GENERAL ELECTRIC COMPANY

Post Office Box 1038, Newport News, Virginia

INSTALLATION AND SERVICE ENGINEERING DEPARTMENT

July 8, 1963

Mr. Thornton,
For your files
RMC

Newport News Shipbuilding & Dry Dock Company
Newport News, Virginia

Attention: Ship Repair Department

Subject: SS Esso Gettysburg

Gentlemen:

We are pleased to transmit three (3) copies of Mr. C. A. Driscoll's June 10, 1963 report of his inspections of turbines aboard this ship. Please let us know if you should have any questions relative to this report.

Very truly yours,

H R Burcham

HR BURCHAM:mu

ENGINEER

EXX-MOR-005977

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EXX-MOR-005978

AE-239 (5 sht) (3-60)

GENERAL ELECTRIC

File No.

Place Newport News, Va. Date June 10, 1963

Customer Newport News Shipbuilding & Dry Dock Co. Customer Order No.

Subject SS Esso Gettysburg

Nameplate rating 700, 575, 340 HP DP Turbines

D. W. J. No. | Supervisor's Name C. A. Driscoll

Contract No. | Telegraph address 1821 Canterbury Road

Complaint No. | Mail address Hampton, Virginia

Copies to: R. P. Cheesman, FICH

Mr. H. R. Burcham

I&SE Dept. Newport News, Va. Office

(1) A Yard work order was issued requesting a G. E. repr. to: 1. In-
(2) spect and recommend the necessary repairs to the TTV and operating valves
(3) on the cargo oil pump turbines and ballast pump turbine; 2. Open #3
(4) cargo oil turbine and ballast turbine casing for inspection and repair;
(5) 3. Rebuild #1 BFPT, using a new exhaust casing and original parts from
(6) damaged unit; 4. Open #2 and #3 BFPT casing, inspect and replace parts
(7) as necessary.
(8) TURBINE SER. #112193, 95, 96, 98 & 99
(9) The TTV and operating valves on the above units were opened, in-
(10) spected, tested and repaired. With the coverplates removed, penetrating
(11) oil was applied to the TTV seat and chest bore. After approximately two
(12) hours, an inspection was made to the underside of the chest and it was
(13) found that #1 unit had a slight leak between valve seat and chest bore.
(14) The #2, 3, and 4 units had much larger leakage; also, #2 valve seat
(15) had two cracks across the seating surface. As the vessel had only one
(16) new seat, it was installed in this unit.
(17) After repairs were completed, the cover plates were made up using
(18) a gasket of Klingerit material. This is a special steam gasket material
(19) manufactured in England and used by Esso on all the DP turbine throttle

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continued

EXX-MOR-005979

valve cover plates to prevent steam leakage. (A sample was included in my report of 11/19/62). New bolts were installed in governor plates on #2, 3 and 4 units.

The above is a general outline of the above turbines. The following outlines each turbine stating conditions found and corrections made:

#1 C.O.P.T. Ser. #112195

1. The TTV had wrong nut on cup. end of stem. This was corrected by installing proper nut.
2. Governor stem locked tight to cup valve and stem was bent. Renewed stem and nut.
3. Slight leakage between valve seat and casing bore. No seat available.
4. Baffle plate missing from top of oil strainer. Made and installed new plate.
5. Operating cup valve spring eroded. Installed new spring.
6. The valves were lightly lapped-in to clean valve and seats.
7. The operating oil cylinder assembly cleaned and inspected. New springs should be ordered for all units.
8. Hand speed changer disassembled and cleaned.
9. One-fourth inch pipe nipple cracked on air motor. Installed new nipple.
10. OS trip would not operate at 6900 RPM. Removed .145" from trip.
11. The pin that locks the low oil pressure trip arm to the latch pin was missing, therefore, the turbine oil trip could not operate. Installed new pin. See attached sheets for operation data.

#2 C.O.P.T. Ser. #112196

The valve seat was found to leak and two cracks were noted across

continued

EXX-MOR-005980

seating area. The seat was packed with dry ice and removed by a jack bolt and plate fastened to operating end of chest. The old seat was checked with micrometers at eight (8) places and found to be round, and the diameter was 4.4995".

