, Inner / Outer Vane plate, Heat shield#1 and rear hook#1.

HG 2651 Turbine stator stage no 2&3

- Wear grooves on stage 3 heat shield honeycomb observed.
- Fretting observed on GV3 heat shield contact area with outlet casing and worn groove on E-sealing ring seating area.
- Observed minor fretting marks on GV#3 locking ring. Depth of contact marks are measured and the result is in criteria.
- Observed 2 pieces of GV2 flexible hoses are damaged.
- Observed cracks indication from PT in area of HS#2 slot, about to 28 locations.
- Replacement parts subject to change as according to MO 60 maintenance plan which are, Turbine GV#2 and Heat shield#2.

Inspection Report

HG 2652 Turbine guide vanes

- Oxidation observed on pressure side of guide vanes stage 1 and inner platform cooling hoes leading edge side.
- Oxidation found on leading edge inner platform on guide vanes stage 2.
- Minor honeycomb seal wear on guide vanes stage 2.
- Dis-coloration found on guide vane stage 3.
- Observed minor contact marks between turbine blade 3 leading edge tip area against GV3 extruded casting area.

HG 2361 Cooling air manifold

- Found cracks on weld seam of support bracket for cooling air manifold, big square pipe = 4 locations and small square = 3 locations.

HG 2261 Turbine bearing

- Light oil varnish film found on all bearing journal pads.

HG 2665 Outlet casing

- Missing and loose double nuts found around fabric bellow expansion joint.
- Observed fabric bellow was being damaged several locations, especially on the top side.
- Cracks / Damages found on insulation cassette 4 Pcs., number # 3, #4, #5, #6 (clockwise).
- Fretting found on front lip and wear groove noticed on front L-shape circumference from contact with e-sealing ring.
- Minor contact marks found around outer cone (Big wok).
- Honeycomb minor wear grooves found on Outer sealing ring.
- Minor wear mark on sealing ring 1, 2, 3 area.
- Found E-Seal cracks/ damages.

HG 2660 Exhaust diffuser

- Minor cracks were observed at front and rear support struts of the exhaust diffuser.

HG 2132 Insulation

- Insulation blanket found damages from operation rubbing against casing due to vibration and heat.
- Insulation found punctured at compressor guide collar area.
- Insulation around bleed air pipes and cooling air pipes found some damages.

Inspection Report

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Inspection Report

2 Personnel on site

Personnel on site:	Date for the visit
Samix Chaiyana, Site manager	240701-240722
Chaophraya Arthaweekul, Field service supervisor (Shift lead day shift)	240701-240722
Sayan Yeunyongkul, Field service technician (day shift)	240701-240722
Siwa Jan-iam, Field service technician (day shift)	240701-240722
Amphon Kaewta, Field service technician-OJT (day shift)	240701-240722
Nantasak Saelim, Field service technician (day shift)	240701-240722
Leif Erik Salama, Gearbox supervisor.	240701-240722
Teanchai Promyota, Field service supervisor (Shift lead night shift)	240701-240722
Subwong Janiam, Field service technician (Night shift)	240701-240722
Chaerit Tangkaew, Field service technician (Night shift)	240701-240722
Sombat Wannasri, Field service technician (Night shift)	240701-240722
Issara Burakhorn, Field service technician (Night shift)	240701-240722
Thanongsak Lakhonkaew, Commissioning Engineer Lead	240701-240722
Tanakrit Kaewutai, Commissioning Engineer	240701-240722
Sirawish Bunchim, Commissioning Engineer-OJT	240701-240722
Thanawach Nilnarong, NDT Engineer	240705-240709
Nataphat Pattamadielok, NDT Engineer	240705-240709
Chawarat Wattanapreechapat, Quality Inspector I	240701-240717

3 General data / Operating statistics

Site:	SSUT Bangpoo GT11
B-number:	BD000166U01
Project manager:	Matilda Björkman Höglund
Application engineer:	Erik Gregeborg
Activity list:	E1B101247263: A
Owner:	SSUT Co Ltd (Bangkok)
Owner representative:	Mr. Charothon Yothiwong
Order number:	4334739

Inspection Report

Gas turbine: Siemens	Type: SGT-800B	S/N: DD080044
Main gear:	Type: TX112/4C	S/N: 12719
Generator:	Type: AMS1240A LK	S/N: 8269006
Configuration:	Combine cycle	
Site:	Power plant	
Fuel	Natural gas	
Operating profile:	Base load	
Compressor washing system/wash interval	Offline & 10000hours	
Site address or GPS coordinates	13.532603, 100.651876	

Fuel: Gas: ☒ Liquid: ☐ Dual fuel: ☐

Digital counter readings

Date: 20240701	Installation
Operating hours:	57486 h
Operating hours equivalent:	61294 h
Starts:	541
Equivalent operating cycles:	758
Total production of MWh:	1942460
Total production of MV Ar+:	386775
Total production of MV Ar-:	10

Mechanical counter readings

Date: 20240701	Installation
Operating hours:	57486 h
Operating hours equivalent:	61294 h
Starts:	541
Equivalent operating cycles:	758

Location of Gas turbine overhaul:

☒ Inside enclosure ☐ On-site Workshop ☐ External Non-Siemens-Energy workshop
☐ Local Siemens-Energy workshop ☐ Siemens-Energy workshop Sweden
Other information:

Report history

Date	Report no	Reason	Author
2023-02-20	E1B101227833	A inspection	Somdej Arunplod
2022-07-31	E1B101126828	FO to replace GV1	Krit Phunsab
2022-06-07	E1B101067448	Bore-scope insp of GV1	Somdej Arunplod
2021-11-12	E1B100962567	A-inspection	Somdej Arunplod

Inspection Report

6 Inspection activities

6.1 Planned inspection

6.1.1 Activities according to maintenance plan

5.2 #	HG/System/KKS	Activity	Field Service Remark
1	/Air intake system/MBL	Visual inspection in air intake housing, ducting, silencer and plenum. Check for obstructions, cleanliness, leakages and for foreign objects. Check flanges, inspection hatches, sealings and gaskets.	Performed.
2	/Air intake system/MBL	Visual inspection of filters for obstruction and contamination.	Performed.
3	2132/Insulation/	Visual inspection.	Performed.
4	2241/Compressor bearing/	Visual inspection.	Performed.
5	2261/Turbine bearing/	Visual inspection.	Performed.
6	2310/Lubricating Oil Pipes Gas Turbine/	Visual inspection.	Performed.
7	2315/Compressor cleaning pipes/	Visual inspection.	Performed.
8	2320/Drain pipes/	Visual inspection.	Performed.
9	2345/Bleed air pipes/	Visual inspection.	Performed.
10	2348/Cooling/sealing air pipes/	Check strainers for contamination	Performed.
11	2361/Cooling air manifold/	Visual inspection.	Performed.
12	2405/Compressor air inlet casing/	Visual inspection.	Performed.
13	2410/Inlet Piece/	Visual inspection.	Performed.
14	2530/Ignition system/	Visual inspection.	Performed.
15	2535/Flame detector/	Visual inspection.	Performed.
16	2610/Turbine casing/	Visual inspection.	Performed.
17	2920, 2925/Assembly material/Erection exhaust diffusor at site/	Visual inspection of the supports.	Performed.
18	2140/Compressor and turbine rotor assy/	Diametrical measurement of turbine disc 1.	Performed.
19	2440/Compressor rotor/	Visual inspection.	Performed.
20	2440/Compressor rotor/	Measuring control of the central sealing	Performed.
21	2440/Compressor rotor/	Measuring control of sealing between discs	Performed.
22	2440/Compressor rotor/	Corrosion control	Performed.
23	2442/Compressor blades/	Penetrant testing of compressor blades. Cleaning to be carried out by Purchaser acc to contract	Performed.
24	2442/Compressor blades/	Documentation of corrosion compressor	Performed.
25	2442/Compressor blades/	Corrosion control	Performed.
26	2452/Compressor vanes/	Penetrant testing of compressor vanes, Cleaning to be carried out by Purchaser acc to contract	Performed.

Inspection Report

5.2 #	HG/System/KKS	Activity	Field Service Remark
27	2452/Compressor vanes/	Corrosion control	Performed.
28	2455/Guide vane actuator/	Visual inspection and control of the variable guide vanes mechanism.	Performed.
29	2510/Central casing/	Visual inspection.	Performed.
30	2540/Burner/	Visual inspection of removed burners	Performed.
31	2580/Combustor/MBM	Visual inspection.	Performed.
32	2351/Fuel manifolds/	Visual external inspection.	Performed.
33	2351/Fuel manifolds/	Visual inspection.	Performed.
34	2640/Turbine rotor (incl. Blades)/	Visual inspection of rotor hub	Performed.
35	2640/Turbine rotor (incl. Blades)/	Measurement check of rotor hub	Performed.
36	2640/Turbine rotor (incl. Blades)/	Penetrant testing of rotor hub	Performed.
37	2640/Turbine rotor (incl. Blades)/	Visual inspection of turbine blade 1.	Performed.
38	2640/Turbine rotor (incl. Blades)/	Visual inspection of turbine blade 2.	Performed.
39	2640/Turbine rotor (incl. Blades)/	Visual inspection of turbine blade 3.	Performed.
40	2650/Turbine stator, stage 1/	Visual inspection of guide vanes stage 1.	Performed.
41	2650/Turbine stator, stage 1/	Visual inspection of guide vanes stage 2.	Performed.
42	2650/Turbine guide vanes/	Visual inspection of guide vanes stage 3.	Performed.
43	2650/Turbine stator, stage 1/	Visual inspection of turbine heat shield 1.	Performed.
44	2650/Turbine stator, stage 1/	Visual inspection guide vane 1 outer vane plate.	Performed.
45	2650/Turbine stator, stage 1/	Visual inspection guide vane 1 inner vane plate.	Performed.
46	2650/Turbine stator, stage 1/	Visual inspection of front outer segment	Performed.
47	2650/Turbine stator, stage 1/	Visual inspection of front inner segment	Performed.
48	2650/Turbine stator, stage 1/	Visual inspection of stator ring 1.	Performed.
49	2650/Turbine stator, stage 1/	Visual inspection of vane carrier 1.	Performed.
50	2650/Turbine stator, stage 1/	Visual inspection of rear hook segment 1.	Performed.
51	2651/Turbine stator, stage 2 and 3/	Visual inspection of turbine heat shield 2.	Performed.
52	2651/Turbine stator, stage 2 and 3/	Visual inspection of turbine heat shield 2 carrier.	Performed.
53	2651/Turbine stator, stage 2 and 3/	Visual inspection of stator ring 2.	Performed.
54	2651/Turbine stator, stage 2 and 3/	Visual inspection of rear hook segment 2.	Performed.

