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CIRCULATING WATER PUMP TURNKEY EMERGENCY REPAIR CASE NO AP-321

Chas G Allen received an emergency request to repair a Johnston Model 58KLC-1, rated 58,000GPM @ 46'TDH. The unit provides cooling water to a 550 Mw combine cycle station. CGA received the call from the plant on Sunday to evaluate the unit and found that the shaft had broken internally. As a turnkey service CGA provide field personnel to remove the equipment on a 24/7 basis. The unit was transported to our service center, disassembled and evaluated for a corrective action plan. The internal shaft coupling had fracture and caused the unit failure. A new coupling was manufacture and the pump was reinstalled at the site within six 6 days of the initial call. The following pages include the opening inspection and final report of the project.

GENERAL OBSERVATIONS

FIELD 9/28-9/29

- Coupling gap after removing bolting 3/8" (Std. 5/8" off bottom)
- Note the pump shaft could be turn by hand, which should have had a weight of 3,100 Lbs as an assemble indicating a fracture
- The motor support was previously shimmed for alignment, indicating the discharge head needs to machine with the stuffing/bearing
- One discharge head stud under the flange in restricted clearance area had to be cutoff to facilitate removal

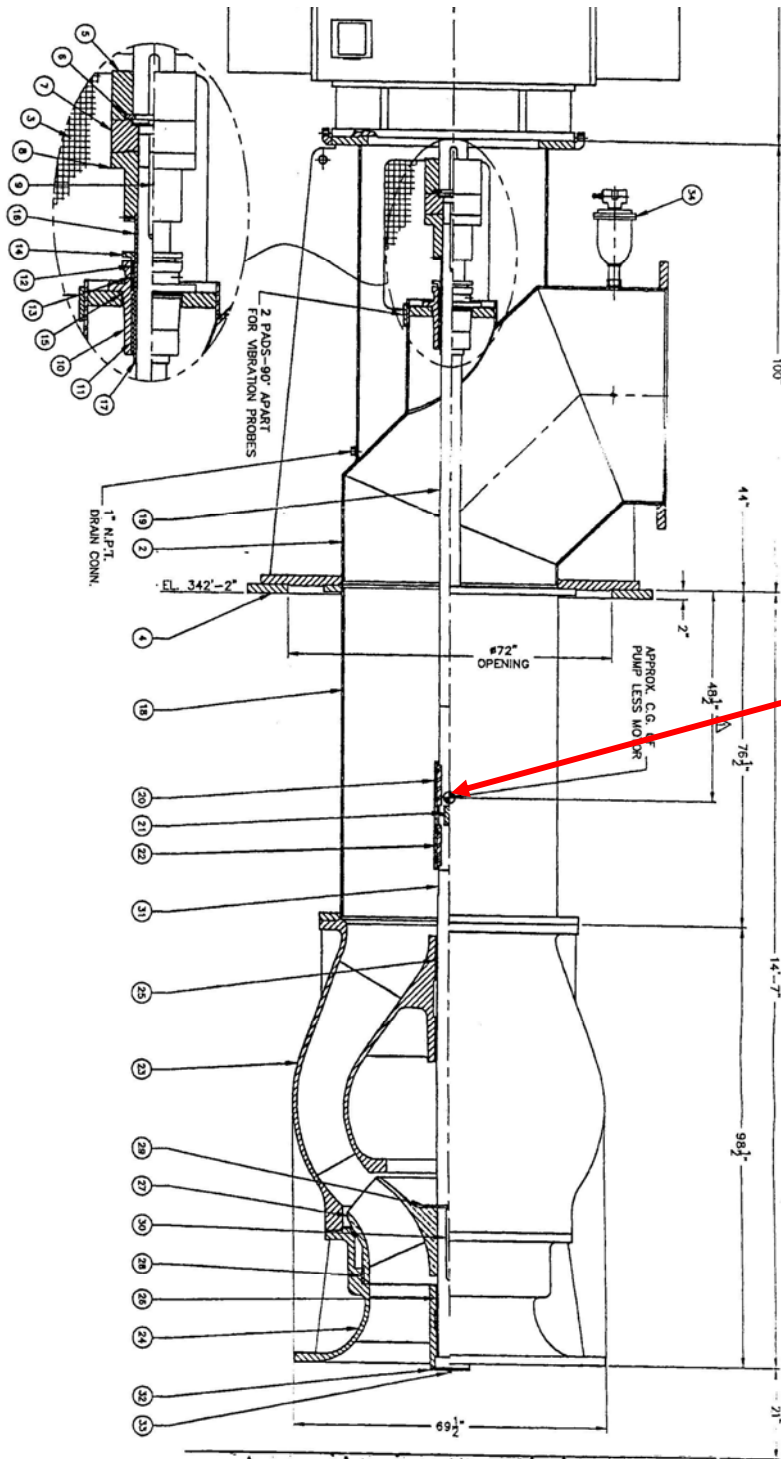
SERVICE CENTER

- #2 Discharge Head-Motor mount out of perpendicularity with the stuffing box bore
- #8 Pump Adjusting Coupling-Good Condition
- #10 Packing Box – blast clean, recoat, good condition
- #11 Packing Box Bearing - .013" clearance, good condition
- #16 Head Shaft Sleeve-Worn 1/6"-1/8" deep from packing, replace in 416SS HT
