

UNCONTROLLED COPY			
WASHINGTON PUBLIC POWER SUPPLY SYSTEM PLANT PROCEDURES MANUAL			
Verified Prior To Use			
Verified By _____		Date _____ WNP. <u>2</u>	
Verified By <u>*10.6.1</u>		Date _____	APPROVED <u>[Signature]</u> DATE <u>7/23/81</u>
VOLUME NAME			
<u>10</u>		MAINTENANCE PROGRAMS AND PROCEDURES	
SECTION			
<u>10.6</u>		HPCS AND LPCS SYSTEMS PROCEDURES	
TITLE			
<u>*10.6.1</u>		HPCS PUMP REMOVAL, OVERHAUL AND REINSTALLATION	

10.6.1.1 Purpose

This procedure provides instructions for the HPCS pump removal, disassembly, inspection, cleaning, reassembly and reinstallation.

10.6.1.2 Discussion

The HPCS pump is a vertical 8 stage enclosed impeller unit driven by a 3000 H.P. motor located at the 442' level in the South East Quadrant of the reactor building. It is designed to supply emergency cooling to the reactor pressure vessel at high pressure and is part of a Quality Class I system.

This pump will operate only a few hours per year and therefore should have a long maintenance free life. The unit should be overhauled per this procedure only when analysis of flow, vibration and/or motor load, give definite evidence of internal failure.

10.6.1.3 References

- A. Ingersoll-Rand Instruction Manual, HPCS Pump, CVI 2-02E22-06, Sheet 14
- B. PPM 10.1.13, System Cleanliness Control

10.6.1.4 Prerequisites

- A. Work Request approved by Shift Supervisor in accordance with PPM 1.3.7.
- B. Clearance Order in accordance with PPM 1.3.8.
- C. System taken out of service per Tech Spec requirements.
- D. RWP in accordance with PPM 11.2.8.

10.6.1.5 Precautions

- A. Assure that pump is properly isolated and tagged out as specified in the Clearance Order.
- B. This is a heavy rigging job; make certain chokers, slings, etc. are adequate and inspected before use. Follow approved rigging practice specified in the WPPSS Safety Manual, Chapter 11. *Walk down line of load path and check for any obstructions.*

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WP-597 R1

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- C. Review the RWP and make certain all requirements are met.
- D. Heat may be applied to the impeller hub, if necessary to remove the impeller from the shaft. Heat the impeller to a temperature no higher than 200°F (measure with a tempil stick), working in successive stages from the periphery towards the impeller hub.
- E. Insure the motor heaters are energized except when the motor is moved or being worked on.
- F. Cleanliness shall be maintained to Grade "B" clean per PPM 10.1.13.

10.6.1.6 Limitations

Discrepancies encountered during the work shall be noted and promptly reported to the Shift Supervisor and your immediate supervisor. Defective equipment discovered during work shall be handled in accordance with PPM 1.3.11

10.6.1.7 Special Tools and Test Equipment

- A. Mechanics tool set.
- B. Vibration analysis equipment.
- C. Measuring instruments (micrometers, calipers, etc.) that are up-to-date on calibration.
- D. A 10 ton crane or chainfall to use with the 20 ton crane in laying down the pump. Wt. 32,500#.
- E. Cribbing for supporting the pump motor so the shaft clears the floor. Wt. 19,000#.
- F. Cribbing to support the pump in a horizontal position 10' long.
- G. Chokers for lifting motor and pump. Motor weight 19,000#, Pump weight - 32,500#. *Use 2 - 1 1/4" DIA. 6x37 lps.*
- H. Dismantling tools shown on pages 11 and 12 of the parts list in the Instruction Manual.
- I. Calibrated torque wrenches 0 to 250 ft. lbs., and 0 to 4000 ft. lbs.

10.6.1.8 Procedures

A. General

NOTE: If possible take a set of voltage, current, flow, pressure and vibration readings before shutting pump down for overhaul.

1. Before starting any work, read and understand the pump disassembly procedures listed in the Instruction Manual starting on page 17.
2. Prepare laydown area per RWP on either the 422' or 441' or 471' levels to provide a clean low exposure area for pump disassembly.
3. Install ²⁰ ton hoist(s) or chainfall(s) in a position to lift the pump vertically from the well then ^{with assistance of 10 ton hoist} lay horizontal in over-haul area if necessary. (Lifting described in RETA pages 18-22.)
4. Place cribbing for pump motor and pump.