Inspection Report

5.2 #	HG/System/KKS	Activity	Field Service Remark
55	2665/Outlet casing/	Internal visual inspection of outlet casing.	Performed.
56	2665/Exhaust casing/	Visual inspection of outlet bellow, metallic parts	Performed.
57	2665/Exhaust casing/	Visual inspection of outlet bellow, soft parts	Performed.
58	2660/Exhaust diffuser/	Visual inspection.	Performed.

7 #	HG/System/KKS	Activity	Field Service Remark
1	4980, 4995/Main gear/Alignment instruction/	Visual inspection of tooth mesh through inspection cover. Main gear.	Performed.
2	4980, 4995/Main gear/Alignment instruction/	Visual inspection of tooth mesh through inspection cover. Starting gear.	Performed.
3	4980, 4995/Main gear/Alignment instruction/	Visual inspection of all gear parts with regards to wear, cracks, damages, leakage, deposits, dirt, burned oil and other signs of abnormalities (dismantling required).	Performed.
6	4980, 4995/Main gear/Alignment instruction/	Inspection of SSS-clutch.	Performed.

6.1.2 Activities outside maintenance plan

9 #	HG/System/KKS	Activity	Field Service Remark
2	/Gas fuel system, General/MBP	PSW/SGT-800/18-004 Safety Warning check Gas fuel hoses	Performed.
9	2640/Turbine Discs & Stator stage 2 and 3/	Hardness and electrical conductivity test on turbine disc 2	Performed by NDT Engineer.
11	2510/Central casing/	TSA of central casing	Performed.
12	/Gear system, General/MBK	Continue to monitor flex coupling flex plate bundle condition during next inspection.	Performed.
13	/Gear system, General/MBK	Continue to monitor for the progression of the white marks pattern on wheel gear.	Performed.
14	/Gear system/MBK	Continue to monitor for the progression of the elector discharge pattern on wheel gear.	Performed.
17	4093/Enclosure/	Enclosure miles expansion hatches on MTB/HIGS Check dimensions for blow out doors regarding the doors versus EG enclosure	Performed.

Inspection Report**7 Inspection result****7.1 HG 4150 Air intake system****Performed work:**

- Visual inspection.

Result:

- Dust collected on weather louvers both intake filter and ventilation filter.
- Found door rubber seal at filter housing entrance room was damaged.
- The customer has been replaced prefilter filter elements.
- Contamination conditions noticed on final filter elements.
- Observed rust and corrosion around flat bar plate of fabric bellow expansion joint seen inside the clean air path internal wall upper side of inlet silencer.
- Condensing conditions noticed on clean air side after final filters.
- Ventilation filter housing intake louvers found dust collected.



Overview conditions for air intake filter housing.



Weather louvers conditions for intake filter.



Inspection Report

Intake duct elbow overall condition.



Rubber seal conditions at filter housing entrance door.



Connecting joint and sealant conditions around flexible bellow.



Floor conditions inside filter housing room.



Pre-filter elements overall condition.



Overview conditions inside filter housing room.



Inspection Report



Present installation for final filter elements.



Final-filter elements overall condition.



Condensing conditions noticed on clean air side behind final filters. Internal wall conditions for clean air side.



Overview conditions for inlet silencer seen from top side. Corrosion conditions on silencer unit column.



Inspection Report



Intake louver condition for Ventilation room.



Overview conditions around ventilation filter housing room.



Overview conditions inside ventilation filter housing.



Floor conditions inside ventilation filter housing.



Ventilation inlet intake channel to Gas turbine enclosure.

Recommendation:

- Re-condition for sealant around joints of external wall for intake inlet duct and elbow during next major shutdown opportunity.

Inspection Report

- Re-conditions and applied rusty protection on flat bar plate of fabric bellow expansion joints, inlet silencer and support silencer.
- When changing new set of pre-filter element ensure they are properly seal between pre-filter element and housing to prevent any open gap causing small insects, water, and unfiltered air to enter filter housing.
- Clean dust collected at weather louver when replace new pre-filter element.
- Clean dust collected on ventilation filter entrance louvers when replacing ventilation filter element.

Actions:

- The customer has been replaced for Pre-filter elements with a new set.
- The customer has been performed for rust removal all points inside the clean air path, flat bar plate, silencer and support silencer.

Air intake system will be in serviceable conditions after all recommendations has been performed.

7.2 HG 4981 Starting gear

Performed work:

- Visual inspection.

Result:

- Observed oil varnish and sludge inside the lube oil chamber, clutches socket of SSS-clutches.



Starter motor overall condition.



Flexible coupling overall condition.

Inspection Report



Shim pack at starter motor side condition.



Shim pack at gearbox side condition.



SSS-Clutch connected with flexible coupling overall condition. SSS-Clutch overall condition.



Sliding splines gear overall condition.



Ratchet tooth overall condition.

Inspection Report



Overview condition for tooth on clutch gear.



Closed view on clutch teeth.



High speed paw jaw condition for left side.



High speed paw jaw condition for right side.



Closed up view on teeth from the ratchet gear view in profile.



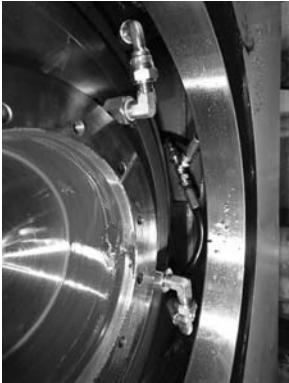
Inspection Report



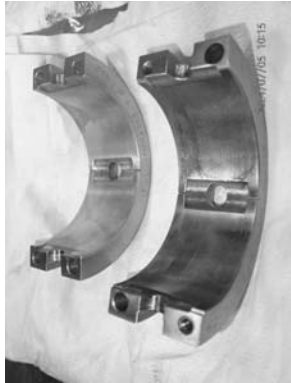
Sliding female splines socket as found condition.



Clutch socket as found condition.



SSS-Clutch bearing 31 overall condition.



SSS-Clutch bearing 32 overall condition.

Inspection Report



Overview conditions for PT test on SSS-clutch bearing 31 and 32.

Recommendation:

- None.

Actions:

- SSS-clutches has been cleaned prior put it to reassembly process.

Starting gear system is in serviceable conditions.

7.3 HG 4980 Speed reduction gear

7.3.1 Casing

Performed work:

- Visual inspection.

Result:

- No remark.



Gearbox casing overall seen from generator side.



Gearbox casing overall seen from starter motor side.

Inspection Report



Backup barring motor side overall condition.



Gearbox foundation support and key overall condition.



Example of under top lid condition.



Example of oil bath bottom condition.

Recommendation:

- None

Actions:

- Gearbox casing oil bath has been cleaned before reassembly.

Gearbox casing is serviceable conditions.

7.3.2 Bearings

Performed work:

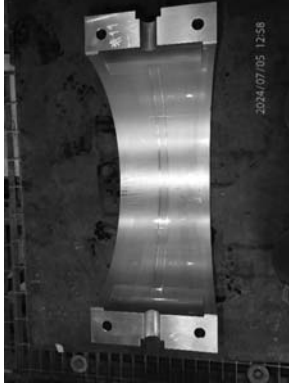
- Visual inspection.

Result:

- Observed minor burnt marks on babbit bearing surface for lower halves of bearing #11 & #12.
- Minor floating surface and pitting marks were observed after cleaning for lower halves of bearing#11 and #12.

Inspection Report

- Observed overheated area on bearing pads surface for upper halves of bearing#21 and#22.



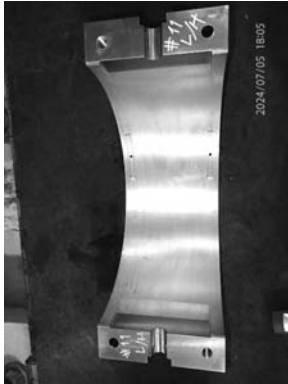
Bearing 11 top half overall condition before clean.



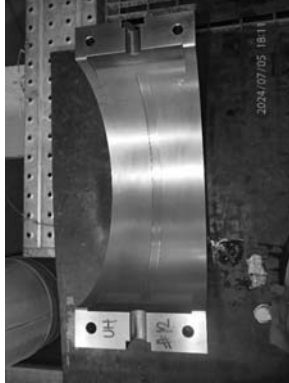
Bearing 11 bottom half overall condition before clean.



Bearing 11 top half overall condition after cleaned.



Bearing 11 bottom half overall condition after cleaned.



Bearing 12 top half overall condition before clean.



Bearing 12 bottom half overall condition before clean.

Inspection Report



Bearing 12 top half overall condition after cleaned.



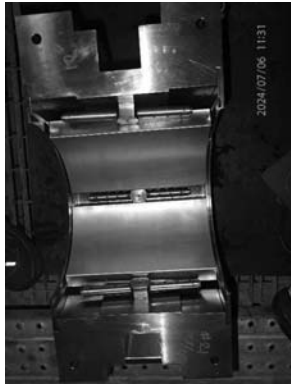
Bearing 12 bottom half overall condition after cleaned.



Bearing 21 top half overall condition before clean.



Bearing 21 bottom half overall condition before clean.



Bearing 21 top half overall condition after cleaned.

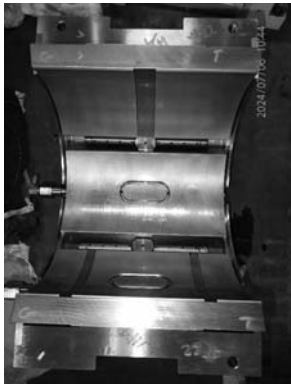


Example of closeup condition on the top pad of bearing 21.

Inspection Report



Bearing 22 top half overall condition before clean.



Bearing 22 bottom half overall condition before clean.



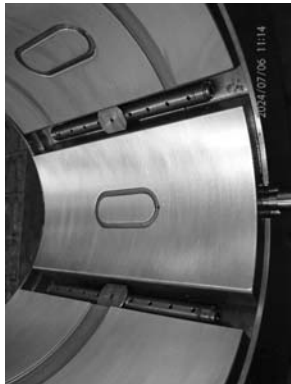
Bearing 22 top half overall condition after cleaned.



Closeup condition on the top pad of bearing 22 top half.

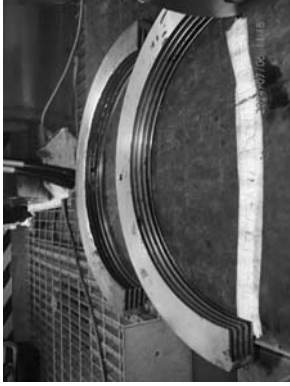


Bearing 22 bottom half overall condition after cleaned.



Closeup condition on the pad of bearing 22 bottom half.

Inspection Report



Example picture for oil seal condition before clean.