- #18 Column Pipe-Good condition clean and recoat
- #19 Lower Head Shaft- .002" TIR Good Condition for one cycle
- #20 Shaft Coupling-Fracture, replace new in 416SS, with upgrades
- #23 Discharge Bowl-Good condition clean and reuse
- #24 Suction Bell-Good condition clean and reuse
- #25 Bearing Discharge Bowl-.014" clearance, clean and reuse
- #26 Bearing-Suction Bell-.012" clearance, clean and reuse
- #27 Impeller-Good condition, minor nicks an dents from contact with coupling parts
- #28 Seal Ring Impeller-Clearance to suction bell
- #31 Pump Shaft- .002" TIR Good Condition for one cycle

Engineered Pump Division
Service, Parts and Repairs

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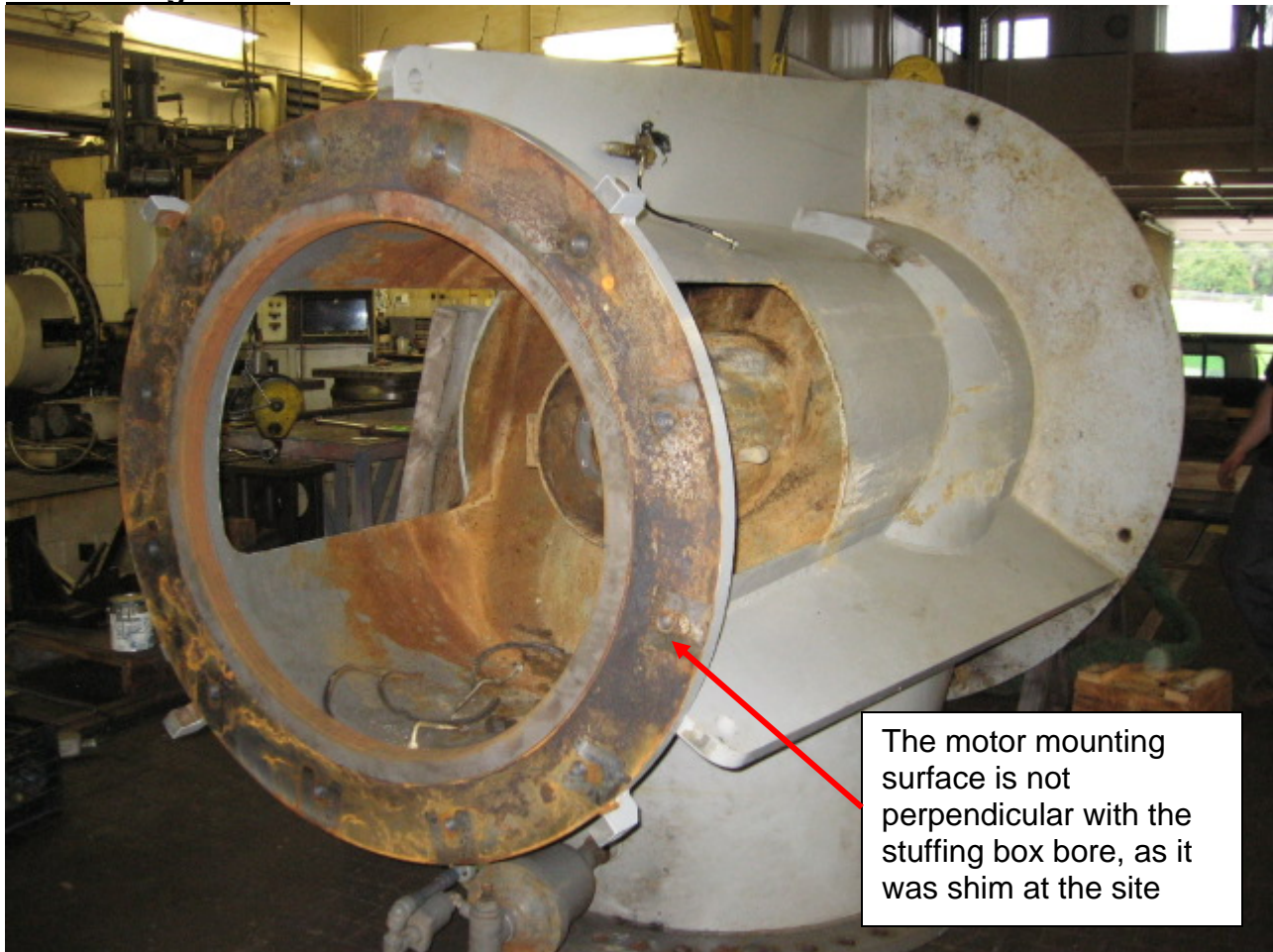
Gary A. Boudreau
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Internal Shaft coupling fracture at keyway



