

Elliott

Form 1158 (1/82)

TRIP OR CONFERENCE REPORT

RECEIVED
JUL 29 1991
ELLIOTT CO.

COMPANY VISITED MARATHON OIL		S.O. NO. 7339R1	
OBJECT OF TRIP OR CONFERENCE OBSERVE TURBINE SPEED VARIATION AND TROUBLE SHOOT AS REQUIRED		G.O. NO.	
DATE(S) OF CONFERENCE JULY 15-16, 1991			
LOCATION OF CONFERENCE ROBINSON, IL		EXPENSE ACCOUNT NO.	
PURCHASER MARATHON OIL		DATE OF REPORT JULY 23, 1991	
USER MARATHON OIL		REPORTED BY WILLIAM G. PACELLI	
ENGINEERING CONTRACTOR			
ATTENDANCE - ELLIOTT WILLIAM G. PACELLI SERVICE ENGINEER		MAILED TO MR. GEORGE MCPHEE (A) E. CHICAGO	
ATTENDANCE - OTHERS MARATHON MR. TED STONE MAINTENANCE FOREMAN MR. ALBERT MINNICK MAINTENANCE SUPERVISOR WOODWARD GOVERNOR MR. ERIC JUNGEN FIELD SERVICE ENGINEER		MR. JACK BEHL (B) DONORA MR. RALPH HERSH (B) POWERTECH HOBART, INDIAN, MR. DAN KELSO (B) DONORA MR. CHUCK ORBON (B) E. CHICAGO MR. BOB SLOBODA (B) 62-10 MR. ALEX RIDDEL (C) 62-4 ROUTE: 1. DAN BARRETT 2. ALLAN HESH 3. JOE HORNYAK 4. FILE (7339)	
RECOMMENDED ACTION SEE REPORT		A - Action Necessary B - Contents Essential C - Information Only	

Exhibit
Pacelli 2

SC-ETM-4765

MARATHON OIL
ROBINSON, ILLINOIS
S.O. 7339

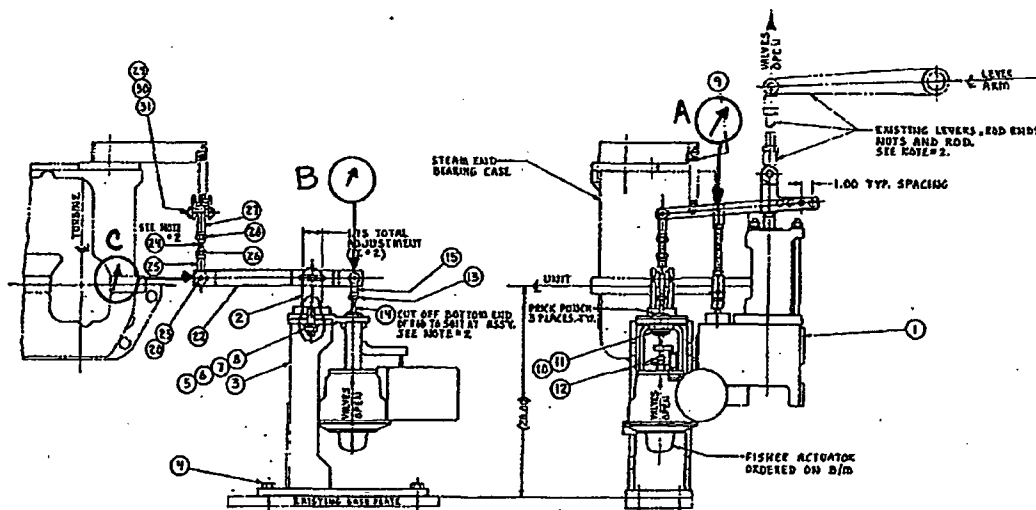
Background

The subject unit is an SQV7-6, S.O. 7339R1, and drives two Dresser Rand (Clark Brothers) compressors. The drive-through compressor is a 3M 3-stage compressor S/N 3-3-248. The outboard compressor is a 2M 6-stage unit S/N 2-6-249. The string was rerated and converted to an electronic governor in the Spring of 1988. The unit had run well until late June when a thrust bearing failure occurred. The governor control had been deteriorating prior to the failure.