Recommendation:

- Keep new set on bearing #11, #12 and #21, #22 for spare with complete set, in case those pads need to be change in next major shutdown while gearbox inspection.
- Continue to monitor condition of varnish builds up on bearings, shaft journal surface and gears teeth from lube oil sampling analysis result.

Actions:

- All bearing surfaces have been cleaned varnish before re-installation.

Gearbox bearings will be in serviceable condition after all recommendation have been perform.

7.3.3 Cogs

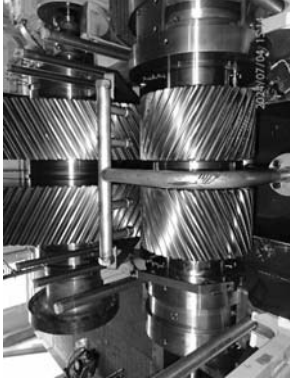
Performed work:

- Visual inspection.

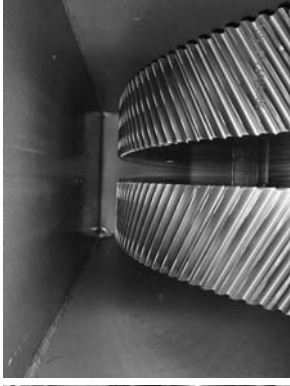
Result:

- Light varnish found over gear cogs surface.
- White marks have been observed on wheel and pinion cogs both generator and turbine side. No propagation on those marks when compared to previous inspections.
- Observed nozzle sprays tip on top manifolds were incorrect for spray direction.
- Jacking oil supply rubber hoses to all bearings were found degraded.

Inspection Report



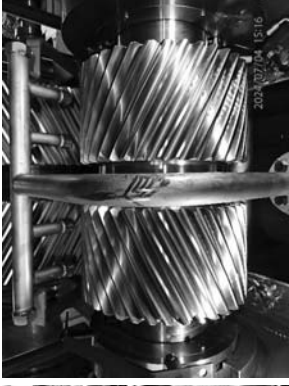
Gear train overall conditions.



Wheel cogs overall condition.



Wheel cogs overall condition.



Pinion cogs overall condition.



Example of white mark on wheel cogs generator side (left) and turbine side (right).

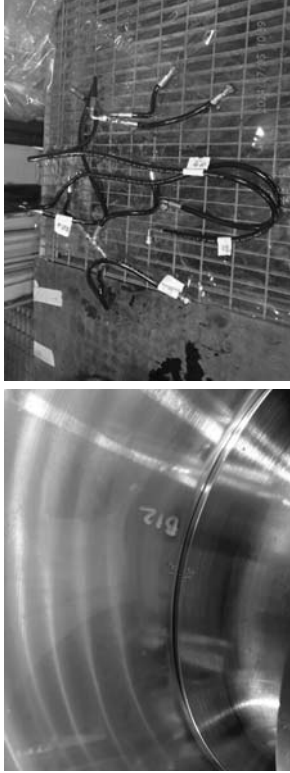
Inspection Report



Example of white mark on pinton cogs starter motor side (left) and turbine side(right).



Example view on tip nozzle oil sprays after direction adjustment (left-top manifold and right-bottom manifold).



Wheel shaft factory mark at 180° position.

Jacking oil hoses conditions.

Recommendation:

- Check condition of varnish builds up on cogs during next inspection. Performed oil sampling analysis every six months to keep track of lubrication oil condition.
- Monitor white marks condition during next inspection for any progression or changes of pattern.

Inspection Report

Actions:

- All jacking oil hoses have been replaced with a new spare set during this inspection.

Gearbox cogs is serviceable after recommendations has been performed.

7.4 HG 2405 Compressor inlet casing

Performed work:

- Visual inspection.

Result:

- Found dirt collected at inlet casing drain area.
- Observed rust and corrosion around flat bar plate of fabric bellow expansion joint seen inside the clean air path internal wall bottom side of inlet silencer.
- Found insert nuts loose several locations around inlet casing manhole.



Inlet casing drain overall conditions.

Inlet casing foundation support overall condition.



Example view for condition on insert nut around inlet casing manhole.

Inspection Report



Dirt found collected at inlet casing drain area inside seen from left side and right side of plenum.



Corrosion notices at flat bar plate for flexible joint connection.



Corrosion condition found at the flexible joint area.



Silencer exit flow side seen from inlet casing side.

Recommendation:

- Clean inside of inlet casing prior to return to operation.
- Remove corrosion found at flexible joint area.
- During alignment checked, foundation support will be re-torquing again.

Inspection Report

Actions:

- The customer has been performed for rust removal all points inside the inlet plenum casing, flat bar plate, silencer and support silencer.

Compressor inlet casing will be in serviceable conditions after all recommendation has been performed.

7.5 HG 2410 Compressor inlet piece

Performed work:

- Visual inspection.

Result:

- Minor contamination stain was observed on compressor inlet piece go into compressor inlet guide vane.
- Oil seal bearing# 1 cover found dirty from mist oil.



External condition of inlet piece left side.



External condition of inlet piece right side.



Inlet piece internal overall condition.



Inlet piece internal overall condition.

Inspection Report



Bearing 1 seal cover condition.



Area in front of IGV entrance.

Recommendation:

- Clean inside inlet piece inner /outer wall and continue to monitor for any traces of water ingress into compressor during each shutdown.
- Check tight mounting flange between inlet piece and inlet casing.

Actions:

- The customer has been cleaned up inside the inlet piece before the unit start up.

Compressor inlet piece will be in serviceable conditions after all recommendation has been performed.

7.6 HG 2310 Lubricating oil pipes GT

Performed work:

- Visual inspection.

Result:

- No remarks.

Inspection Report



Lube oil supply line to bearing 1.



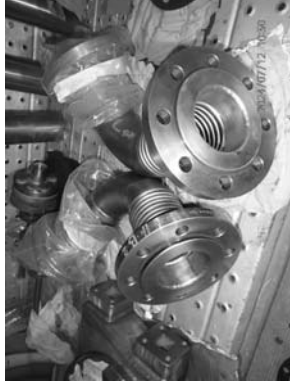
Lacking oil pipe to bearing 1 overall condition.



Lube oil supply to bearing 2 overall condition.



Lube oil return line from bearing 2 before dismantling.



Lube oil return line from bearing 2 after dismantling.

Recommendation:

- None.

Lubricating oil pipes are in serviceable condition.

Inspection Report

7.7 HG 2315 Compressor cleaning pipes

Performed work:
- Visual inspection.

Result:
- No remark.



Compressor washes manifold overall condition.



Compressor wash filter housing overall condition.



Compressor wash spray nozzle overall condition.

Recommendation:
- None.

Compressor cleaning pipes is serviceable condition.

Inspection Report

7.8 HG 2320 Drain pipes

Performed work:
- Visual inspection.

Result:
- No remark.



Drain ports control valves overall condition.



All drains overall condition..

Recommendation:
- None.

Drainpipes is in serviceable condition.

Inspection Report

7.9 HG 2345 Bleed pipes

Performed work:
- Visual inspection.

Result:
- No remark.



Bleed pipe exits overall condition.



Condition on right bleed pipe.

Recommendation:
- None.

Actions:

- The customer has been sending bleed valves to local workshop for overhaul during this MO 60 inspection.

Bleed pipes is in serviceable condition.

Inspection Report

7.10 HG 2348 Cooling/sealing air pipes

Performed work:
- Visual inspection.

Result:
- No remark.



Cooling sealing air pipe overall condition.



Butterfly valve condition inside the pipe.

Recommendation:
- None.

Cooling/sealing air pipes is in serviceable condition.

7.11 HG 2241 Compressor bearing

Performed work:
- Visual inspection.

Result:

- Axial and radial bearing pads found minor scratches marked on some pads.
- Light oil varnish deposit noticed on bearing surface.

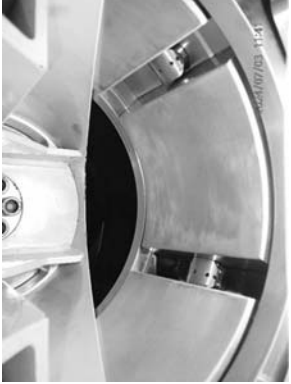
Inspection Report



Coupling on Bearing I overall condition.



Example of as found condition on radial jacking oil pads.



Example of radial top pads as found condition.



Example of trust axial pads overall condition.



Axial thrust pads as found overall condition.

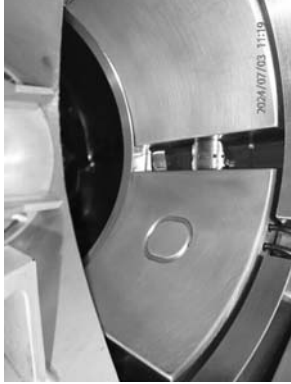


Close view on axial thrust pads before clean.

Inspection Report



Example of axial pad after cleaned condition.



Example of radial pads after cleaned condition.

Recommendation:

- Keep new set on thrust pads for spare with complete set, in case bearing clearance being enlarged and those pads need to be change in next major overhaul inspection.

Action:

- Bearing pads for thrust and radial have been cleaned- up before re-assembly with coupling.

Compressor bearing is in serviceable condition.

7.12 HG 2455 Guide vane control

Performed work:

- Visual inspection.

Result:

- No remark.



GV actuator support bracket overall condition.



GV actuator arm linkage overall condition.

Inspection Report



Guide vane mechanism overall condition left side.



Guide vane mechanism overall condition right side.



Guide vane mechanism overall condition top side.

Recommendation:

- Guide vane control was removed for cleaning and inspection then overhauled as per MO 60 inspection activity list.

Guide vane control is in serviceable conditions.

7.13 HG 2440 Compressor rotor

Performed work:

- Visual inspection.
- Measuring turned and caulked sealing edges on rotor.
- Dry ice blasting on compressor rotor.

Result:

- Measure height of sealing edges on coupling 1 and visual inspection on splines. No remarks found.
- Minor red deposits have been observed at the compressor rotor stage#12 to stage #15.

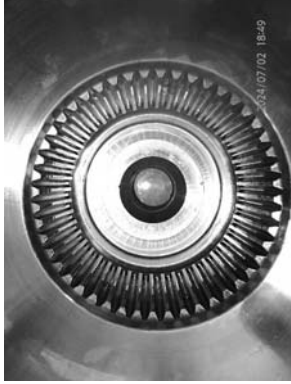
Inspection Report



Compressor coupling as found condition.



Compressor coupling caulked sealing edges condition.



Compressor coupling spline overall condition.



Example closeup on coupling spline condition.



Example of compressor rotor stage 1 condition.



Example of corrosion found between stages 1-2.

