WATTS BAR NUCLEAR PLANT

MAINTENANCE INSTRUCTION

MI-67.1

REMOVAL, INSPECTION, AND REPAIR OF THE ESSENTIAL RAW COOLING WATER PUMPS

UNIT 1 OR 2

Rev. By	Rev. No.	Date	Revised Pages
MLG	1	6/10/80	All
MLG	2	RLL 3-24-81	2 and 10

The last page of this instruction is number 31

1C	Plant Master File
	Superintendent
	Assistant Superintendent
1C	Mechanical Maintenance Supervisor
	Results Supervisor
1C	Operations Supervisor
2C	Quality Assurance Supervisor
	Health Physicist
	Administrative Supervisor
	Chemical Laboratory
	Instrument Shop
1C	Shift Engineer's Office
	Unit Control Room
	Health Physics Laboratory
	PSU Supervisor
	Mechanical Engineer
	Reactor Engineer
	Chemical Engineer
	Instrument Maintenance Supervisor
1U	Asst. Director of Nuc Power (Oper)
1C	Electrical Maintenance Supervisor
1C	Plant Industrial Engineer
1C	Outage Director
1U	NRC
1C	Nuclear Safety Review Staff
1C	Assistant Maintenance Supervisor
1U	NUC. Maintenance Branch - C
1C	Nuc. Training Center

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PORC Review 6/10/80
Date

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Date Approved 6/10/80

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1. WBNP Tech Spec's draft II, dated 1/23/80

Signature | Date 06/09/80

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1.0 PURPOSE AND APPLICABILITY

The purpose of this instruction is to describe the procedure for disassembling, inspection, and repairing the essential raw cooling water pump. Conditions and restraints are specified in the Technical Specification 3.7.4.1. This instruction is applicable to operational modes 1, 2, 3, 4, 5, and 6.

2.0 REFERENCES

2.1 Byron Jackson Instruction Manual for Essential Raw Cooling Water Pumps

2.2 TVA Contract No. 76K31-83158

2.3 Technical Specification 3.7.4.1

3.0 PREREQUISITES

3.1 Coordinate the performance of this instruction with the shift engineer by obtaining his authorization of the trouble report that requires the performance of this MI. (Record the TR number on the Data Cover Sheet.)

3.2 Obtain the necessary clearances for the performance of this instruction. (Tagging procedure is attached as Appendix B, page 29.

3.3 Notify the QA section that QC inspector coverage will be required during the performance of this instruction.

3.4 All supports and restraints that have to be removed to perform this instruction must be match marked prior to removing so they can be reinstalled to their proper location.

3.5 Contact safety engineer for evaluation of transient fire loads.

4.0 PRECAUTIONS

4.1 Essential raw cooling pumps are located on elevation 741 at the intake pumping station. Positively identify the proper pump before beginning work. The pumps are marked A-A through D-A and E-B through H-B.

4.0 PRECAUTIONS (Continued)

4.2 Every precaution should be made to maintain a clean work area. All requirements for cleanliness given in this instruction shall be followed.

4.3 Ensure that the affected pump and its system is cool, depressurized, vented, and isolated.

4.4 Any oil drained from the unit should be removed immediately from the work area to the waste oil storage area after draining.

4.5 Refer to Appendix D, page 30 for safety precautions on handling acetone or Isopropyl Alcohol.

4.6 Bolted connections that have to be loosened or removed to perform this instruction must be identified on the bolted connection data sheet in Appendix A, page 27. Prior to removeing any welded connection, the maintenance supervisor must be notified.

4.7 As supports and restraints are removed the I.D. number must be recorded on the support and restraint data sheet in Appendix A, page 28. If any shims are found during the disassembly of the restraints or supports, they must be match marked and listed on the support and restraint data sheet in Appendix A, page 28.

5.0 PREPARATION FOR WORK

5.1 The responsible foreman shall review the task to be performed.

5.1.1 To preclude the possibility of a maintenance initiated common mode failure, crew personnel and M and TE should not be the same for two consecutive performances of this MI unless the performance of the component covered by the previous MI has been tested and proven satisfactory.