#2 Discharge Head



Recommendations:

- Setup the discharge head in a vertical turret lathe and machine the motor mounting surface to be perpendicular with the stuffing bore.

Note - Not an option at this time due to time constants

- Brush blast to achieve surface profile for epoxy coating
- Coat the interior with Devtar 5A Grey
- Coat exterior with Sherman Williams – Battle Ship Grey

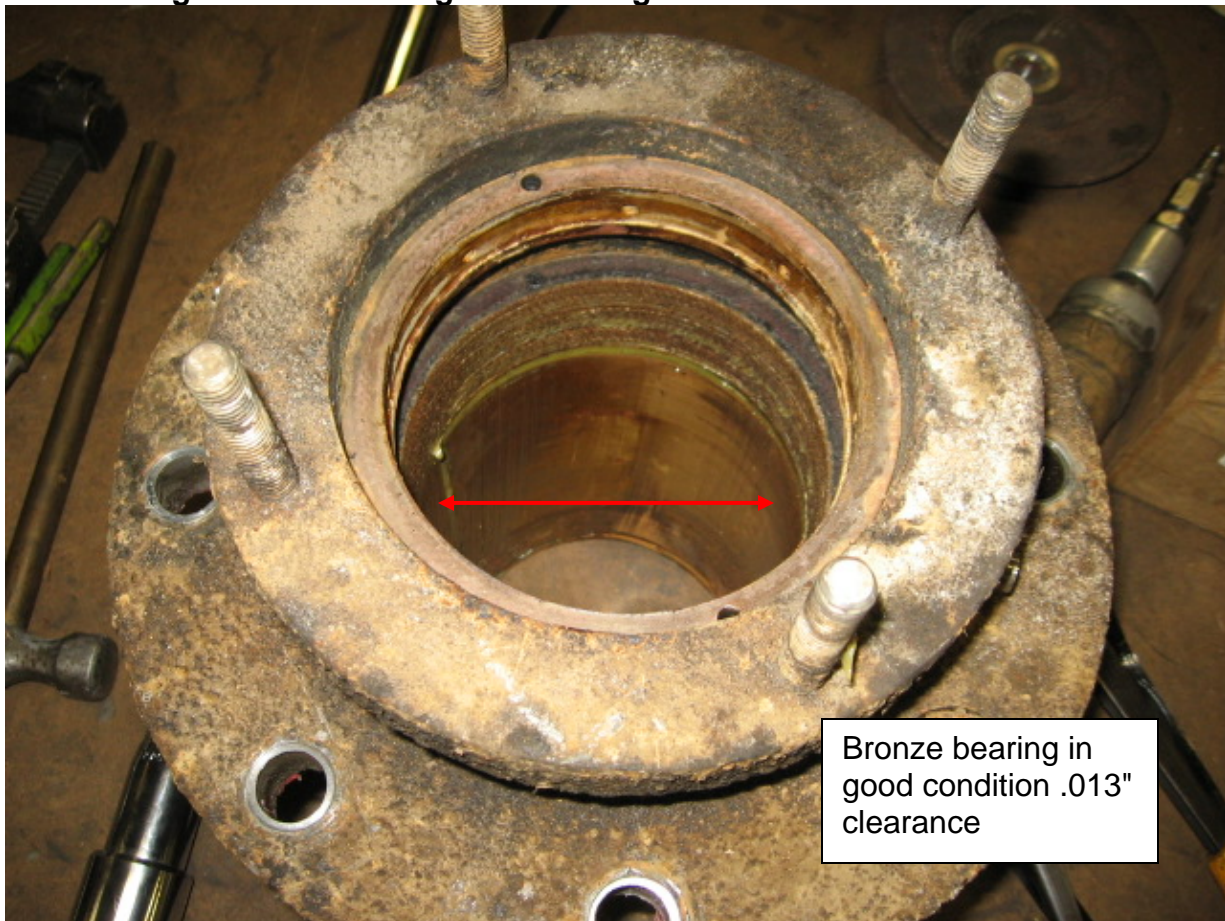
#8 Pump Adjusting Coupling

In good condition, rust build on surfaces

Recommendations:

- Clean and stone all mating surfaces
- Install on shaft and check for proper fit

#10 Packing Box/#11 Packing Box Bearing



Recommendations:

- Sandblast to near white metal
- Furnish new packing
- Coat exterior surfaces with Devtar 5A Grey

#16 Head Shaft Sleeve-Grooved form the packing



Recommendation:

- Furnish a new head shaft sleeve in 416SS
- Add three dog point set screws to hold sleeve in place
- Furnish a new Buna-N O-Ring

#18 Column Pipe

Recommendations:

- Brush blast to achieve surface profile for epoxy coating
- Coat the interior and exterior with Devtar 5A Grey

#19 Lower Head Shaft-TIR.002", some pitting and corrosion at journal

Recommendations:

- Hand clean by mechanical methods
- Verify shaft runs outs. TIR not to exceed .001" per foot, max .006" total