The chest bore was checked using the same micrometers and found to be 4.999" diameter. This results in only a .0005" interference fit. The new seat diameter = 4.503". This results in an interference fit of .0035".

The new seat was cooled using liquid nitrogen and installed. A jack plate was used to hold the seat down in chest bore to prevent cocking and rising. After seat had expanded, a micrometer check was made from top of chest to top of seat and at 3 and 6 o'clock measurement = 5.058"; at 9 and 12 o'clock = 5.059". A new operating cup valve, stem, nut and spring was installed.

The threads were found stripped in the cover plate mounting holes for the operating cylinder. The plate was sent to R. M. shop, holes welded, redrilled and tapped.

Oil operating cylinder opened and cleaned. The spring, pt. 89, on Dwg. 81C1725 found very pitted and eroded, and ship should order new springs. See attached sheets for operation.

#3 C.G.P.T. Ser. #112198

The TTV, turbine and gear casing were opened for inspection and the following conditions noted:

1. TTV cup had approximately 1/4" movement between stem and cup. Installed new stem and nut.

2. The HP end journal was found ridged and undersize .012". Micrometer

continued

EXX-MOR-005981

measurement 2.487 to 2.489".

3. The center or second ring of carbon packing journal had worn an elliptical undercut approximately 1/3 the shaft circumference.

4. The outside fit had a slight undercut in the same axial plane approx. .007" to .010" deep.

5. All three rings of carbon packing found broken and frozen in packing box. The box fits had a heavy deposit of built up rust. This was removed by hand scraping and machine wire brushing.

6. The first stage nozzle and intermediates are badly eroded and new parts should be ordered and installed at next availability.

7. Water was found approximately 3/4" deep in exhaust casing. It is requested that the factory check their drain connection drawings and, if possible, relocate this drain from its present location in the vertical wall to the bottom of casing, thereby eliminating this condition.

The rotor was removed to RM shop, cleaned and the bearing journals were chrome plated. The packing journals were metal sprayed and journals machined to original size and rotor balanced. Rotor was landed in casing new journal and thrust bearing installed and clearances checked. Also, the turbine-to-gear alignment was checked and clearances are shown on attached sheet.

GEAR

The gear casing was opened, high speed pinion and oil pan removed to clean sump tank. Approximately 1" of oil sludge and water remained in the gear casing. The ship's crew, when changing oil, drained the tank using the drain valve that is provided, then refilling sump with new oil.

continued

As can be noted, the part that needs cleaning is left unattended. It is this writer's opinion that hand hole cover plates should be provided to allow access to the sump tank. Also, the drain valve should be in the bottom tank and not on the vertical wall. Mr. John Ireland, port engineer, and ship's crew also expressed the same opinion on the above condition.

The pinion and gear bearings were checked and found satisfactory. Clearances shown on attached sheet.

8. The oil line from the LO cooler to the low oil trip was found rusted out completely in two places approximately 6" apart. In removing this line it crumbled into three sections. The Yard did not have the steel tubing, therefore, copper tubing was used as a substitute for repairs.

9. The overspeed trip would close throttle at 5500 RPM. It was necessary to add a .125" spacer to trip in order to perform satisfactorily.

10. Excessive steam leakage at the valve stem leak-off drains. New bushings required on all units.

#4 C.O.P.T. Ser. #112199

The trip throttle valve seat was found to leak as described earlier in this report but no new seat was available at this overhaul. The upper bushing was missing from the cover plate on operating valve. A new bushing assembly was installed. The governor stem and spring were renewed. The stem was found bent and grooved.

BALLAST TURBINE Ser. #112193

The upper half of turbine casing was removed along with rotor. The conditions found were as follows:

1. The exhaust casing at coupling end was bowed approximately 3/16".

continued

2. The low pressure end packing box was cracked on the lower section. This crack is located just forward of the casing fit and extends from horizontal joint down approximately 2" on each side. The box was sent to RM shop and repaired by brazing and remachining.

3. Nozzle and intermediates in very poor condition and should be replaced as soon as possible.

4. Carbon packing rings broken and frozen in box.

5. The HP end bearing journals .012" undersize.

The rotor was sent to shop and cleaned, chrome plated HP and LP end bearing journals, polished carbon packing fits, and rotor balanced.