B. Motor Removal

1. When disconnecting motor electrical leads from motor terminal box, identify leads for proper "Phase" installation.
2. When disconnecting thermocouple, heaters, ground wire and electrical leads (if necessary) as required to remove pump and motor, identify all lifted leads for reinstallation.
3. Remove casing vent pipe by unbolting flange connection. Identify parts for re-installation.
4. Remove seal inlet and leak off piping by breaking flange/union, and pipe hangers as necessary to withdraw pipe from stand area. Also remove the three flanged seal piping connections. (See Attachment 3) Tag parts for identification.
5. Refer to Attachment 2 and install spacer (18).
6. Back off set screws (17) as required to free them from shaft and prevent galling. Do not remove set screws.

NOTE: Refer to Attachment 1 for the following steps.

7. Disconnect spacer coupling (439) by releasing tab lockwashers (241E), bolts (35A) and (35B) and HEX Nuts (258H). Identify bolts and nuts for re-installation. Discard lockwashers.
8. Remove coupling (439).
9. Remove driver to discharge head flange (361-2). Remove cap screws (179A) and lock washers (241A) from driver to discharge head flange. Identify cap screws for reinstallation. (Bag and tag lockwashers.)
10. Rig motor by lifting lugs, to overhead ^{20 Ton} hoist. (motor weight 21,000 lbs.)
11. Lift motor to laydown area and place on blocking on the floor.

C. Pump Removal

NOTE: Refer to Attachment 1 and 2 for Part () numbers.

1. Remove shaft adjustment (69), pump half coupling (33), and key (12).
2. Remove the gland studs (178B), HEX nuts (258C) and washers (241B) from mechanical seal. Identify parts for re-installation.
3. Pull the complete seal packing (429) including sleeve (Attachment 2) from stuffing box extension (361-7). Store seal package in protective area until re-installation. (Free from damage, dirt, etc.)
4. Remove "O" Ring (456H), gasket (363B), and spacer bushing (156) from pump stuffing box (361-7). Discard "O" Ring (456H) and gasket.
5. Release the three (3) allen set screws (259C) in shaft nut (126B).
6. Loosen shaft nut (126B) by use of face spanner wrench and remove shaft nut from end of shaft (10).
7. Install yoke dismantling tool against face of stuffing box (361-7) using mechanical seal gland bolting (258C/241B/178B).
8. Install four (4) 3/8" x 10" studs provided thru the 1/2" holes of the 5.38" diameter yoke bolt circle and thread into mating holes in throttling sleeve (440). Install plain washer and nuts (provided) on each of the 3/8" x 10" studs.
9. Tighten nuts evenly against yoke to extract throttling sleeve (440) from pump stuffing box (361-7).
10. Remove throttling sleeve (440) over end of shaft (10).
11. Remove the discharge head flange (361-1) to shell flange bolting (258A/178A). Verify match marks exist between head flange (361-1) and shell flange (359-1).
12. Install four (4) chokers thru discharge head motor mounting flange (361-2) thru the side "windows" and anchor one on each lug located just beneath the mounting flange.
13. Lift pump element sufficient to install two (2) lifting plate assemblies dismantling tool spaced 180° apart on flange discharge head (361-1). Secure lifting plate using the ten (10) studs and twenty (20) nuts provided.
14. Place protective blocking across shell flange (359-1) and lower pump element back into the shell (359) until lifting plate assemblies (dismantling tool) mounted on the discharge head flange (361-1) comes to rest on the blocking.

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15. Remove the four (4) chokers from lugs, under flange (361-2).
16. Install chokers thru eye in each lifting plate assembly and rig to overhead hoist. Install spreader between chokers such that the chokers are held away from motor mounting flange (361-2) and any piping protruding from discharge head. Prepare laydown area for pump suction head.
17. Lift out pumping element using care so as not to damage pumping element.

NOTE: Leave pump in the vertical position.

18. Remove protective blocking from shell flange (359-1). Remove and discard gasket 363A.

D. Pump Disassembly

1. Stage suction head (360) to laydown area.
2. Verify tab lock washer (241C) are installed properly (i.e.,) a tab is bent on nut and on flange so nut (258D) will not turn).

Inspector

Date

3. Release table lockwashers (241C).
4. Carefully remove the suction head (360) from end of shaft (10).
5. Remove "O" Ring (456A) and discard.
6. Remove retaining ring (397) from its groove and move towards the first stage impeller (3A).
7. Slide journal sleeve (135) towards the impeller and remove journal sleeve key (291) from shaft. Remove journal sleeve (135) and retaining ring (397). Inspect journal sleeve (135) for damage and repair if required.