#20 Shaft Coupling

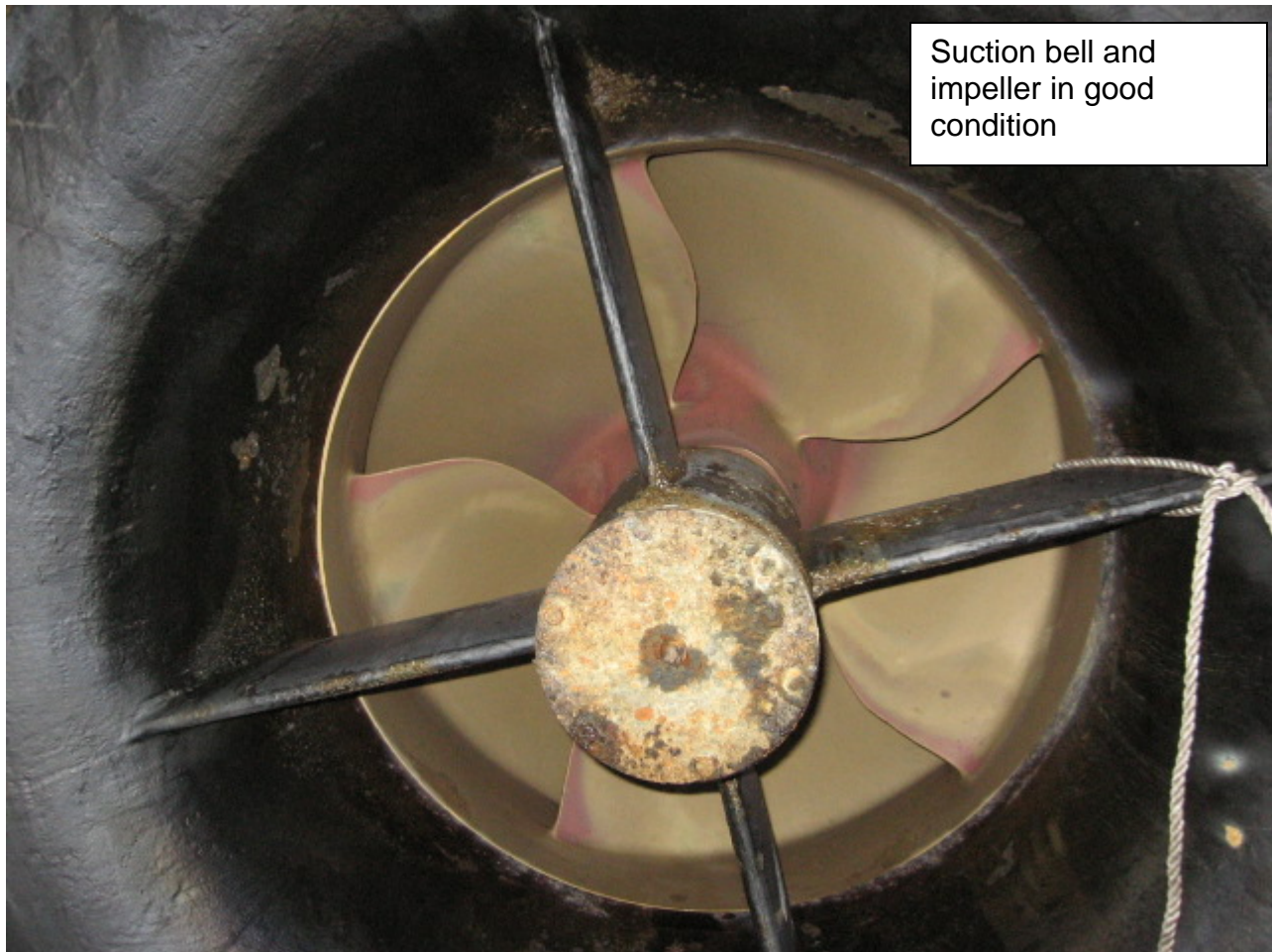
Recommendations:

- Manufacture a new shaft coupling in 416SS forging, with modifications to the wall thickness and keyway radius

#23 Discharge Bowl

Recommendation:

- Brush blast to achieve surface profile for epoxy coating
- Coat the interior and exterior with Devtar 5A Grey

#24 Suction Bell**Recommendation:**

- Brush blast to achieve surface profile for epoxy coating
- Coat the interior and exterior with Devtar 5A Grey

#25 Bearing Discharge Bowl- As found .014", bore smooth**Recommendations:**

- Clean and reuse

#26 Bearing-Suction Bell- As found .012", bore smooth**Recommendations:**

- Clean and reuse

#27 Impeller-Minor nicks in vanes, overall good condition**Recommendations:**

- Clean by mechanical methods
- Hand dress nicks and dents
- Perform a dye penetrant examination for cracks
- Dynamically balance, acceptance criteria 4W/N



#28 Seal Ring Impeller- Suction bell ID 39.021”, Impeller Ring OD 38.967” Clearance .054”Recommendations:

- Clean and polish for reuse
- Standard clearance .052 - .058”

#31 Pump Shaft-TIR .002”

Recommendation:

- Clean and polish for reuse

REASSEMBLY SERVICE CENTER

- Reassemble with the following new components

Item #	Qty	Description	Material
1	1	Headshaft Sleeve O-Ring	Buna-N
2	1	Packing Box O-Ring	Buna-N
3	1	Headshaft Sleeve	416 SS
4	6	Packing Rings	Crane #1340
5	1	#20 Coupling	416SS
6	1	#21Thrust Stud Coupling	416 SS

- Provide flat bed service to the site.