Inspection Report



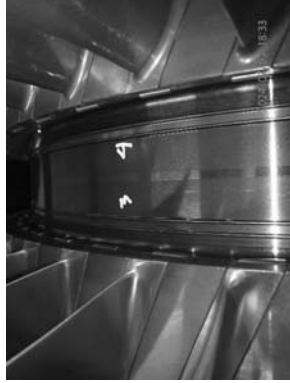
Example of compressor rotor stage 2 condition.



Example of corrosion found between stages 2-3.



Example of compressor rotor stage 3 condition.



Example of corrosion found between stages 3-4.



Example of compressor rotor stage 4 condition.



Example of corrosion found between stages 4-5.

Inspection Report



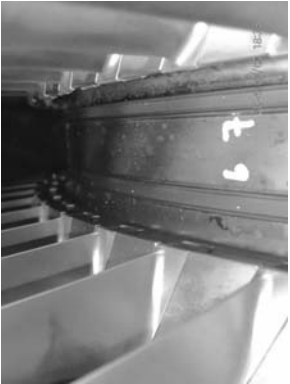
Example of compressor rotor stage 5 condition.



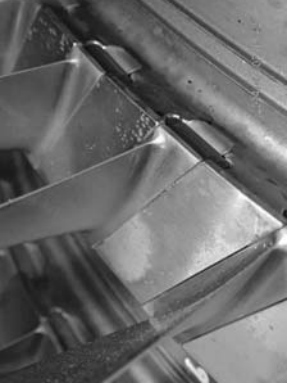
Example of corrosion found between stages 5-6.



Example of compressor rotor stage 6 condition.



Example of corrosion found between stages 6-7.

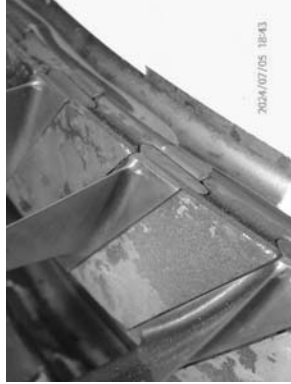


Example of compressor rotor stage 7 condition.



Example of corrosion found between stages 7-8.

Inspection Report



Example of compressor rotor stage 8 condition.



Example of corrosion found between stages 8-9.



Example of compressor rotor stage 9 condition.



Example of corrosion found between stages 9-10.

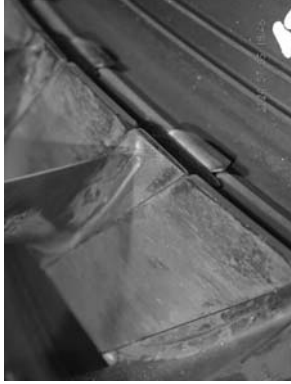


Example of compressor rotor stage 10 condition.



Example of corrosion found between stages 10-11.

Inspection Report



Example of compressor rotor stage 11 condition.



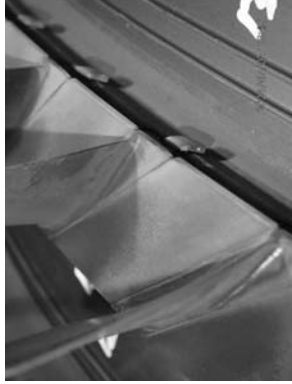
Example of corrosion found between stages 11-12.



Example of compressor rotor stage 12 condition.



Example of corrosion found between stages 12-13.



Example of compressor rotor stage 13 condition.



Example of corrosion found between stages 13-14.

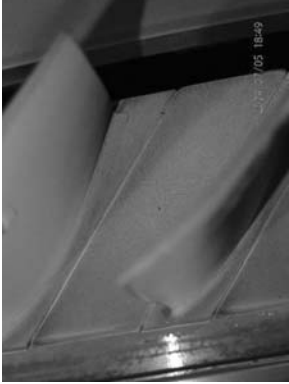
Inspection Report



Example of compressor rotor stage 14 condition.



Example of corrosion found between stages 14-15.



Overall condition of rotor.



Balancing weight location on BP2.



Compressor's turbine nuts overall condition.

Inspection Report



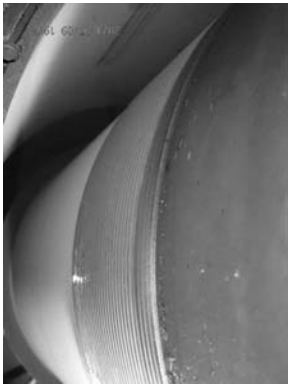
Compressor rotor spigot fit area overall condition.



Example close view on spigot fit surface condition.



Compressor rotor turned seals at bottom location.



Central sealing turned sealing edges overall condition.

Recommendation:

- None.

Compressor rotor is in serviceable condition.

7.14 HG 2442 Compressor blades

Performed work:

- Visual inspection.
- The compressor blades stages 1-15 were penetrant tested by a local third-party company during the inspection.
- Core engine upgraded from B1 to B3, replaced 4 staged of compressor blades from stage 1 to stage 4 with new blades design.

Result:

- Minor red deposits have been observed at the compressor blades stage#12 to stage #15.

Inspection Report



Compressor blades stage 1 overall condition.



Compressor blades stage 2 overall condition.



Compressor blades stage 3 overall condition.



Compressor blades stage 4 overall condition.



Compressor blades stage 5 overall condition.



Compressor blades stage 6 overall condition.

Inspection Report



Compressor blades stage 7 overall condition.



Compressor blades stage 8 overall condition.



Compressor blades stage 9 overall condition.



Compressor blades stage 10 overall condition.

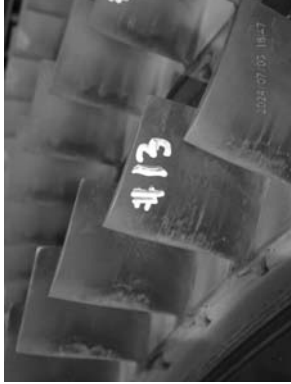


Compressor blades stage 11 overall condition.



Compressor blades stage 12 overall condition.

Inspection Report



Compressor blades stage 13 overall condition.



Compressor blades stage 14 overall condition.



Compressor blades stage 15 overall condition.

Recommendation:

- Perform compressor wash every 10,000 hours to maintain good compressor efficiency.

Actions:

- Dry ice blasting performed for cleaning of corrosion on compressor blades.

Compressor blades is in serviceable condition.

7.15 HG 2450 Compressor stator

Performed work:

- Visual inspection.
- Measures wear marked on abrasible seal.

Result:

- Minor wear marks noticed on all stages of abrasible seals.

Inspection Report



Compressor casing left half inside - outside view overall condition.



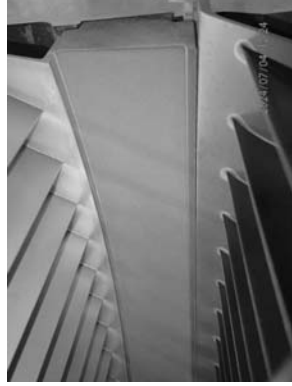
Compressor casing right half inside overall condition.



Condition of abrasible seal stage 3.



Condition of abrasible seal stage 4.



Condition of abrasible seal stage 5.

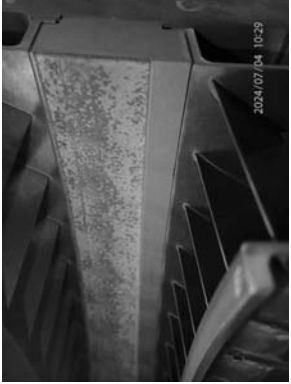
Inspection Report



Condition of abrasible seal stage 6.



Condition of abrasible seal stage 7.



Condition of abrasible seal stage 8.



Condition of abrasible seal stage 9.



Condition of abrasible seal stage 10.

Recommendation

- None.

Inspection Report

Actions:

- Compressor casing VGV holes has been cleaned prior to assembly.

Compressor stator is in serviceable condition.

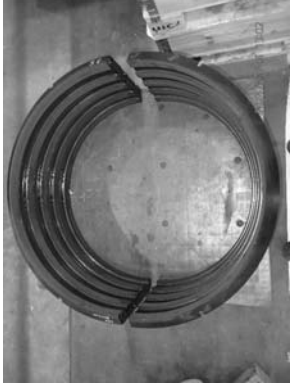
7.16 HG 2451 Rear compressor stator

Performed work:

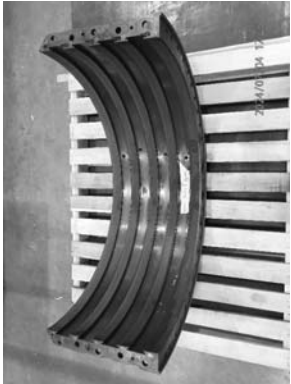
- Visual inspection.
- Measures wear marked on abrasible seal.

Result:

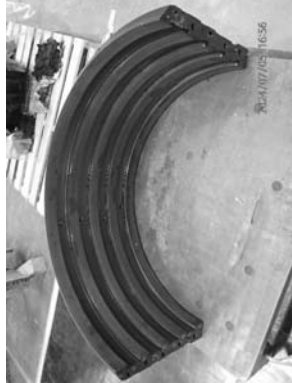
- Minor wear marks noticed on all stages of abrasible seals.
- Found damaged on spacer ring front liner inner stage#14.



Rear inner casing as found overall condition.



Rear inner casing left side as found overall condition.



Rear inner casing right side as found overall condition.



Inspection Report



Example of abradable seal stage 11 overall condition.



Example of abradable seal stage 12 overall condition.



Example of abradable seal stage 13 overall condition.



Example of abradable seal stage 14 overall condition.



Example of abradable seal stage 15 overall condition.



Spacer ring front liner stage 14 found damaged.

Inspection Report



Close up view around damaged point on spacer ring front liner stage 14.

Recommendation:

- None.

Action:

- Spacer ring front liner stage#14 has been changed with new spare during this MO 60 inspection.

Rear compressor stator is in serviceable conditions.

7.17 HG 2452 Compressor vanes

Performed work:

- Visual inspection.
- B3 Upgrade replaced compressor vanes stage 1,2,4 and 5 with a new design.
- Compressor vane stage 0, 3, 6-15 were penetrant tested by a local third-party company during the inspection.

Result:

- Honeycomb wears within tolerance limit observed on all stages.
- Relevant cracks indication found by PT on guide vane segments compressor stator stage #3, #10 and #15.

Inspection Report



VGV stage 0 overall condition.



VGV stage 0 inner ring condition.



VGV stage 1 overall condition.



VGV stage 1 inner ring and honeycomb overall condition.



VGV stage 2 overall condition.



VGV stage 2 inner ring and honeycomb overall condition.

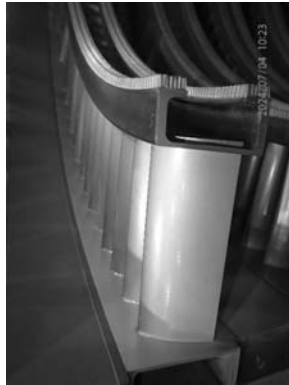
Inspection Report



Example of guide vanes stage 3 overall condition.