Inspector

Date

8. Verify threads for set screws (259B) have been peened.

Inspector

Date

9. Prepare cribbing under first stage impeller (3A).

24. Loosen cap screw in throttling sleeve key (211) and remove key from shaft (10).
25. Install two 3/4" eyebolts (shoulder type) spaced, 180 degree apart, in tapped holes on last stage channel ring (60B).
26. Rig onto the two 3/4" eyebolts and carefully lift and remove last stage channel ring (60B) over the end of shaft (10).
27. Remove "O" Ring (456C) and discard.
28. Verify four socket head cap screws (179C) are peened.

Inspector

Date

29. Remove the four socket head cap screws (179C) from lock collar (312) and remove split lock collar. Identify cap screws and lock collar to the approximate stage of pump for assembly identification.
30. Remove impeller (3B) and impeller key (11B).

NOTE: A deep penetrating oil such as "free-all" by John Crane Company or equivalent should be applied to shaft (10) to ensure easy removal and reinstallation of parts.

31. Repeat steps 3.2.28 through 3.2.31 for eighth through third stages. Identify parts to applicable stage of pump for re-installation.

(Eighth)

Inspector

Date

(Seventh)

Inspector

Date

(Sixth)

Inspector

Date

(Fifth)

Inspector

Date

(Fourth)

Inspector

Date

(Third)

Inspector

Date

NOTE: Ensure shaft (10) is supported as each stage is removed.

32. Remove channel ring (60A) from second pump stage.
33. Install shaft yoke (provided) on threaded coupling end of shaft (10) and rig to hoist.
34. Withdraw the shaft (10) (with second stage impeller (3B) attached) from bottom cover (394).
35. Place shaft (10) on blocking to prevent rolling such that measurements can be made.
36. Remove sockethead cap screws (179C) from lock collar (312) and remove lock collar. Identify cap screws and lock collar to appropriate stage of pump for assembly identification.
37. Remove impeller (3B) and key (11B).
38. (7th -3rd Stage) Remove the twenty cap screws (179B) holding the diffuser (56) from the bottom cover.
(No "O" Rings are installed.)
39. (8th Stage) Remove the cap screws (179B), twenty each, holding the diffuser (56) and cover plate (232) from channel rings (60A) and (60B).
40. Remove "O" Rings (456D and E). This completes disassembly.
41. Record dimensions required on Data Sheet I.

E. Examination/Inspections/Cleaning

1. Verify the threads for headless screw pins (259A) located in the casing rings (6A/B) are properly staked such that pins are locked. Indicate below any unsatisfactory conditions as to stage and if upper or lower ring (total of 48 pins in 16 locations.)

STAGE	SATISFACTORY	UNSATISFACTORY	INSPECTOR
1			
2			
3			
4			
5			
6			
7			
8			

2. Visually inspect all bearings and casing rings for cracks, for excessive wear, scratches, or other damage. Also verify bearings are not loose in casing. Note any unsatisfactory conditions and indicate parts, location, and problem.
3. Clean all pump parts particularly mating surfaces using clean stainless steel brushes, stoddard solvent, methanol or other materials approved by G.E. document 408HA110.
4. Refer to sectional assembly drawings, seal drawing and running clearances, and torque value and operating check sheets for respective pump.
5. Check for pump shaft straightness by the following method:
Attach a sketch with readings to this procedure.
 - a. Indicate each section of shaft on "V" blocks or rollers for Total Indicated Runout (TIR). The shaft shall be supported by two "V" blocks (rollers) near the ends of the shaft at the bearing and/or coupling areas of approximately the same diameter. The TIR of the rollers ("V" Blocks) shall not exceed 0.001 inches. The shaft journals or journal sleeves must be round to within 0.001 inch at the support areas on the "V" Blocks or Rollers.
 - b. Total indicator readings should be taken at every bearing and coupling area and/or every 12 inches between long bearing spans. Record distances from end of shaft to each TIR measurement and for every 90 degrees around the shaft.
 - c. Maximum allowable TIR is 0.001" X total length of shaft in feet. Shafts that exceed this limit can be straightened by either cold straightening or heat straightening. Refer to Cameron Pump Division for heat straightening procedure.

Inspector

Date

6. Examine all parts for cracks, excessive wear, corrosion and/or erosion, distortion, etc. Report discrepant conditions by description, part number, and location.

F. Assembly

NOTE: See Data Sheet No. 1 for required clearances and "as-found" and "as-left" data to be recorded.