When the rotor was returned to ship, I rechecked bearing and packing fits and found the shop had machined the LP fits down to 2.490". This, they stated, was necessary to round journals. I miked all journals before sending to shop and sizes are as follows:

HP bearing journal 2.488" LP 2.4985".

HP end packing journals 2.498" at 3 places along shaft.

LP end packing journals 2.498" at 3 places along shaft.

After rotor return, the HP end 2.495" to 2.496" and low pressure end 2.490". It was therefore necessary to hand fit all carbon rings to provide a .008" to .015" clearance.

BEARING BRACKET

Due to the distorted casing, it was necessary to add a .020" shim to the lower bearing bracket to provide suitable bearing to journal contact. Rotor was landed on new bearings and a new thrust plate installed. Wheel clearances were checked and are shown on attached sheet.

A new operating cup valve was installed as old cup badly pitted and lip heavily chipped.

continued

One 3/4" socket tap bolt in the operating valve plate was found broken off. This was drilled and tapped using the cover plate and a drill busing as a guide. The overspeed would not operate at 115% rated speed. It was necessary to remove .075" spacer from trip.

This concludes the trials and tribulations on the above machines. There are two suggestions I might add that could be included in the Instruction Book:

1. A sketch showing clearance between the operating valve stem and the underside of the valve. It seems the nuts are tightened against the cup, locking the cup valve to stem.

2. A sketch showing the intermediate blade bolting as there are three different combinations that can be used.

<u>BALLAST TURBINE</u>

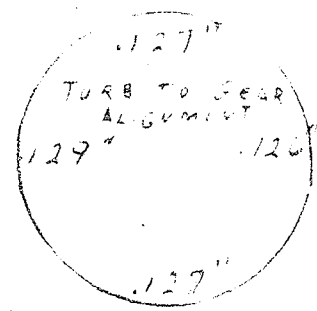
	BRG.	JOURNALS	PACKING FITS	PACKING
HP End	New	2.4985"	2.495"	2.508
LP END	New	2.4995"	2.490"	2.500"
Thrust	.014"			
Nozzle	.060"			
N	.045"			
R	.066"			
S	.073"			

continued

#3 C.O.P.T. CLEARANCE TURBINE SER.#112198

	Pinion Brg.	Journal	Gear Brg.	Journal
Turb. End	2.506"	3.4995"	4.0065"	3.999"
Pump End	2.505"	3.4995"	4.006"	3.999"

Gear Thrust	.008"
Thrust	.007"
Nozzle	.038"
N	.060"
R	.060"
S	.059"
Carbon Packing journals	2.998"
Packing	3.012"



TURB. TO GEAR TO PINION

CARGO AND BALLAST TURBINE OPERATIONS

Turb. & Pump No.	R.P.M.	Steam PSIG	EXH.	SUCT.	DISC.	SS Press.	GEAR OIL PSIG	GEAR OIL F	TURB. OIL PSIG	TURB. OIL F
T1 12195	6000	535	15"	2"	140	2	10	110	10	110
P-1	1850	800								
T1 12196	6000	535	30	12	145	2	10	100	11	95
P-2	1850	800								
T1 12198	6000	535	35	2	140	2	10	110	10	110
P-3	1850	800								
T1 12199	6000	535	20	2	140	2	10	100	10	100
P-4	1850	800								
T1 12193	1775	535	37#	6	100	-	-	-	8	110
Ballast	1775	800								

Unit No.	1	2	3	4	Ballast
Overspeed Trip	6525	6550	6450	6550	1975
[redacted]					
High Speed Step	6000	6000	6000	6000	1775
Disch. Relief Valve		150			125
Turb. Oil Trip Speed	720	700	725	675	650
Gear Oil Trip Speed	700	675	700	700	-
Brg.Oil Press. at trip	2	2	3	2.5	2
Gear Oil Press. at trip	5	5	5	5	-
Air Press.	13	12.5	13	12.5	12
Does Turb. step by TTV	Yes	Yes	No	No	Yes
L. S. Step Turb.		4700		4450	
L. S. Step Pump		1450		1350	

#1 B.F.P. TURBINE, S/N 112187

The turbine was removed from its storage aboard ship to the RM Shop. There it was completely dismanteld and rebuilt using a new exhaust casing and parts are listed on attached sheet.