Example of guide vanes stage 3 honeycomb wear condition.



Example of guide vanes stage 4 overall condition.



Example of guide vanes stage 4 honeycomb wear condition.



Example of guide vanes stage 5 overall condition.



Example of guide vanes stage 5 honeycomb wear condition.

Inspection Report



Example of guide vanes stage 6 overall condition.



ple of guide vanes stage 6 honeycomb wear condition.



Example of guide vanes stage 7 overall condition.



ple of guide vanes stage 7 honeycomb wear condition.



Example of guide vanes stage 8 overall condition.



ple of guide vanes stage 8 honeycomb wear condition.



Example of guide vanes stage 9 overall condition.



2 of guide vanes stage 9 honeycomb wear condition.



Example of guide vanes stage 10 overall condition.



2 of guide vanes stage 10 honeycomb wear condition



Example of guide vanes stage 11 overall condition.



of guide vanes stage 11 honeycomb wear condition

Inspection Report



Example of guide vanes stage 12 overall condition. Example of guide vanes stage 12 honeycomb wear condition.



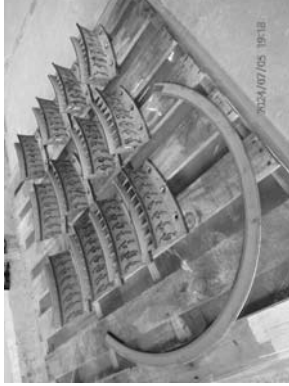
Example of guide vanes stage 13 overall condition. Example of guide vanes stage 13 honeycomb wear condition.



Example of guide vanes stage 14 overall condition. Example of guide vanes stage 14 honeycomb wear condition.



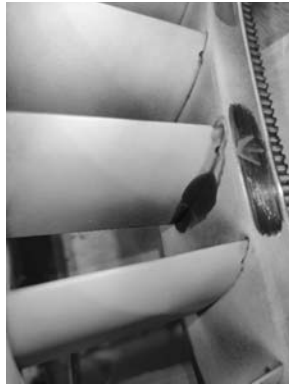
Inspection Report



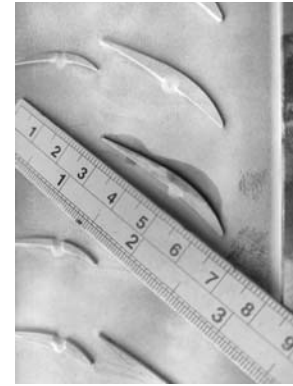
Example of guide vanes stage 15 overall condition. Example view for cracks found by PT on guide vane stage #3.



Cracks found by PT on guide vane stage #3 cold side. Cracks found by PT on guide vane stage #10.



Cracks found by PT on guide vane stage #10 cold side. Cracks found by PT on guide vane stage #15.



Recommendation:

- Perform compressor wash every 10,000 hours to keep compressor at their best possible performance condition.

Inspection Report

Action:

- Compressor guide vanes stage #3, #10 and #15 have been changed complete set with new spare during this MO 60 inspection.
- Compressor guide vanes were cleaned by dry ice blasting to remove corrosion.

Compressor vanes are in serviceable conditions.

7.18 HG 2580 Combustor

Performed work:

- Visual inspection.
- Geometrical measurement on combustor diaphragm and turbine flange.

Result:

- Fretting from contact with main inner ring at inner diaphragm sealing.
- Observed debris deposit inside combustion chamber and turbine flange.
- Combustor has been replaced with the new part as according to the document for MO 60 maintenance plan.
- Combustor diaphragm and turbine flange were geometrically deformations which lead to the deviation of relative rotor to stator position from normal operating values.



Combustor after removed overall condition.



Fretting condition at combustor contact area.

Inspection Report



Inner heatshield seen from turbine side overall condition. Combustion diaphragm and turbine flange disassembly.



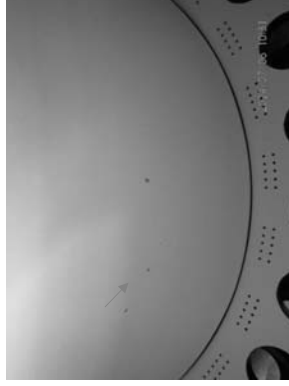
Example of outer outlet ring cooling holes.



Example of inner outlet ring cooling holes.



Front panel inner/outer wall TBC condition.



Debris deposits inside combustion chamber.

Inspection Report



Example of fretting condition at flame detector port.



Debris deposit around Turbine flange.



Pulsation tubes as found condition.



New turbine flange during performed the measurement.



New combustor during performed the measurement.



New complete set of combustor, turbine flange and diaphragm.

Recommendation:

- The recommendation from engineering support team, is to adjust this relative rotor to stator position to reduce the risk in axial contact between turbine stator and rotor parts, and to

Inspection Report

improve the turbine rotor seal efficiency, reduce the risk for new turbine disc 2 exposure to higher temperature by replacing both combustor diaphragm ring and turbine flange.

Action:

Combustor is scheduled to replace during MO 60 inspection according to SGT-800 maintenance plan.

Combustor is in serviceable conditions.

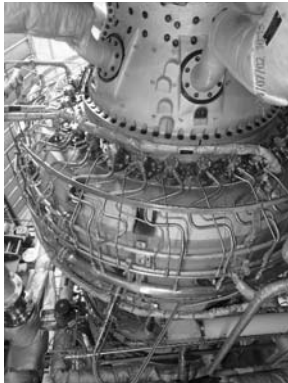
7.19 HG 2540 Fuel burner

Performed work:

- Visual inspection.

Result:

- Minor deformed of outer bellow noticed.
- Fretting at hood sealing and at pilot flame piston ring area.
- Fuel injector burner has been replaced during this MO 60 inspection.
- TBC loss at tip.



Overall burners as found condition before dismantling.



All removal burners as found condition.

Inspection Report



Example condition in main gas fuel port.



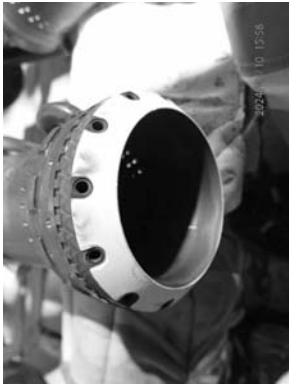
Example of minor deformed on outlet bellow condition.



Example of pilot fuel pipe condition.



Example of fretting at pilot flame piston ring condition.



Example of TBC coating and pilot holes condition.



Example of inside mixing chamber condition.

Inspection Report

Remark	Description
1.	Fretting on hood sealing ring.
2.	Fretting on pilot flame area.
3.	Pilot flame nozzles crack.
4.	Outer bellow deformed.
5.	TBC less at tip.

Fuel burner		Remark						
Burner no	Id no	Previous Id no	1	2	3	4	5	Note
1.	BI2019-15847	2428810-A/C	X	X				
2.	BI2019-15848	2428810-A/C	X	X			X	
3.	BI2019-15869	2428810-A/C	X	X				
4.	BI2019-15840	2428810-A/C	X	X			X	
5.	BI2019-15851	2428810-A/C	X	X				
6.	BI2019-15845	2428810-A/C	X	X				
7.	BI2019-15863	2428810-A/C	X	X				
8.	BI2019-15850	2428810-A/C	X	X				
9.	BI2019-15846	2428810-A/C	X	X				
10.	BI2019-15843	2428810-A/C	X	X				
11.	BI2019-15841	2428810-A/C	X	X				
12.	BI2019-15862	2428810-A/C	X	X				
13.	BI2019-15858	2428810-A/C	X	X			X	
14.	BI2019-15866	2428810-A/C	X	X				
15.	BI2019-15865	2428810-A/C	X	X				
16.	BI2019-15849	2428810-A/C	X	X				
17.	BI2019-15868	2428810-A/C	X	X			X	
18.	BI2019-15867	2428810-A/C	X	X				
19.	BI2019-15860	2428810-A/C	X	X				
20.	BI2019-15856	2428810-A/C	X	X				
21.	BI2019-15857	2428810-A/C	X	X				
22.	BI2019-15864	2428810-A/C	X	X				
23.	BI2019-15861	2428810-A/C	X	X				
24.	BI2019-15855	2428810-A/C	X	X				
25.	BI2019-15852	2428810-A/C	X	X				
26.	BI2019-15844	2428810-A/C	X	X				
27.	BI2019-15859	2428810-A/C	X	X				
28.	BI2019-15842	2428810-A/C	X	X				
29.	BI2019-15853	2428810-A/C	X	X				
30.	BI2019-15854	2428810-A/C	X	X				

Recommendation / Actions:

- Burner replacement according to SGT-800 M0 60 inspection maintenance plan.
- Old set of burners will be sent back to Siemens Energy for further inspection and refurbish.

Inspection Report

7.20 HG 2535 Flame detector

Performed work:
- Visual inspection.

Result:
- No remark.



Flame detector overall condition before dismantling (MBA10CQ0005-left and MBA10CQ010-right).



Flame detector body overall condition.

Recommendation:
- None.

Flame detector is in serviceable conditions.

Inspection Report

7.21 HG 2530 Ignition system

Performed work:
- Visual inspection.

Result:
- Minor fretting found on the tip fitting sphere area.



Ignitor body overall condition.



Condition of fretting at tip area.

Recommendation:
- None.

Inspection Report

7.22 HG 2351 Fuel manifold

Performed work:

- Visual inspection.

Result:

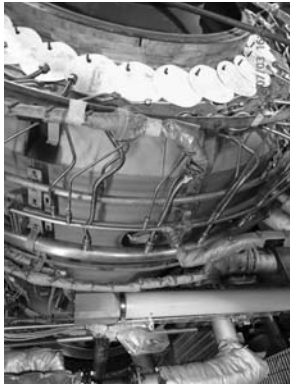
- No remarks.



Main gas fuel supply tie-in overall condition.



Example of flexible hose condition.

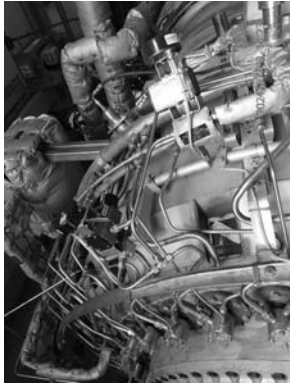


Fuel manifold overall condition.

Recommendation:

- None.

Fuel manifold is in serviceable condition.



Piping from manifold to burners overall condition.