1. For the first stage, install diffuser (56) to bottom cover plate (394) using (20) cap screws (179B). No "O" Rings required. Use loctite (screw lock grade) on cap screws. Tighten 14-16 ft/lbs, and set cap screws taking care not to strip HEX socket.

Torque Wrench I.D.

As Left

Inspector

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2. Install "O" Ring (456D and E) in grooves on each of channel rings (60A) and channel rings (60B).

Inspector

Date

3. For Stages Two through Seven, install diffuser (56) to channel rings (60A) using twenty cap screws (179B) in each ring. Use (screw lock grade) "loctite" on cap screws.

STAGE	TORQUE WRENCH I.D.	TORQUE AS LEFT	INSPECTOR
2			
3			
4			
5			
6			
7			

4. For Stage Eight, install cover plate (237) to last stage channel ring (60B) using cap screws (179B). Use (screws lock grade) "loctite" on cap screws.
5. Tighten all cap screws (179B), torque to 14-16 ft/lbs, using care so as not to strip HEX socket.

Torque Wrench I.D.

As Left Torque

Inspector

NOTE: Deep penetrating oil, i.e., "Free All" by John Crane, may be applied on the shaft to ensure easy assembly of impellers and shaft coupling, etc.

6. Install second stage key (11B) and second stage impeller (28) over upper end of shaft (10) and position key (11B).

(Sixth)

Inspector

Date

7. Install split lock collar (312) and four cap screws (179C) torque cap screws to 14-16 ft/lbs.

Torque Wrench I.D.

As Left Torque

Inspector

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8. With shaft yoke installed, install shaft (10) with second stage impeller (38) to bottom cover (394).

NOTE: Support bottom cover (394) and stabilize shaft (10) while installing subsequent pump stages.

9. Remove shaft yoke from pump shaft (10).
10. Install two 3/4" eyebolts, 180 degrees apart on second stage channel ring (60A) and rig to hoist.
11. Install new "O" Ring (456C) in bottom cover (394) and install channel ring (60A) on bottom cover. Insure second stage channel ring (60A) is properly seated on bottom cover (394).

Inspector

Date

NOTE: Repeat Steps 12 through 15 to install Stages 3-8.

12. Remove two 3/4" eyebolts from second stage channel ring and rig to next stage channel ring, continue through eighth stage.
13. Install third stage key (118) and impeller (38) or shaft (10).
14. Install split lock collar (312) and four cap screws (179C) torque cap screws to 14-16 ft/lbs.

STAGE	TORQUE WRENCH I.D.	TORQUE AS LEFT	INSPECTOR
3			
4			
5			
6			
7			
8			

15. Install new "O" Ring (456C) between pump stage, and be sure all channel rings (60A and B) are properly seated.

(THIRD STAGE)

Inspector

Date

(FOURTH STAGE)

Inspector

Date

(FIFTH STAGE)

Inspector

Date

(SIXTH STAGE)

Inspector

Date

(SEVENTH STAGE)

Inspector

Date

(EIGHTH STAGE)

Inspector

Date

16. Install key (211) for throttling sleeve (440) on shaft (10). Tighten and set cap screw in key (211). Torque to 14-16 in/lbs.

Torque Wench I.D.

As Left

Inspector

17. Install "O" Ring (456G) in groove on discharge head flange (36 1-1).
18. Rig hoist to lifting plate assemblies installed on discharge head flange (361-1), use spreader to keep chokers from contacting head mounting flange.
19. Install choker around tie rods (374).
20. Lift discharge head (361) and place in the vertical position. Then remove choker from tie rods (374).

CAUTION: Use care so as not to damage tie rods by striking them against the floor or other objects.

21. Align matchmarks on tie rod/bottom cover and lower the discharge head (361) and tie rod assembly over shaft (10) and pump stages. Insure tie rods (374) line up and enter respective hole in bottom cover (394). Verify components of the channel ring (60A/B) bundle are properly seated.

Inspector

Date

22. Install tab washer (299) and nut (2588) on each tie rod (374) and snug down. Torque nuts to a total of 3500-4000 ft/lbs as follows:

	TORQUE WRENCH I.D.	AS LEFT	INSPECTOR
--	-----------------------	---------	-----------

First pass 100-150 lbs.

Second pass 500-600 lbs.

Third pass 1000-1500 lbs.

Fourth pass 3500-4000 lbs. _____

23. Raise discharge head flange (361-1) vertically from the support blocking sufficient to install first stage casing and remove support blocking.