5.2 The following is a list of spare parts that are normally needed to do this job. These parts are listed and shown in Figure-01 (drawing No. 1F-7879). These parts should be checked for availability prior to starting work. Any part that has to be replaced must have its part number and "575" number recorded on the data sheet provided in Appendix A, page 21.

NOTE: Do not unwrap any part until it is actually needed.

Item Number	Part Name	Quantity Required
1	Lock screw-bearing	1
2	Suction bell	1
3	Sand cap	1
4	Lock screw-sand cap	2
5	Thrust collar	1
6	Impeller - 1st stage	1
7	Case wear ring	2
8	Bottom bearing	1
9	Split ring-impeller	1
10	Key-impeller	2

List continues on next page.

5.0 PREPARATION FOR WORK (Continued)

Item Number	Part Name	Quantity Required
12	"O"-ring - cases	2
13	Impeller liner	2
14	Impeller - 2nd stage	1
15	Split ring - impeller	1
16	Thrust collar - 2nd stage	1
18	"O" ring - top case	1
19	Case bearing	2
20	Pump shaft	1
25	Column shaft - intermediate	10
26	Column bearing	10
27	"O" ring - column	10
28	Gib key - coupling	22
29	Split ring - coupling	11
30	Shaft coupling	11
31	Key coupling	22
34	Top column shaft	1
35	Lock screw - throttle bushing	1
36	Throttle bushing	1
37	Stuffing box	1
38	Shaft sleeve	1
39	Gib key - sleeve	1
40	Retaining ring - sleeve	1
41	Key - coupling	1
42	"O" ring stuffing box	1
43	"O" ring sleeve	1
44	Case ring	2
45	Packing 1/2" square - 3-5/16" I.D. John Crane 100M	5 rings
50	Split ring - motor	1
51	"O" ring stuffing box	1
	Suction bell to case, case to case, and case to column	
	Studs 1-8 UNC x 4-1/2" lg	72
	Hex nuts 1-8 UNC	72
	Column flanges	
	Hex head cap screws 1-8 UNC x 5" lg	240
	Hex nuts 1-8 UNC	240
	Stuffing box to head	
	Studs 7/8-9 UNC x 4" lg	4
	Hex nuts 7/8-9 UNC	4

5.0 PREPARATION FOR WORK (Continued)

5.3 The following work aids will be required for this job and shall normally be at the work area prior to beginning work.

5.3.1 A container for temporary storage of miscellaneous parts

5.3.2 Lint-free rags

5.3.3 Hook chain or cable sling

5.3.4 Thread compound - Felpro or equal (approved by TI-35)

5.3.5 Eye bolt with 1-8 UNC thread

5.3.6 Tube of petrolatum jelly

5.3.7 Impeller adjustment tools

5.3.7.1 Hydraulic jack and ram (P-76 porto-power with R-263 ram or equal)

5.3.7.2 Split jacking plates

5.3.7.3 Hydraulic hose couplings and hose

5.3.7.4 Pressure gage 10,000 psi capacity

5.3.8 Lifting equipment - refer to drawing No. 108N10422-1 through 4 for identification

5.3.8.1 I-beam assembly - MK-1

5.3.8.2 Saddle support column - MK-2

5.3.8.3 Impeller casing support - MK-5

5.3.8.4 Shaft coupling - MK-6

5.3.8.5 Lifting spider - MK-7

5.3.8.6 Shaft support rod used with spider

5.3.8.7 Shaft lifting eye

5.3.9 Isopropyl Alcohol or acetone - review the attached precautions (Appendix D) before using.

5.0 PREPARATION FOR WORK (Continued)

5.4 Obtain for use in this instruction the following special tools and instruments. Record the tool number (if applicable) or instrument TVA number and calibration due date on data sheet provided in Appendix A., page 20.