During the outage work was done to the valve rack, servo motor, and the governor (see A. Hurt's report dated 6/30/91). These changes had resulted in stable operation at all but one point. At 81 percent valve opening the speed would start varying approximately 100 rpm. Marathon requested a Service Engineer to trouble shoot the problem and advise what changes could be made to improve the system.

Site Visit

After arrival at site and meeting with Messrs. Stone and Jungen, proceeded up to the unit. Three dial indicators were obtained and mounted to monitor various parts of the servo motor linkage. The locations are as indicated below:



A visual inspection of the unit uncovered the following items:

- 1) The Fisher actuator has been replaced with a size 25 Valtek actuator with a pneumatic positioner. The governor signal was converted to pressure by a Fisher Type 546 I/P. The output of the I/P is taken back to the control panel to an automatic-manual station then to the positioner.
- 2) The left side torque shaft bracket has been welded multiple times.
- 3) The right lift rod lever arm is approximately 1 degree higher than the left lift rod. This corresponds to 1/8 inch at the lift rod pins.
- 4) The right lift rod linkage is out of plumb by approximately 1/16".
- 5) The linkage between the actuator and servo motor appears to be free and easily moved. No wear or burrs are evident.

Operations lowered the speed of the unit to get the unstable region of operation. This region was entered several times. Each with a duration of 4-6 cycles then the unit would stabilize out. Each cycle lasted approximately 5 seconds with speed changes of about 50 rpm. During each cycle the dial indicators cycled as follows:

DIAL INDICATOR	TIR RANGE (MILS)
A	98 - 01
B	95 - 04
C	96 - 98

The indicator movement was steady and smooth (other than the inherent vibration). No sticking or binding was found.

A visual inspection of the valve rack on the steam chest showed binding was evident on the right assembly as the governor opened the valves. The left assembly would move very smooth and steady. The right portion would move very little, then stick and suddenly break free. The same occurrence was present in the downward stroke. This action was repeated in each cycle. Placing a screw driver in the linkage indicated as much as 1/8 inch lost motion in the linkage. The Woodward 505 operation was satisfactory and allowed a normal variance of 3-4 rpm.

Discussion

At Mr. Stone's request, a list of observations and recommendations was developed (see Attachment 1). This list was reviewed with Messrs. Stone and Minnick. Mr. Minnick indicated that new Torrington needle bearings had been ordered for the torque shaft. Other items that may be contributing to the problem is the packing and valve orientation. Mr. Stone indicated in a cold position on the work bench, the valve rack assembly moved freely with no binding or hesitation. Also the valve packing had been changed during the rebuild and replaced with Graphoil type packing. I suggested that if a millwright was available we could try to adjust the packing while the unit was on line. Mr. Stone did not think this would help due to the looseness in the linkage.

Marathon had also suggested that the hunting point was where the number 6 valve was previously seen fluctuating between 150 psig and 250 psig during the heavy swings. With the rerate, all valves were changed to 1-1/16" size. If the valve position was the problem similar occurrences should take place when each valve is opening. This has not been noted. Mr. Stone noted the unit had not run at this higher level in the past. Plant production is increasing monthly.

Action Items

- Pacelli
to send
reading to
C.O. to quote
price/del.*
- from M.W.S*
- 1) Elliott to quote oversize pins to tighten up linkage to reduce binding and lost motion. Marathon to ream holes in linkage to Elliott supplied dimensions. Action: Pacelli/McPhee
 - 2) Marathon to order replacement parts as required to rebuild steam chest assembly to original design. Action: Marathon
 - 3) Marathon to advise if quotation is required to replace entire steam chest assembly with current design. Action: Marathon
 - 4) Elliott to review and comment on relocation of Valtek actuator to be in line with servo motor thus eliminating excessive linkage. Action: McPhee to enter engineering study.
- Contact
Alex P. Padden
what's it going
to take -*

Other items were discussed on this unit and other Elliott equipment.