The trip throttle valve seat was found to leak under a 65# air and water test. The seat was removed and both seat and casing bores were checked at six places. Results are shown at end of report.

The chest was welded and remachined to 4.500" and a new seat installed with a .00375" interference fit. Seat tested and found satisfactory. Clearances were checked, unit completely assembled and installed aboard ship and aligned to pump. Results are shown below.

The unit was started and overspeed trip tested and operated 5200 RPM. The coupling made up and unit put on line feeding the boiler at a discharge pressure of 950# at 3750 RPM, and allowed to operate for approximately 12 hours.

In shifting load from #1 to #3 unit, the operating cup valve was noted to stick and hang open, preventing governing of turbine.

The cup valve was removed and impression markings of the ring guide and supports could be noted. The cup was hand polished and checked with micrometers and diameter was found to be 2.438".

The unit was assembled and after five minutes of operation, the cup valve would stick and not respond to the hand speed or air motor. The cup valve was then sent to the Yard tool makers shop and the inside diameter was increased .004". This eliminated all sticking and resulted in smooth operation on both the hand speed changer and air motor controls.

continued

EXX-MOR-005987

Note: I would appreciate the factory comments on whether the thermal/expansion between a new seat and an old cup valve would result in the above condition. The TTV cup being new operated satisfactorily on the new seat.

CLEARANCES

Old seat 4.5025 at 6 places

New seat 4.50375

Chest Bore 4.500-4.501 welded due to steam cut and remachined to 4.500

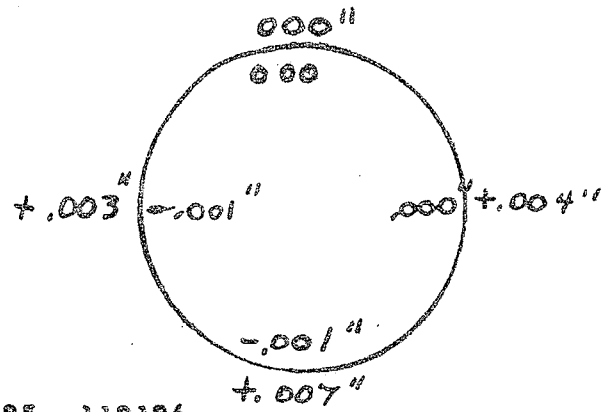
Carbon Packing Journals - Coupling end 2.492, Governor end 2.495

Bearing Journals 2.498

Overspeed trip 5200

Total float	.078
Nozzle	.039
Thrust	.011
N	.039
E	.050
S	.057

TURBINE TO PUMP ALIGNMENT



BFP TURBINES S/N 112185, 112186

The turbine casings were opened and roters removed for inspection.

1. Nozzle plates were found in very poor condition. New nozzles installed.

2. Intermediates were found in fair condition--slight cutting has started across blade ring. (No new intermediates available)

3. Bearing journals undersize and scarred on #2 unit. Roter sent to shop; cleaned, chrome plated journals, machined and balanced.

continued

EXX-MOR-005988

Journals on #3 unit satisfactory. The rotors were landed on new bearings and thrust. Four rings of carbon packing installed in each box instead of three as requested by Mr. Ireland.

Clearances checked and are shown on attached sheets.

4. The oil governor and lube oil cooler removed and cleaned. The coolers were tested for leakage and found satisfactory.

5. New diaphragm assemblies installed in hand speed changer.

OPERATION

Units were started and overspeed trip tested and found satisfactory. Due to the original over capacity of the pumps, the turbines must be operated very near the LS stop. At 3750 RPM, the pump discharge is 950#; therefore, the high speed stop must be set to limit the hand speed changer to approximately 3/4 of a turn.

The vessel departed from local yard on June 6, 1963.

112186

Thrust .015

Nozzle .040

N .040

R .052

S .076

HP Bearing Journal 2.500

LP Bearing Journal 2.500

Carbon Packing fits 2.498-2.499 Packing 2.509-2.511

OS Trip 5200

continued

EXX-MOR-005989

112185

Thrust .010

Nozzle .030

N .040

R .058

S .070

HP End Bearing 2.506 Journal 2.4985 Installed new bearings in
LP End Bearing 2.509 " 2.497 HP & LP end.
Overspeed trip 5250

C. A. Driscoll