Inspection Report

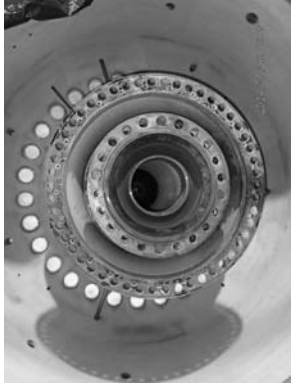
7.23 HG 2510 Central casing

Performed work:

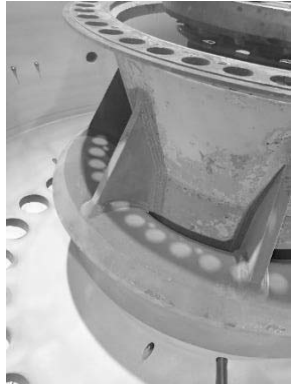
- Visual inspection.

Result:

- Red skin spalling noticed on area around compressor exit flow area.
- Metallization additional coating at the inner of the central casing has been performed by external company (AST Local SE sub-contractor) during this MO 60 inspection.



Central casing overall condition.



Close view on central casing condition.

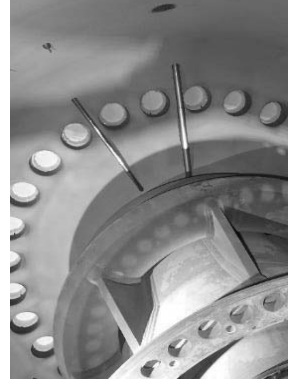


Central casing drain area internal condition.



Central casing inside as found condition.

Inspection Report



Inspection Report



Recommendation:

- None.

Central casing is in serviceable condition.

7.24 HG 2640 Turbine rotor

Performed work:

- Visual inspection for rotor disc stage 1, 2, 3 and Rotor hub.
- Visual inspection for intermediate rings sealing rings between disc 1-2 and 2-3.
- Visual inspection for turbine tie bolts module bolts and turbine nuts.
- Measurement of sealing ring 1-2 turned sealing edges height.

Result:

- Found debris at front of turbine disc 1 cooling entrance to turbine blades 1 and debris has been collected for sampling checked.

Inspection Report

- Found fine dark particles at front of turbine disc 1 blades cooling entrance.
- Found fine dark particles, debris in the root of disc #2 groove.
- Fretting observed on root of TD#2 root and groove.
- Found gap between locking plates and sealing plates of turbine blade stage #1 "X and Y" sides were over than acceptable range.
- Sealing ring 1 has been replaced during this inspection from reason new design, which following to maintenance activity list.



Disc 1 "X" side overall condition.



Disc 1 "Y" side overall condition.



Example of fine dark particles in front of cooling intake to blades "X" side and around the sealing plate "Y" side.



Inspection Report



Sealing ring (Old) between disc 1-2 overall condition.



Close up on sealing ring 1-2 seating slot.



Actual gap at Blade 1 position 2 upstream side.



Gap checked at Blade 1 position 54, upstream side.



Example view for actual gap at Blade 1 position 27 (left) and 52 (right) for downstream side.



Inspection Report



Disc 2 "X" side overall condition.



Disc 2 "Y" side overall condition.



Example view for actual gap at Blade 2 downstream side.



Example view of fir-free condition on Turbine disc#2 and fine dark particles found in the groove.



Inspection Report



Example view for condition on blade root and groove on turbine disc#2.



Sealing ring (Old) between disc 2-3 overall condition.



Close up on sealing ring 2-3 seating slot.



Disc 3 "Y" side overall condition.



Disc 3 "X" side blade tip example condition.

Inspection Report



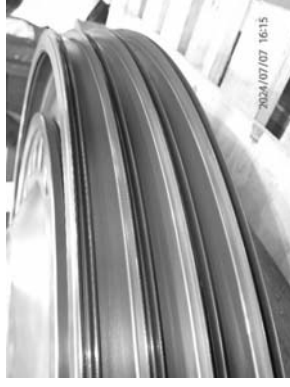
Example view for conditions of Balancing weights on Turbine disc#3.



Rotor hub condition seen from against flow direction.



Caulked sealing edges rotor hub as found condition.



Turned sealing edges rotor hub as found condition.



Tie-bolts overall condition.

Module bolts overall condition.

Recommendation:

- None.

Action:

- All turbine discs and rotor hub are cleaned prior to assembly.
- PT test was performed on rotor hub no indication of crack found.
- NDT test was performed on turbine disc 2 by SE NDT Engineer.

Turbine rotor is in serviceable condition.

Inspection Report

7.25 HG 2642 Turbine blades

Performed work:

- Visual inspection.

Result:

- TBC coating loss condition noticed on leading edge, blades tip and trailing edge and some on trailing edge base platform stage 1.
- Oxidation found on leading edge cooling holes, blade tip and rear platform of turbine blades stage 1.
- Oxidation and discoloration found on Turbine blade stage#2.
- Minor rubbing marks have observed at leading edge tip turbine blade stage 3.
- Turbine blades stage#1 and #2 have been replaced during this MO 60 inspection.



Turbine blade 1 condition "X" side.



Turbine blade 1 condition "Y" side.



Example of blade 1 trailing side overall condition.



Inspection Report



Example view of blade 1 leading side overall condition.



Turbine blade 2 condition before disassembled.



Discoloration on blade 2 leading side overall condition.



Example of blade 2 suction side overall condition.



Example of blade 2 pressure side overall condition.

Inspection Report



Example of internal cooling entrance condition.



Example of blade 2 fir-tree as found conditions.



Example picture on blade 3 tip leading side.



Example picture on blade 3 trailing side.

Recommendation:

- Turbine blades stages 1 and 2 replacements according to SGT-800 C-inspection maintenance plan.
- Follow up the conditions of rubbing marks at TB#3 tip during next inspection.
- Old blades are packed and ready for shipping back to Siemens Energy for further examination.

Turbine blades stage no.1 and no.2 will be replaced as per maintenance plan, turbine blades stage no.3 can return to serviceable condition.

Inspection Report

7.26 HG 2650 Turbine stator stage no 1

Performed work:

- Visual inspection.
- Measurement honeycomb wear on main inner ring and on swirl generator.
- Measurement the orifice diameter of heat shield cooling air supply plug in the guide vane carrier and add 45 deg chamfer of minimum 1 mm. on the outside of orifice.
- B3 Upgraded on some component parts of turbine stator stage 1.

Result:

- Inner/Outer vane plates noticed with TBC coating loss and oxidation/cracks found at the lip of Outer vane plate.
- Minor fretting observed on all inner cooling air pipes fitting diameter and on inner ring.
- Fretting mark noticed on main inner ring at combustor contact surface and wear grooves on honeycomb seal noticed but within inspection criteria.
- Noticed a honeycomb radial wear grooves on swirl generator.
- Split e-seal GV1 stator front found deformation.
- Replacement parts subject to change as according to MO 60 maintenance plan which are, Turbine GV#1, Inner / Outer Vane plate, Heat shield#1 and rear hook#1.



GV1 as found condition before remove.



C&D measurement on GV1 stator and rotor.

Inspection Report



GVI Overall condition before dismantled (left) and after dismantled from gas turbine (right).



Honeycomb wear condition on swirl generation.



Honeycomb wear condition on swirl generation.



Example of cooling pipes overall condition.

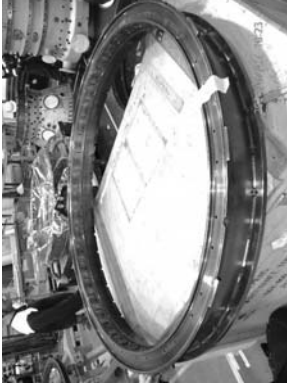


Example of deformed condition found on split e-sealing.

Inspection Report



Overview conditions on Stator ring I.



Overview conditions on GVI carrier.



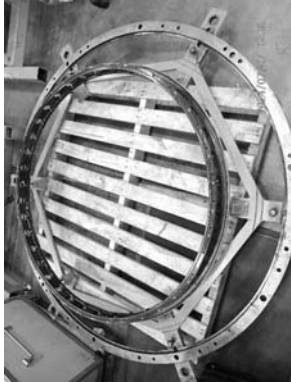
Heatshield I cooling hole overall condition.



Heat shield cooling air supply plug after modified by add 45 deg chamfer.



Inspection Report



Inner guide vane ring overall condition.



Cooling pipe seating slots overall condition.



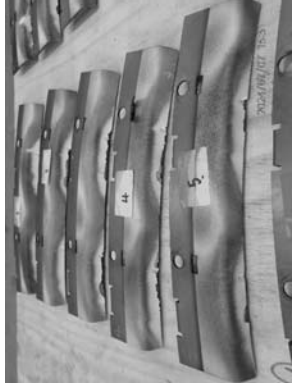
Main inner ring overall condition.



Pretting condition from contact with combustor.



Outer vane plates overall condition.

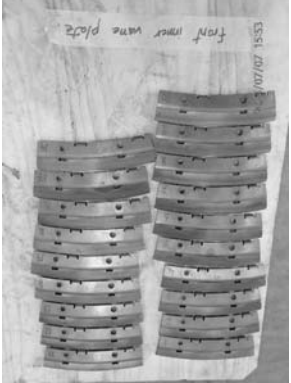


Example of oxidation condition found.

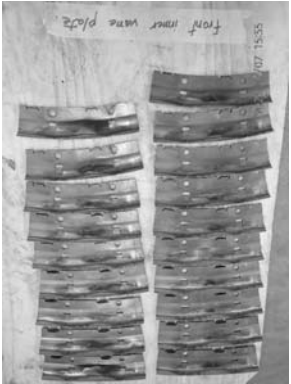
Inspection Report



Front outer segments overall condition.



Inner vane plates overall condition.



Front inner segments overall condition.



Inspection Report



Rear hooks overall condition.



Rear hooks overall condition.



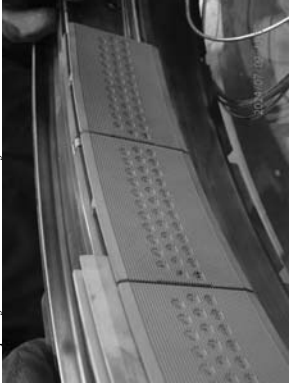
Heatshields 1 overall condition.



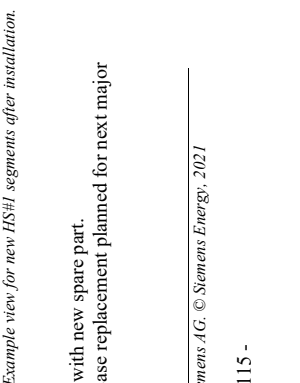
Heatshields 1 overall condition.



Example of back side of heatshield 1.



Example of oxidation and cracks found on HS#1.



Example view for new HS#1 segments after installation.