- A) The rotor removed from 7339R1 during the recent shutdown is boxed and ready for shipment to Elliott. The 4th and 5th stage have a light gray buildup on the disk, blading, and shroud. This buildup was thought to have caused the thrust failure. A problem with this rotor is a different OD of the shaft at the thrust collar disk. This was done by a non-Elliott shop and documented by Donora in 1988. Marathon requests a part number to purchase a thrust collar by.

Action: Elliott to generate appropriate drawings to cover assembly with thrust collar - Pacelli

- B) With the increased first stage pressure as a result of the rerate (210 psia vs. 174 psia) there is more steam leakage from the first stage packing case. Marathon has considered replacing the carbon seal with a John Crane gas face seal. They also want to look at labyrinths similar to other Elliott turbines.

*Alay
R date 1*

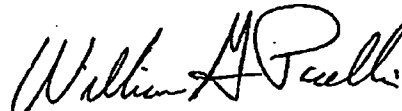
Action: Elliott to review design and determine if sufficient room exists for labyrinth quote if possible. G. McPhee to enter quotation study (DMS 92-092822 entered).

- C) Approximately two months ago a Western Gear gearset was sent to Elliott-Chicago for submerged arc weld repair to the journals. Mr. Stone believes this is now in Donora and would like a status update.

Action: G. McPhee to advise status of gear repair to Mr. Stone.

*sent to
G. McPhee 9/3/77
MS
C. ant*

- D) Marathon has been working closely with John Crane on installation of gas face seals on rotating equipment. One converted unit is a BYRH driving a cooling tower pump. The seal currently installed is a third generation seal and has been operating satisfactory.


William G. Pacelli

WGP/kl

MARATHON OIL
ROBINSON, ILLINOIS
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Observation

- 1) Speed variation exhibited is approximately 50 rpm with current system.
- 2) Dial indicators mounted in the following locations:
 - A) Actuator vertical travel.
 - B) Actuator lever horizontal travel.
 - C) Pilot valve vertical travel.

Do not indicate any binding or sticking linkages are present. Movements are clean and exhibit no discontinuities.

- 3) The lift bar level on the left (when viewed from the steam end) of the steam chest is approximately 1/4 inch below that on the right.
- 4) The clevis connecting the lift bar lever on the right to the right hand lift rod is out of line by 1/16 inch.
- 5) Torque arm bearings (originally needle bearings) are now oilite bearings. No provisions to lube bearings have been installed.
- 6) In the hunt cycle, the right clevis assembly appears to be hanging up. A jerky movement is present in both directions indicating a binding is occurring. This problem is out of phase with speed. As the speed is decreasing the normal motion is to open the valve rack to supply steam. The left side of the valve rack is lifting. The right side does not lift smoothly but lifts 1/16 inch abruptly.
- 7) There does not appear to be a problem with the Woodward 505 governor.

Recommendations

- 1) The lift rod shaft must be replaced to align the right lift bar lever to the left lift bar lever.
- 2) The lift bar lever on the left side should be aligned with the lift rod.
- 3) A grease fitting should be added to each oilite bearing.
- 4) The pins on the left side lift rod assembly must be removed, inspected, and replaced. As a short term repair, the holes can be redrilled and reamed with oversize pins installed.
- 5) Each lift rod must be removed, checked for wear, bending, buildup and replaced if required. Bushings in the steam chest cover must be inspected and replaced if required.

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- 6) For long term consideration a new steam chest cover may be considered to bring to up to date standards.
- 7) When work is complete hysteresis curves must be done on actuator and valve rack.
- 8) Long Term - Review movement of pneumatic actuator to eliminate some linkage.
- 9) Elliott to provide part numbers on thrust collar assembly of original rotor.

William G. Pacelli
July 15, 1991

(2917K)