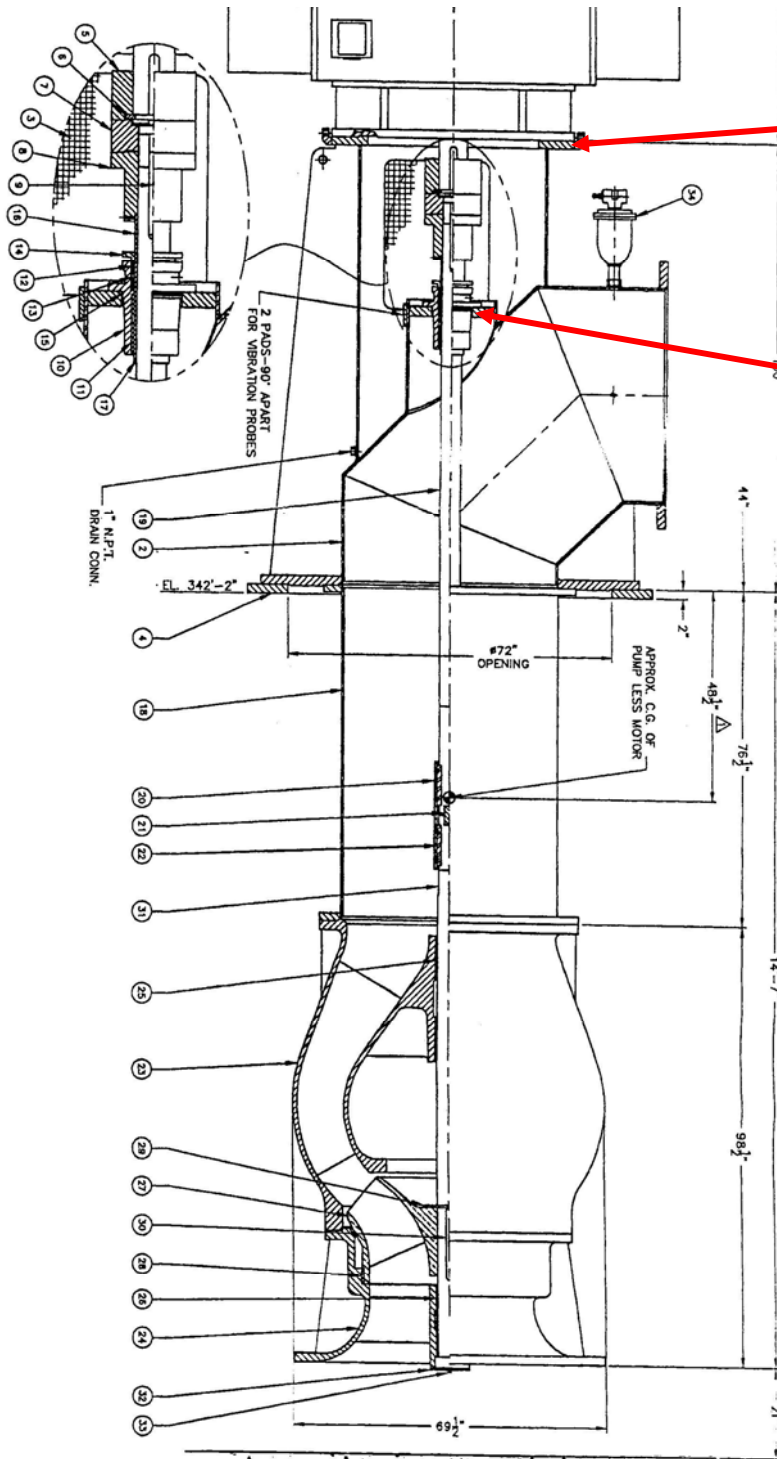
FINAL REPORT OF PROJECT

FIELD 10/4/2008

- Installed pump in pit and torque discharge flange bolts to 100FT/LBS
- Recorded total axial float of the pump 1.12"
- Installed the motor and corrected perpendicularity of the motor to the discharge head by shimming the under the motor mounting face
- This was accomplished by setting the coupling gap with a .500" gauge box and shimming under the motor mounting flange until equal within .002" at the coupling gap at four equal points
- NOTE: The motor rotor weight had to be support by the crane in order to turn the shaft, inserted eye bolt at top of shaft
- NOTE: The discharge head should be machine at the next schedule outage to eliminate shimming