5.4.1 Torque wrench capable of torquing 150 ft./lbs.
5.4.2 Two dial indicators (grad. .001")
5.4.3 Pressure gauge capable of reading 10,000 PSI
5.4.4 Snap gauge 3" to 4"
5.4.5 O.D. micrometer 3" to 4"
5.4.6 I.D. micrometer 14" to 15"
5.4.7 O.D. micrometer 13" to 14"

6.0 PERFORMANCE OF WORK

6.0.1 Remove any conflictive supports and restraints, and record the I.D. of each on the support and restraint data sheet in Appendix A, page 28. NOTE: If any shims are discovered during disassembly, they must be match marked prior to removing and recording on the support and restraint data sheet when they are disassembled.

6.0.2 Disassembly any conflictive or restrictive bolted connections. As each bolted connection is disassembled, the craftsman must record it and its bolt size on the bolted connection data sheet in Appendix A, page 27.

NOTE: Number in ( ) refer to Figure-01.

6.1 Remove pump from its sump.

Hold Point: Maintenance Engineer to verify driver leads disconnected.

6.1.1 Craftsman to disconnect driver leads to power source and sign data sheet, page 22, and Maintenance Engineer to verify by signing data sheet.

6.0 PERFORMANCE OF WORK (Continued)

6.1.2 Disconnect auxiliary and main piping. Disconnect the driver half coupling from the adjusting plate (48), then detach and remove the driver. Store driver in an upright position.

6.1.3 Remove the adjusting plate (48), pump half coupling (47), coupling key (41), gland (46), packing (45), and cage ring (44).

6.1.4 Remove the discharge head (33) to sole plate (32) bolts.

6.1.5 Lift the pump until there is sufficient clearance between the outer column flange and the sole plate to install the I-beam assembly (MK-1) and saddle support assembly (MK-2).

6.1.6 Install and bolt together the I-beam assembly (MK-1).

6.1.7 Install and bolt together the saddle assembly (MK-2). Lower the pump slowly until it is supported in the assembly by the upper flange of the outer column.

6.1.8 Remove the discharge head (33) from the pump assembly.

6.0 PERFORMANCE OF WORK (Continued)

6.1.9 Clean the shaft above the shaft coupling (30).

6.1.10 Remove the cap screws that lock the shaft coupling sleeve (30) and gib keys (28) in place on the shaft.

CAUTION: The area on the pump shaft directly above the coupling must be clean and free of all dirt and scale prior to raising the shaft coupling.

6.1.11 Raise the shaft coupling (30) and remove the gib keys (28) and split clamp ring (29).

NOTE: As parts are removed they should be matched marked and placed in an area to prevent damage.

6.1.12 Remove the top column shaft (34) with shaft coupling (30) and coupling keys (31) still attached.

6.1.13 Attach lifting fixture (MK-7) to upper flange of outer column and lift pump assembly to relieve the pressure from the saddle support (MK-2).

6.1.14 Open the saddle support, then lift the pump assembly until the upper flange of the next outer column section is above the saddle support.

6.1.15 Close the saddle support, then lower the pump assembly until it is supported by the upper flange of the outer column.

6.1.16 Remove the outer column from the pump assembly.

6.1.17 Clean the shaft above the shaft coupling (30).

6.1.18 Remove the cap screws that lock the shaft coupling sleeve (30) and gib keys (28) in place.

CAUTION: Area on the shaft above the coupling must be clean and free of all dirt and scale to help prevent galling of the coupling to the shaft.

6.1.19 Raise the shaft coupling (30) and remove the gib keys (28) and split clamp ring (29).

6.1.20 Remove the column shaft (25) with its shaft coupling (30) and coupling keys (31) still attached.

6.0 PERFORMANCE OF WORK (Continued)

6.1.21 Repeat steps 6.1.13 through 6.1.20 until all sections of the outer column have been removed except one.

6.1.22 To remove the last section of the outer column, lift the pump assembly until the top of the casing is high enough above the pit to allow installing the impeller casing support fixture (MK-5).

6.1.23 Install the impeller casing support (MK-5) on top of the saddle support. Lower the pump assembly until it is supported by the outer flange of the upper case (17).