24. Install "O" Ring (456B) in groove in first stage casing (1).

Inspector

Date

25. Position first stage casing (1) under pumping element install first stage casing over the end of shaft (10). Note clearance on data sheet

26. Install studs (178D), tab lockwashers (241D), and nuts (258E) to bottom cover (394) and first stage casing (1) and snug up nuts and position against bottom cover (394) to ensure proper seating.

27. Torque nuts (258E) to a final value of 175-195 ft/lbs as follows:

	<u>TORQUE</u>		
	<u>WRENCH I.D.</u>	<u>AS LEFT</u>	<u>INSPECTOR</u>
First pass 50-60 lbs.	_____	_____	_____
Second pass 100-150 lbs.	_____	_____	_____
Third pass 175-195 lbs.	_____	_____	_____

28. Set tab lockwashers (241D).

Inspector

Date

29. Position first stage impeller (34A) under suspended pumping element.

30. Install impeller key (11A), impeller (3A), and shaft nut (126A). Tighten shaft nut with pin spanner wrench. (No torque requirement listed.) Note clearance between casing ring and impeller.

Inspector

Date

31. Tighten and set the three screws (259B) in shaft nut (126A) and peen the set screws. Torque to 20-30 in/lbs.

Torque Wrench I.D.

As Left

Inspector

32. Install retaining ring (397) on shaft beyond its groove and install journal sleeve (135) beyond key-way then install key (291). Record journal sleeve (135) to suction head bearing clearance.

33. Position journal sleeve (135) on key (291) and move retaining ring (397) into its groove on shaft (10).
34. Install "O" Ring (456A) in groove of suction head (360).

Inspector

Date

35. Position suction head (360) under pumping element and against first stage casing (1). Install the suction head over the end of shaft (10) and into position against the first stage casing (1).
36. Install the tab lockwashers (241C) and bolting (178C/2580) to suction head and first stage casing. Snug nuts (2480).
37. Torque nuts (2580) to a final value of 48-58 ft/lbs as follows, and set tab lockwashers (241C).

	TORQUE WRENCH I.D.	AS LEFT	INSPECTOR
First pass 20-30 lbs.	_____	_____	_____
Second pass 48-58 lbs.	_____	_____	_____

First pass 20-30 lbs.

Second pass 48-58 lbs.

38. Install new gasket (363A) in position on shell flange 359-1).

Inspector

Date

39. Place protective blocking across shell flange (359-1).
40. Lower pumping element into shell (359) until lifting assemblies are resting on blocking. Insure head flange (361-1) into shell flange (359-1) match marks lineup.

Inspector

Date

41. Remove lifting rings from lifting assemblies and install (4) chokers through discharge head motor mount flange (361-2) side "windows" and anchor one choker to each lug beneath mounting flange.
42. Lift pump element enough to remove the two lifting plate assemblies from discharge head flange (361-1). Remove blocking from shell flange (359-1).
43. Lower pumping element so that discharge head flange (361-1) contacts shell flange (359-1) nuts (258A). Snug nuts.

44. Torque nuts (258A) to a final value of 450-475 ft/lbs as follows:

	TORQUE WRENCH I.D.	AS LIFT	INSPECTOR
First pass 50-60 lbs.	_____	_____	_____
Second pass 100-150 lbs.	_____	_____	_____
Third pass 200-300 lbs.	_____	_____	_____
Fourth pass 450-475 lbs.	_____	_____	_____

45. Install throttling sleeve (440) onto shaft (10) and slide into position on key (211). Start three set screws (259C) into threaded holes in shaft nut (126B) but do not allow screws (259C) to project into the bore of the shaft nut. Note clearance between throttling sleeve and throttling bushing.

Inspector

Date

46. Slide the shaft nut (126B) into shaft (10) and install on to threaded portion of shaft until nut (126B) has metal to metal contact with throttling sleeve (440). Tighten shaft nut 126B using face spanner wrench.

Inspector

Date

47. Tighten and set the three set screws (259C) in shaft nut (126B).

Inspector

Date

48. Slide spacer bushing (156) onto shaft (10) and install into position in stuffing box (361-7).

49. Install "O" Ring (456H)/gasket (363B) in groove on gland flange (429), and gasket (363B). Insure "O" Ring (11) is lubricated or "soaped" and shaft threads are protected.

50. Refer to Attachment 2: The Mechanical Seal Drawing", after the seal has been assembled with all "O" Rings/Gaskets installed bolt the guard plate (14) uptight to the discharge plate (361-3) install spacer (18) which automatically sets the alignment of the inner seal element, and drive collar (16) to the shaft.