- Aligned the coupling to the motor by rotating the shaft with a dial indicator and jacking the motor to within .003" TIR of the pump half hub
- Set the coupling gap at .625" and coupled to the motor
- Returned to the site at 11:00 PM for startup
- Pump and motor start operated within the design parameters
- NOTE leaked at discharge flange

FIELD 10/6/2008

- Crew dispatched to site to torque flange bolts to 150 FT/LBS
- Corrected leakage at discharge flange



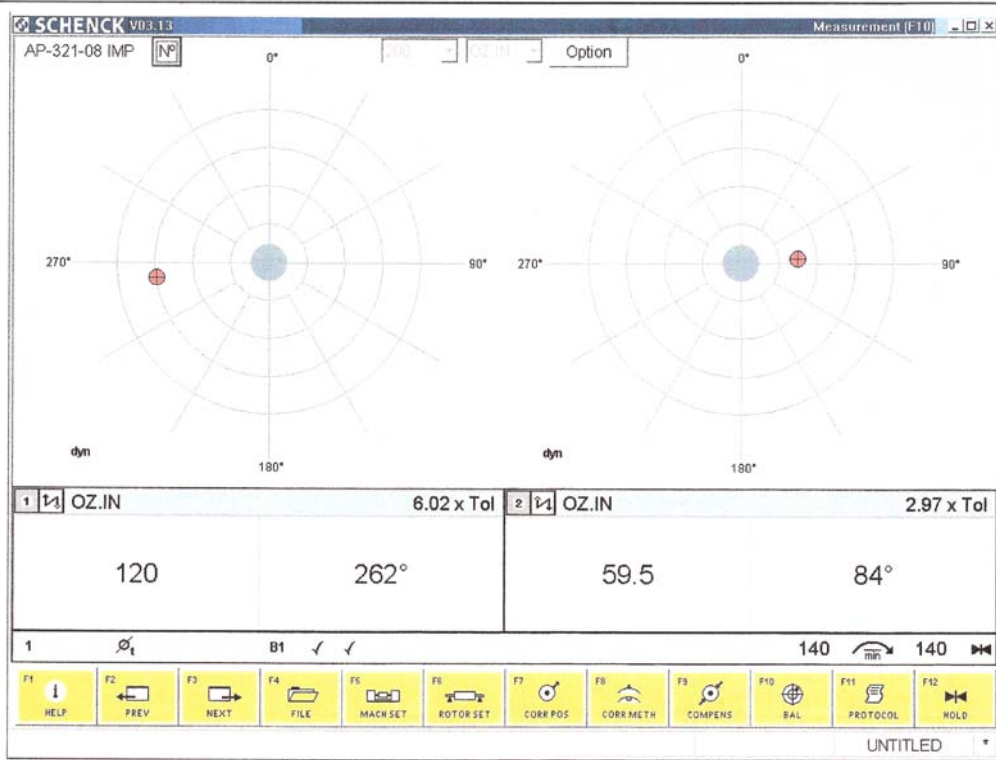
NOTE: This area should be corrected by machining the flange for the motor mounting surface to be perpendicular to the stuffing box bearing bore