Recommendation:

- Replace damaged split e-seal GV1 stator front with new spare part.
- Keep new set of Main inner ring for spare, in case replacement planned for next major overhaul.

Inspection Report

- Turbine GV#1, Inner/outer vane plates and HS#1 have been replaced according to SGT-800 MO-60 inspection maintenance plan.

Turbine stator stage no.1 is in serviceable condition.

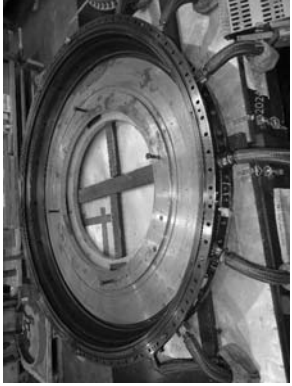
7.27 HG 2651 Turbine stator stage no 2&3

Performed work:

- Visual inspection.

Result:

- Wear grooves on stage 3 heat shield honeycomb observed.
- Fretting observed on GV3 heat shield contact area with outlet casing and worm groove on E-sealing ring seating area.
- Observed minor fretting marks on GV#3 locking ring. Depth of contact marks are measured, and the result is in criteria.
- Observed 2 pieces of GV2 flexible hoses are damaged.
- Observed cracks indication from PT in area of HS#2 slot, about to 28 locations.
- Replacement parts subject to change as according to MO 60 maintenance plan which are, Turbine GV#2 and Heat shield#2.

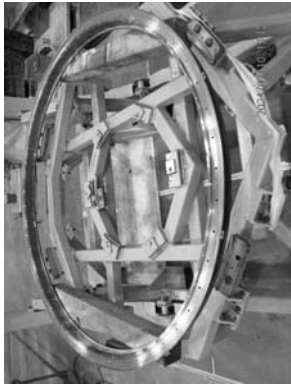


GV2 stator ring overall condition.

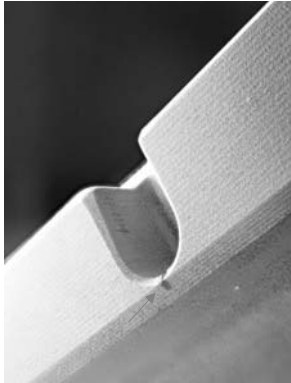


GV2 segments seating slot overall condition.

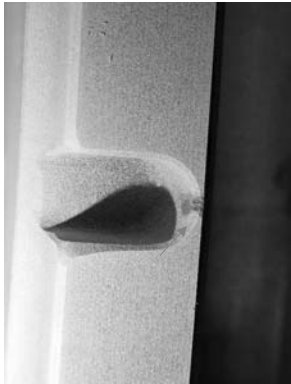
Inspection Report



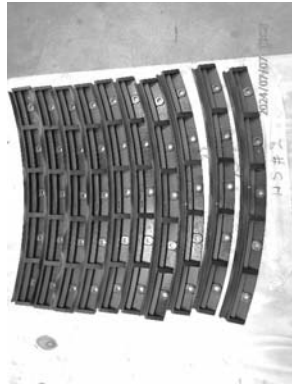
Heatsield carrier ring overall condition.



Cracks found by PT in heatshield lugs seating slot



Another view of cracks in area HS#2 slot.



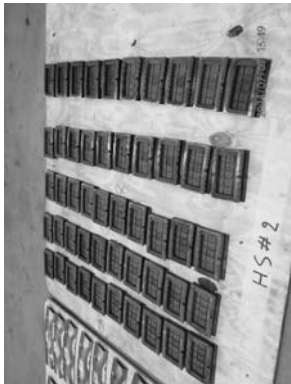
Rear hooks 2 overall condition.



Inspection Report



Overview condition on HS#2.



Example view on GV2 cooling hose, flexible thread damaged (left) and hose deformation (right).



GV3 assembly overall condition against flow direction. Example view on condition of GV3 trailing side.

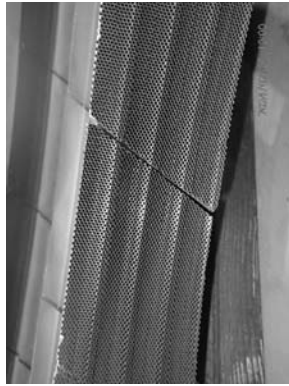
Inspection Report



Example of fretting condition against outlet casing.



Heatshield 3 honeycomb wear groove at outer platform.



Heatshield 3 honeycomb wear groove at inner platform.



Recommendation:

- Replaced new GV#2, HS#2 according to SGT-800 MO60 inspection maintenance plan.
- Replaced GV2 flexible hoses with a new spare set.
- All components will be cleaned prior to assembly.

After B3 upgrade performed, Turbine stator stage no 2&3 are serviceable condition.

7.28 HG 2652 Turbine guide vanes

Performed work:

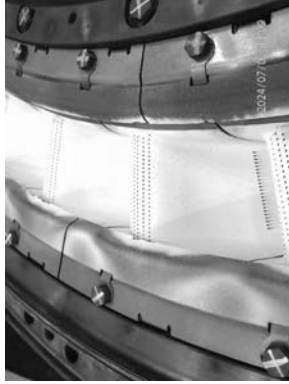
- Visual inspection.

Result:

- Oxidation observed on pressure side of guide vanes stage 1 and inner platform cooling holes leading edge side.
- Oxidation found on leading edge inner platform on guide vanes stage 2.

Inspection Report

- Minor honeycomb seal wear on guide vanes stage 2.
- Dis-coloration found on guide vane stage 3.
- Observed minor contact marks between turbine blade 3 leading edge tip area against GV3 extruded casting area.



Mild oxidation conditions on CV1 pressure side.



Mild oxidation conditions on CV1 suction side (left) and leading side (right).



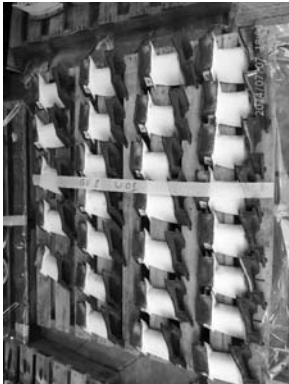
Inspection Report



GV1 cooling pipe slot condition.



Outer platform of GV1 overall condition.



GV2 overall conditions after dismantling.



Example view on GV2 condition before dismantling.



Oxidation noticed on leading edge inner platform of GV42.



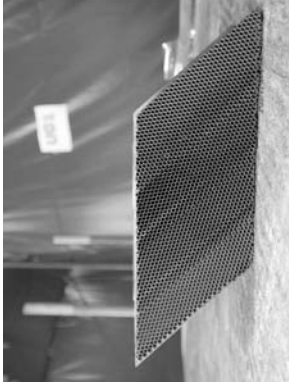
Inspection Report



Example view for GV2 convex side overall condition.



GV2 trailing edge cooling passages overall conditions.



Example of honeycomb wear condition.



GV3 pressure side overall condition.



GV3 leading edges overall condition.

Inspection Report



Minor contact marks found on GV3 extruded casing area.

Recommendation:
- None.

- None.

Turbine casing is in serviceable condition.

7.30 HG 2361 Cooling air manifold

Performed work:
- Visual inspection.

- Performed work:**
- Visual inspection.

Result:
- Found 4 locations

- Found cracks on weld seam of support bracket for cooling air manifold, big square pipe = 4 locations and small square = 3 locations.

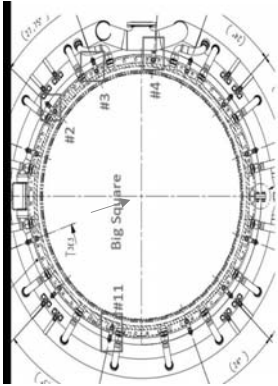


T-bar suspension housing overall condition.

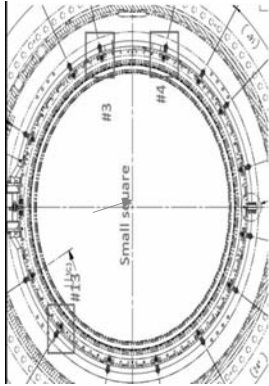


Big round pipe split line flange as found condition.

Inspection Report



Support bracket on big square pipes found broken.



Support bracket on small square pipes found broken.



ESC housing as found conditions.

Recommendation:

- None.

Action:

- Welds repair on support bracket for big square pipes has been performed by SE.

Inspection Report

- Torque corrected on split flange of cooling air manifold to turbine stage#2 has been performed by Siemens Energy.

Cooling air manifolds is in serviceable condition.

7.31 HG 2261 Turbine bearing

Performed work:

- Visual inspection.

Result:

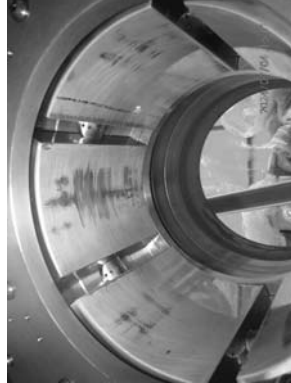
- Light oil varnish film found on all bearing journal pads.



Overall condition on turbine bearing before cleaning.



Jacking oil pad before clean condition.



Radial pad before clean condition.



Jacking oil tube line to bearing2 lower pad condition.

Recommendation / Actions:

- Cleaned oil varnish from bearing surface.

Turbine bearing is in serviceable condition.

Inspection Report

7.32 HG 2665 Outlet casing

Performed work:
- Visual inspection.

Result:

- Missing and loose double nuts found around fabric bellow expansion joint.
- Observed fabric bellow was being damaged several locations, especially on the top side.
- Cracks / Damages found on insulation cassette 4 Pcs., number # 3, #4, #5, #6 (clockwise).
- Fretting found on front lip and wear groove noticed on front L-shape circumference from contact with e-sealing ring.
- Minor contact marks found around outer cone (Big wok).
- Honeycomb minor wear grooves found on Outer sealing ring.
- Minor wear mark on sealing ring 1, 2, 3 area.
- Found E-Seal cracks/ damages.



Outlet casing overall condition before dismantling. Observed double nuts missing and loose around fabric bellow.



Example view on fabric bellow condition.

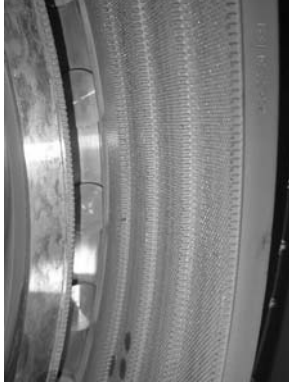


Sealing ring 1,2,3 area overall condition.

Inspection Report



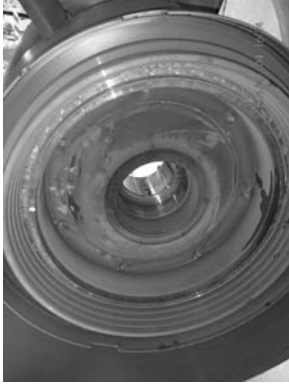
Inner sealing ring honeycomb overall condition.