6.1.24 Remove the last section of the outer column and the column shaft from bowl assembly.

6.1.25 Remove the bowl assembly from the pit and place it horizontally on suitable supports.

6.1.26 After the bowl assembly has been removed from the pit, the pit should be covered to prevent any objects from falling into it.

6.2 Disassemble bowl assembly

6.2.1 Disconnect and remove the suction bell (2).

6.2.2 Disconnect and remove top case (17).

6.2.3 Remove in turn the lock screws (4), sand cap (3), cap screws, thrust collar (5), split ring (9), impeller (6), key (10), series case (11), cap screws, thrust collar (16), split ring (15), and key (10).

6.2.4 Clean all parts for inspection using solvent, wash and dry using clean, dry filtered compressed air. Clean, lint-free rags may be substituted for the compressed air.

6.3 Inspection of pump internals and cases. Craftsman performing the inspection shall verify the results by signing the data sheet in Appendix A, page 22. Any part that is unsatisfactory must be replaced.

6.0 PERFORMANCE OF WORK (Continued)

6.3.1 Craftsman to visually inspect the following parts for unusual wear or damage caused by erosion or corrosion. Parts are acceptable if there are no cracks, unusual wear, or damage visible. If any part is unsatisfactory, it must be replaced.

6.3.1.1 Suction bell (2)
6.3.1.2 Thrust collar (5) and (16)
6.3.1.3 Impeller - 1st stage (6)
6.3.1.4 Case wearing ring (7)
6.3.1.5 Split ring impeller (9) and (15)
6.3.1.6 Series case (11)
6.3.1.7 Impeller liner (13)
6.3.1.8 Impeller 2nd stage (14)
6.3.1.9 Top case (17)
6.3.1.10 Column shaft (21)(22)(34)
6.3.1.11 Split ring (29)
6.3.1.12 Shaft coupling (30)
6.3.1.13 Throttle bushing (36)
6.3.1.14 Stuffing box (37)
6.3.1.15 Shaft sleeve (38)
6.3.1.16 Retaining ring (40)
6.3.1.17 Cage ring (44)
6.3.1.18 Pump shaft (8)

HOLD POINT: Maintenance Engineer

6.3.2 Craftsman to measure and record the diametral clearances of the following parts. The maintenance engineer is to evaluate and verify by signing data sheet in Appendix A, page 23.

6.3.2.1 Clearance between bottom bearing (8) and pump shaft (20). Total clearance should be .010" to .013". Clearance is acceptable if it does not exceed .013". If bearing is acceptable, omit step 6.3.2.1.1.

6.3.2.1.1 Remove bottom bearing and replace with a new one. (NOTE: Clearance should be rechecked after it has been installed. Bearing may have to be reamed out.)

6.0 PERFORMANCE OF WORK (Continued)

6.3.2.2 Clearance between the case bearings (19) and pump shaft (20). Total clearance should be .010" to .013". Clearance is acceptable if it does not exceed .013". Note there are two case bearings. If case bearing clearance is acceptable, omit step 6.3.2.2.1.

6.3.2.2.1 Remove case bearings (19) and replace with the new ones. (NOTE: Clearance should be rechecked after they have been installed. Bearings may have to be reamed.)

6.3.2.3 Clearance between the case wear rings (7) and the 1st stage impeller (6) and the 2nd stage impeller (14). Total clearance should be .020" to .035". Clearance is acceptable if the clearance does not exceed .035". (NOTE: If the case wear rings are acceptable, omit steps 6.3.2.3.1, 6.3.2.3.2, and 6.3.2.3.3).

6.3.2.3.1 Remove the wear ring set screws and then either machine out the wear rings or remove by separating with a diamond pointed chipping tool.

6.3.2.3.2 Install new wear rings in case and lock in place with set screws.

6.3.2.3.3 Bore new case wear rings to obtain total clearance of .020" to .024".

6.3.2.4 Clearance between column bearings (26) and the column shaft (25). Total clearance should be .010" to .013". Bearings are acceptable if the clearance does not exceed .013". (NOTE: There are ten column bearings. If the column bearings are acceptable, omit steps 6.3.2.4.1.)