51. Torque nuts (258C) to a final value of 130-140 ft/lbs as follows:

	TORQUE WRENCH I.D.	AS LEFT	INSPECTOR
First pass 50-60 lbs.	_____	_____	_____
Second pass 90-100 lbs.	_____	_____	_____

Third pass 130-140 lbs. _____

NOTE: Set Attachment 2 for following steps:

52. Install spacer (18) and drive collar (16) on sleeve (10).
53. Tighten set screws (17) so drive collar (16) is fixed on sleeve (10). Do not allow set screws (17) to protrude from ID of sleeve (10) or drive collar (16) this will damage shaft when installing seal or setting rotor.

NOTE: See Attachment 1 for the following steps:

54. Install coupling key (12), pump half coupling (33), and adjusting nut (69) on pump shaft (10).
55. This completes the re-assembly/installation of the pump.

Inspector

Date

G. Startup and Testing

1. Following completion of the pump installation and after "bumping" the motor to check for free rotation, have Operations restore the unit to service, and start the pump up following prescribed operating procedures.
2. Take motor amperage readings, bearing temperatures, measure discharge pressure, measure flow, measure differential pressure across the suction strainer and monitor vibration. Record this data on the data sheet.

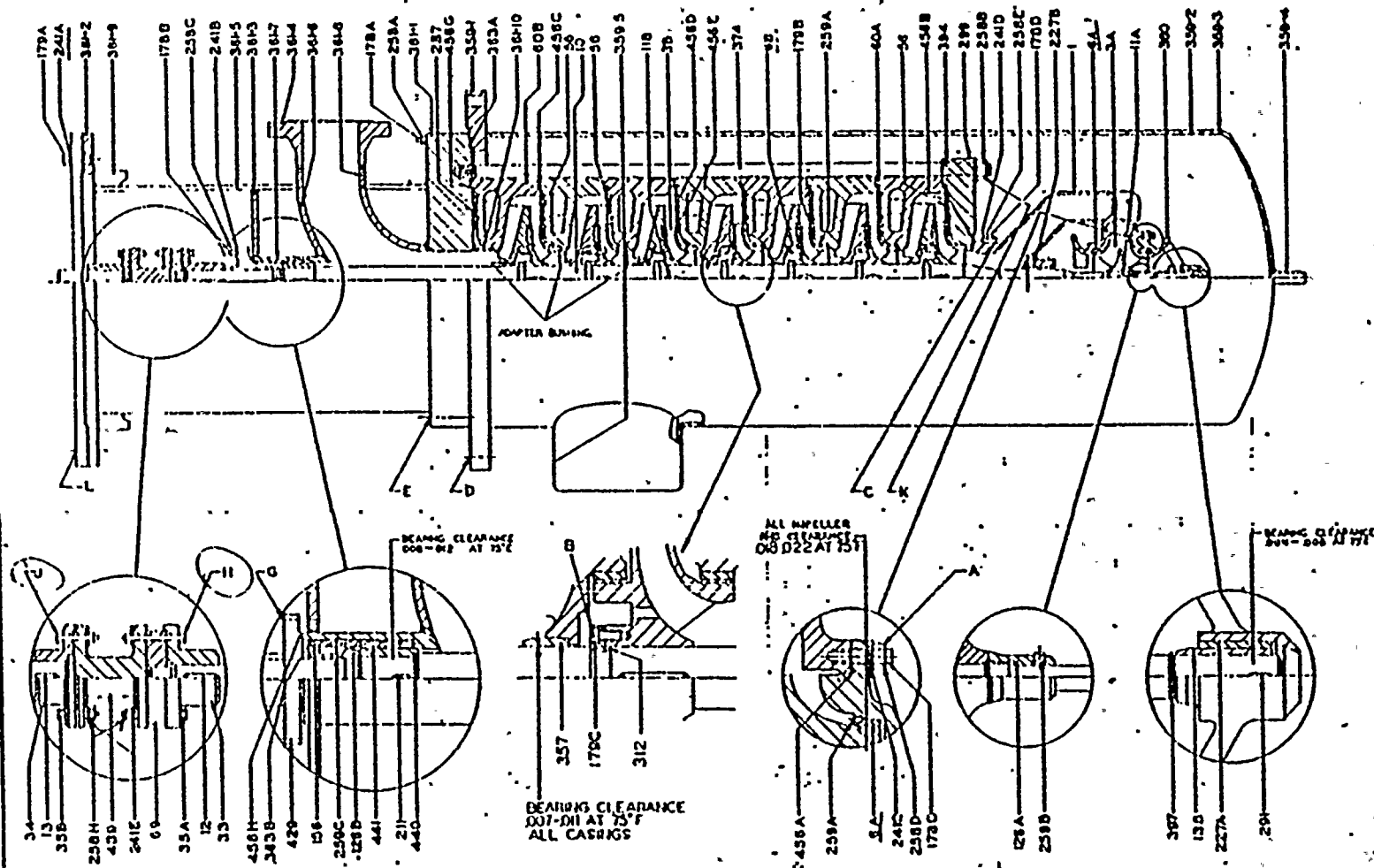
10.6.1.9 Documentation

- A Complete the Data Sheet I and work request format. Record any repair work performed and attach the check sheet and material acceptance tags to the Work Request.

10.6.1.10 Attachments

- A. 1-R Drawing-F-12X2CKD500X3A
- B. John Grane Packing Co., Drawing H-SP-1666
- C. Data Sheet I

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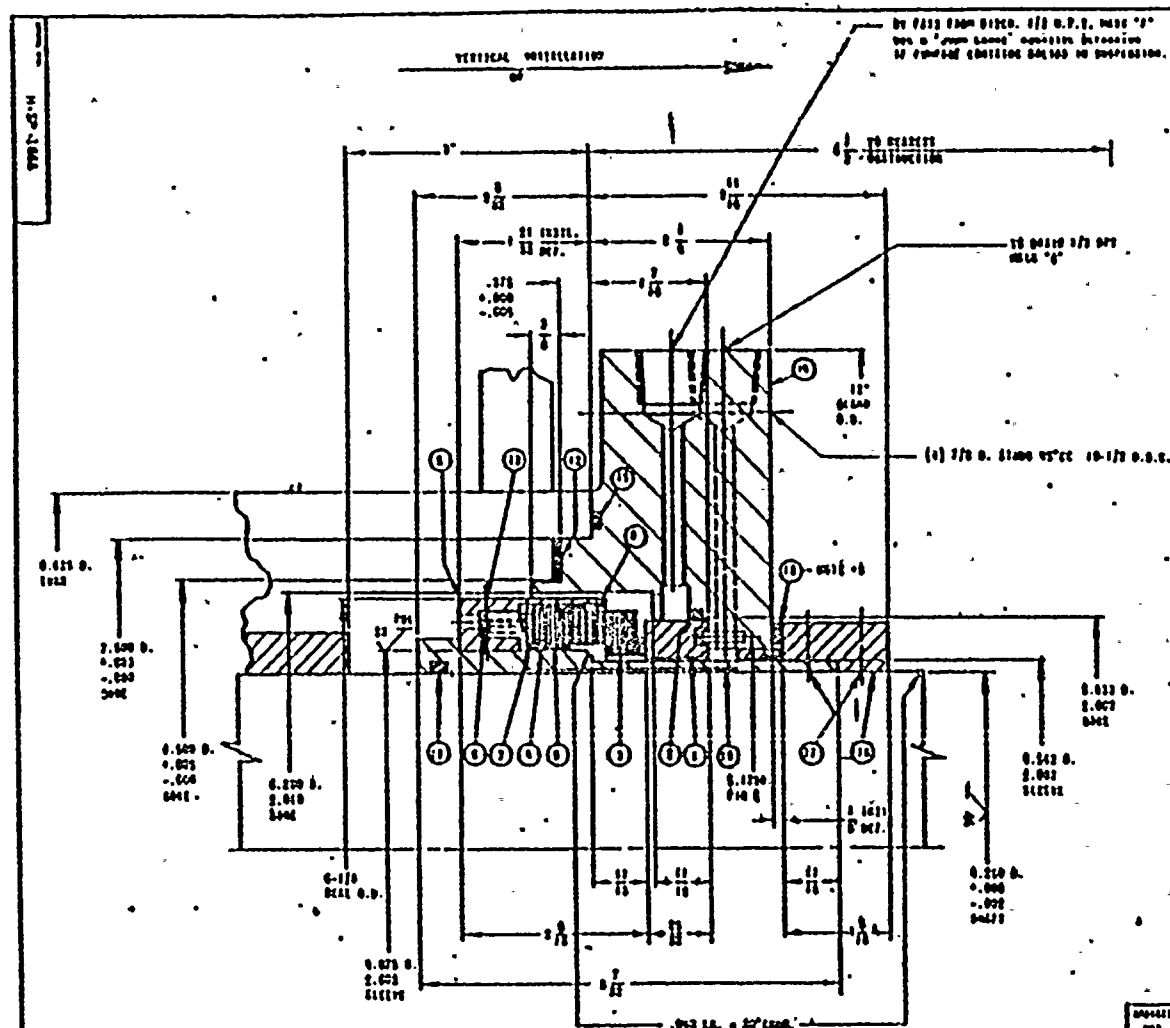