Stuffing box bearing

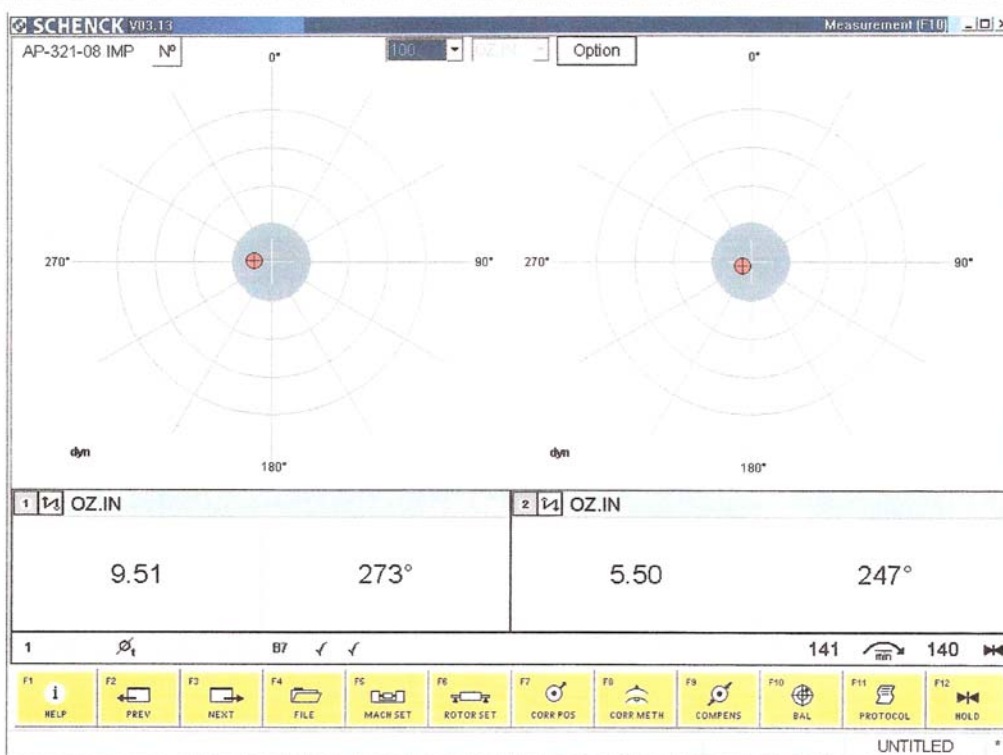


Engineered Pump Division Proprietary AP-321
DYNAMIC BALANCE REPORT-IMPELLER ON SHAFT

1st Run



Final





A. #28 SEAL RING IMPELLER CLEARANCES-Design.052"/.058" Diametrical

Location	Casing Ring ID	Impeller Hub OD	Clearance	Comments
#28 Seal Ring Impeller	40.021"	39.967"	.054"	Cleaned and Polished for reuse

B. #31 PUMP SHAFT TIR

Location	As Found	As Left	Comments
Impeller Fit			Not removed
Lower Journal	.003"	.003"	In spec
Upper Journal	.001"	.001"	In spec
Upper Coupling	.0015"	.0015"	In spec

C. #19 LOWER HEAD SHAFT TIR

Location	As Found	As Left	Comment
Lower Coupling	.002-.003"	.002-.003"	In spec
Packing Box	.002-.003"	.002-.003"	In spec

D. BEARINGS/JOURNALS-CLEARANCES-Design .012"/.018" Diametrical

Location	Bearing ID	Journal OD	Clearance	Comments
#26 Bearing Suction Bell	5.011"	4.998"	.013"	Bearing cleaned and reused
#25 Bearing Discharge Bowl	5.012"	4.998"	.014"	Bearing Cleaned and reused
#11 Packing Box	5.262"	5.250"	.012"	New Sleeve, Bearing cleaned and reused

E. #8 PUMP ADJUSTING COUPLINGS-CLEARANCES-Design .0005"/.002" Diametrical

Location	Coupling ID	Shaft OD	Clearance	Comments
#8 Pump Adjusting Coupling	5.002"	4.999"	.003"	Cleaned and reused

G. SHAFT COUPLINGS-CLEARANCES-Design .0005"/.002" Diametrical

Location	Coupling ID	Shaft OD	Clearance	Comments
#20 Shaft Coupling	4.489"	4.487"	.002"	New coupling used Loctite #277 on set screws

H. #16 HEADSHAFT SLEEVE-CLEARANCES-Design .0005"/.002" Diametrical

Location	SLEEVE ID	Shaft OD	Clearance	Comments
#16 Head Shaft	4.500"	4.498"	.002"	New Sleeve