Outer sealing ring honeycomb overall condition.



Rotor hub sealing area overall condition.



Front lip of outer heatshield overall condition.

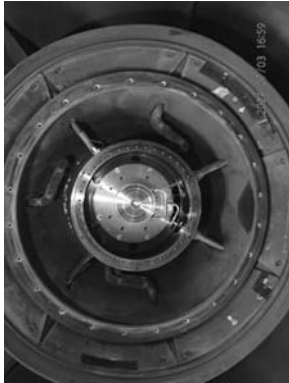


Example of wear groove at front L-shape condition.

Inspection Report



Example of fretting found at front lip area.



Central bearing housing overall condition.



Balancing piston pipes overall condition.



Balancing piston pipes and oil seal pipes



Vibration transducer bearing 2 conditions.

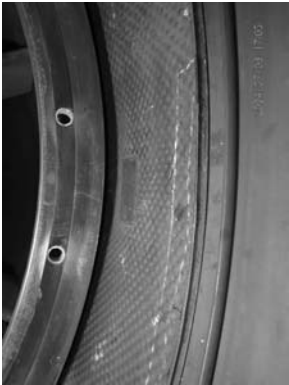


Jacking oil pipes connection ports condition.

Inspection Report



Example view for condition on Insulation cassette from previous repaired at cassette no. 3,4 (clockwise).



Example condition of rear L-shape and heatshield.



Outlet cone overall condition.



Outlet cone overall condition.



Example view for contact marks on outlet cone (Big wok).

Inspection Report



Example of front side exhaust gas channel condition.



Example of bottom struts overall condition.

Recommendation

- Repair outlet casing weld filled in L-profile.
- Replaced all broken / damaged insulation cassettes with new spare part.
- Replace / repair fabric bellow expansion joint.

Actions:

- Repair outlet casing weld filled in L-profile is belonging to customer scope, all repaired methods have been done by customer and complied with Siemens energy instruction.
- Insulation cassettes have been replaced by customer with under supervised from SE Meeh TFA.
- Fabric bellow has been replaced with new spare during this MO60 inspection by customer.

Outlet casing is in serviceable conditions.

7.33 HG 2660 Exhaust diffuser

Performed work:

- Visual inspection.

Result:

- Minor cracks were observed at front and rear support struts of the exhaust diffuser.

Inspection Report



Exhaust diffuser seen against flow direction.



Exhaust diffuser seen follow flow direction.



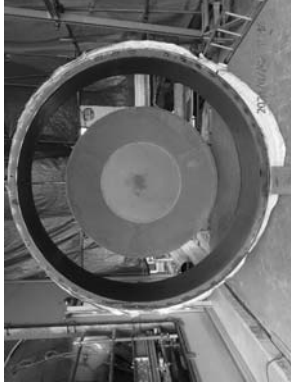
Example view for cracks on weld seam of rear support struts.



Example view for cracks on weld seam of front support struts.



Inspection Report



Intermediate cone overall condition.

Recommendation:

- Perform PT test on welded seams area on support struts to confirm start & end point of cracks before repair.
- Welds repair on exhaust struts is belonging to customer scope, all repaired methods must be complied with Siemens energy instruction.

Action:

- PT test on welded seams area to confirm starting & end point of cracks and weld repair cracks during MO 60 inspection has been performed by customer.

Exhaust casing will be in serviceable conditions after all recommendations have been performed.



Example view for internal wall of intermediate cone.

- Perform PT test on welded seams area on support struts to confirm start & end point of cracks before repair.
- Welds repair on exhaust struts is belonging to customer scope, all repaired methods must be complied with Siemens energy instruction.

Action:

- PT test on welded seams area to confirm starting & end point of cracks and weld repair cracks during MO 60 inspection has been performed by customer.

Exhaust casing will be in serviceable conditions after all recommendations have been performed.

Inspection Report

7.34 HG 2132 Insulation

Performed work:

- Visual inspection.

Result:

- Insulation blanket found damages from operation rubbing against casing due to vibration and heat.
- Insulation found punctured at compressor guide collar area.
- Insulation around bleed air pipes and cooling air pipes found some damages.



Damages insulation after dismantling from gas turbines.

Recommendation:

- For any severely damages insulations, those has been replaced with a new insulation from customer.

After repaired, insulation will return to serviceable condition.

7.35 HG 2920 Skid erection, GT

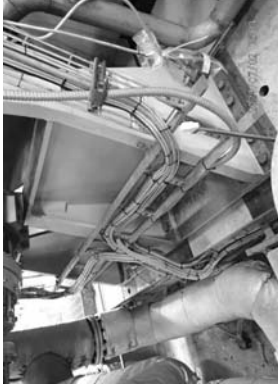
Performed work:

- Visual inspection.

Result:

- No remark.

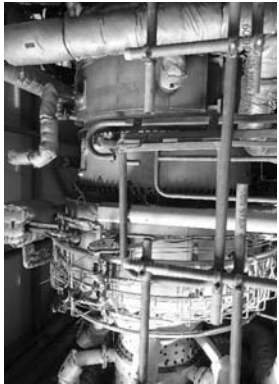
Inspection Report



Inlet piece foundation support overall condition.



Front support condition on the left side.



Right central casing side support condition.



Left central casing side support condition.



Central keys support overall condition.

Recommendation:
- None.

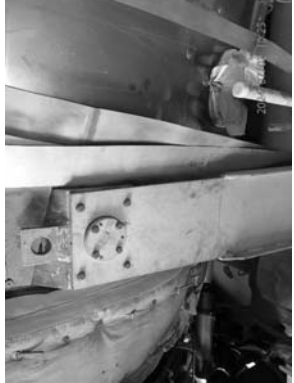
Skid erection, GT is in serviceable condition.

Inspection Report

7.36 HG 2925 Erection, exhaust diffuser

Performed work:
- Visual inspection.

Result:
- No remark.



Left side support connection.



Left side support foundation condition.

Recommendation:
- None.

Erection, exhaust diffuser is in serviceable condition.

Inspection Report

8 Recommendations

HG 4150 Air intake system

- Re-condition for sealant around joints of external wall for intake inlet duct and elbow during next major shutdown opportunity.
- Re-conditions and applied rusty protection on flat bar plate of fabric bellow expansion joints, inlet silencer and support silencer.
- When changing new set of pre-filter element ensure they are properly seal between pre-filter element and housing to prevent any open gap causing small insects, water, and unfiltered air to enter filter housing.
- Clean dust collected at weather louver when replace new pre-filter element.
- Clean dust collected on ventilation filter entrance louvers when replacing ventilation filter element.

HG 4981 Starting gear

- Keep new set on bearing #11, #12 and# 21, # 22 for spare with complete set, in case those pads need to be change in next major shutdown while gearbox inspection.
- Continue to monitor condition of varnish builds up on bearings, shaft journal surface and gears teeth from lube oil sampling analysis result.
- Check condition of varnish builds up on cogs during next inspection. performed oil sampling analysis every six months to keep track of lubrication oil condition.
- Monitor white marks condition during next inspection for any progression or changes of pattern.

HG 4980 Speed reduction gear

- Gearbox casing oil bath has been cleaned before reassembly.
- Keep new set of bearing 21 and 22 pads for spare, in case those pads need to be change in next major shutdown while gearbox inspection.
- Continue to monitor condition of varnish builds up on bearings, shaft journal surface and gears teeth from lube oil sampling analysis result.
- Check condition of varnish builds up on cogs during next inspection. performed oil sampling analysis every six months to keep track of lubrication oil condition.
- Monitor white marks condition during next inspection for any progression or changes of pattern.

HG 2405 Compressor inlet casing

- Clean inside of inlet casing prior to return to operation.
- Remove corrosion found at flexible joint area.
- During alignment checked, foundation support will be re-torquing again.

HG 2410 Compressor inlet piece

- Clean inside inlet piece inner /outer wall and continue to monitor for any traces of water ingress into compressor during each shutdown.
- Check tight mounting flange between inlet piece and inlet casing.

Inspection Report

HG 2241 Compressor bearing

- Keep new set on thrust pads for spare with complete set, in case bearing clearance being enlarged and those pads need to be change in next major overhaul inspection.

HG 2255 Guide vane control

- Guide vane control was removed for cleaning and inspection then overhauled as per MO 60 inspection activity list

HG 2442 Compressor Blades

- Perform compressor wash every 10,000 hours to maintain good compressor efficiency.

HG 2452 Compressor vanes

- Perform compressor wash every 10,000 hours to keep compressor at their best possible performance condition.

HG 2580 Combustor

- The recommendation from engineering support team, is to adjust this relative rotor to stator position to reduce the risk in axial contact between turbine stator and rotor parts, and to improve the turbine rotor seal efficiency, reduce the risk for new turbine disc 2 exposure to higher temperature by replacing both combustor diaphragm ring and turbine flange.

HG 2540 Fuel burner

- Burner replacement according to SGT-800 M0 60 inspection maintenance plan.
- Old set of burners will be sent back to Siemens Energy for further inspection and refurbish.

HG 2642 Turbine blades

- Turbine blades stages 1 and 2 replacements according to SGT-800 C-inspection maintenance plan.
- Follow up the conditions of rubbing marks at TB#3 tip during next inspection.
- Old blades are packed and ready for shipping back to Siemens Energy for further examination.

HG 2650 Turbine stator stage no 1

- Replace damaged split e-seal GV1 stator front with new spare part.
- Keep new set of Main inner ring for spare, incase replacement planned for next major overhaul.
- Turbine GV#1, Inner/outer vane plates and HSh#1 have been replaced according to SGT-800 MO-60 inspection maintenance plan.

HG 2651 Turbine stator stage no 2&3

- Replaced new GV#2, HSh#2 according to SGT-800 MO60 inspection maintenance plan.
- Replaced GV2 flexible hoses with a new spare set.
- All components will be cleaned prior to assembly.

HG 2652 Turbine guide vanes

- Replace turbine guide vanes stage 1, 2 as according to MO 60 inspection maintenance plan.

Inspection Report

HG2261 Turbine bearing

- Cleaned oil varnish from bearing surface.

HG 2665 Outlet casing

- Repair outlet casing weld filled in L-profile.
- Replaced all broken / damaged insulation cassettes with new spare part.
- Replace / repair fabric bellow expansion joint.

HG 2660 Exhaust diffuser

- Perform PT test on welded seams area on support struts to confirm start & end point of cracks before repair.
- Welds repair on exhaust struts is belonging to customer scope, all repaired methods must be complied with Siemens energy instruction.

HG 2132 Insulation

- For any severely damages insulations, those has been replaced with a new insulation from customer.