12X20KD - 8 STAGE PUMP
HIGH PRESSURE CONE SHAFT
PROJECT NAME - HAWK FORD II

12X20KD500X3 PLN PG 1,2

TORQUE TIGHTENING			
PER CCIP-1095			
LOCATION	SIZE	TORQUE	FT-LBS
A	1/2	48-50	
B	1/2	14-16	
C	3/4	175-195	
D	1 1/4	2000-3000	
E	1 1/2	450-475	
G	1 1/2	120-140	
H	1	450-475	
J	1	450-475	
K	2 1/4	3500-4000	
L	1 1/2	705-755	

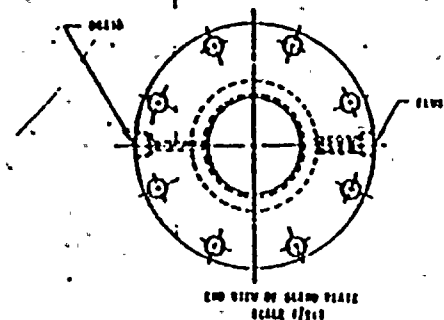
Ingersoll-Rand
KD-PUMP
F-12X20KD500X3A

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ASTM-A-276 TYPE-316 SS. CONDITION "A"

ASTM-A-479 TYPE-304 SS WITH BRONZE

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ORIGINAL COPY.
ORIGINAL ELECTRIC
994-10947 (1) 12-20-50



**CRANE PACKING
COMPANY**
211 E. 21ST ST.
CHICAGO, ILL. 60611

[illegible]

TYPE - 001
4.278 D: PACKAGE WITH SEAL
FOR
4.250 D WITH
BURNSIDE AND CO.

44-38861-1000

- [illegible]

DATA SHEET I

Description	Required	As Found		As Left		Inspection	
Journal Slv. (135) to Suction Head Bearing (227A).	0.004" to 0.008"						
Casing (227B) to Shaft (10)	0.007" to 0.011"						
Casing Ring (wear ring) to Impeller 3A (1st stg)	0.018" to 0.022"	Upper	Lower	Upper	Lower	Upper	Lower
Casing Ring (wear ring) (68) to impeller (38)	0.018" to 0.022"	Upper	Lower	Upper	Lower	Upper	Lower
4.1 2nd Stage	0.018" to 0.022"						
4.2 3rd Stage	0.018" to 0.022"						
4.3 4th Stage	0.018" to 0.022"						
4.4 5th Stage	0.018" to 0.022"						
4.5 6th Stage	0.018" to 0.022"						
4.6 7th Stage	0.018" to 0.022"						
4.7 8th Stage	0.018" to 0.022"						
Bushing Channel Ring (357) to Shaft (10)	0.007" to 0.011"	Upper	Lower	Upper	Lower	Upper	Lower
5.1 2nd Stage	0.007" to 0.011"						
5.2 3rd Stage	0.007" to 0.011"						
5.3 4th Stage	0.007" to 0.011"						
5.4 5th Stage	0.007" to 0.011"						
5.5 6th Stage	0.007" to 0.011"						
5.6 7th Stage	0.007" to 0.011"						
5.7 8th Stage	0.007" to 0.011"						
Throttling Sleeve (440) to Throttling Bushing (441).	0.008" to 0.012"						
Shaft (10) Runout (TIR) NOTE: Runout to be indicated should be with Rollers or "U" blocks located at the coupling impeller or bearing journals areas.	0.008" to TIR						



	<u>AS FOUND</u>	<u>AS LEFT</u>	<u>ACCEPTABLE</u>
Motor Voltage	_____	_____	_____
Motor Amperage	_____	_____	_____
Discharge Pressure	_____	_____	_____
Pump Flow	_____	_____	_____
Differential Pressure Across	_____	_____	_____
Suction Strainer	_____	_____	_____
Vibration			
Top of Motor (Axial)	_____	_____	_____
Top of Motor - A	_____	_____	_____
Top of Motor - B (90° from A)	_____	_____	_____
Top of Pump Discharge Flange	_____	_____	_____
Side of Pump Discharge Flange	_____	_____	_____