6.3.2.4.1 Remove coupling bearing (26) from outer column and replace with new ones. (NOTE: New bearing clearance should be checked after they are installed. If new bearing clearance is not at least .010", they will have to be reamed out.)

6.0 PERFORMANCE OF WORK (Continued)

6.4 Reassembly pump

6.4.1 Reclean all parts using solvent, wash and dry, using clean, dry, filtered compressed air. Clean, lint-free rags may be substituted for the compressed air.

NOTE: All gaskets and "O" rings removed during disassembly are to be discarded and replaced with new ones.

6.4.2 Install impeller key (10), 2nd stage impeller (14), split ring (15), thrust collar (16), thrust collar cap screws, and series case (11) with case bearing (19) installed.

6.4.3 Install impeller key (10), 1st stage impeller (6), split ring (9), thrust collar (5), thrust collar cap screws, sand cap screws (3) and sand cap lock screws.

6.4.4 Install top case (17) with new "O" ring (12) and case bearing (19) installed.

NOTE: Before installing O-rings, lightly coat the O-rings with petrolatum jelly and apply protective compound to all permanent threads.

6.4.5 Install suction bell (2).

6.4.6 Remove cover from pump pit and open impeller casing. Support fixture (MK-5) and place the bowl assembly so the top flange of the series case (11) rests on the support.

6.4.7 Lubricate the "O"-ring (18) and install it in the groove in the upper face of the top case (17).

6.4.8 Connect the first section of column shaft (25) as follows:

6.4.8.1 Install two keys (31) and a coupling sleeve (30) on the column shaft (25) and restrain the sleeve above the clamp ring groove while lowering the shaft to mate with the pump shaft (8).

6.4.8.2 Install the split clamp ring (29) and gib keys (28) in the pump shaft. Lower the sleeve as far as possible and install the cap screws to lock the gib keys to the sleeve.

6.0 PERFORMANCE OF WORK (Continued)

Hold Point: QC Inspector to witness and verify final torquing.

6.4.9 Lift and install the bottom column (21) and connect the column-to-case fasteners. Craftsman to torque bolts to 90 ft. lbs. ± 5 % and sign data sheet, page 25. QC Inspector to verify torquing by signing data sheet in Appendix A, page 25.

NOTE: Bolts are to be installed with the heads down.

6.4.10 Lift the assembly using the lifting fixture (MK-7). Remove the casing support fixture (MK-5). Lower the assembly until the saddle support (MK-2) can be closed. After the saddle support has been closed, continue to lower the pump assembly until it is supported by the upper flange of the outer column.

6.4.11 Repeat steps 6.4.7 through 6.4.10 to install the remaining column sections, shaft sections, and discharge head at which time the pump will be supported by means of the top flange of column (23).

6.4.12 Lift up on the pump assembly. Remove the saddle support and I-beam assembly and lower the pump assembly onto the sole plate (32), fastening the sole plate to the discharge head.

6.4.13 Install the gland (46). Do not install the cage rings (44) or packing (45) at this time.

6.4.14 Install the pump half coupling key (41), pump half coupling (47), and adjusting plate (48). Screw the adjusting plate all the way down on the top shaft (34).

6.4.15 Mount motor on discharge head using bolts provided.

NOTE: Apply Felpro to all permanent threaded connections.

Hold Point: Maintenance Engineer to verify driver leads re-connected.

6.4.16 Craftsman to re-connect driver leads and sign data sheet, page 26 Maintenance Engineer to verify re-connection by signing data sheet.

CAUTION: Be sure motor coupling half is not touching adjusting plate on pump shaft.

6.4.17 Check motor rotation by bumping jog button. Pump rotation is counterclockwise (viewed from coupling end). Craftsman to verify correct rotation by signing data sheet in Appendix A, Page 25.

6.0 PERFORMANCE OF WORK (Continued)

HOLD POINT: Maintenance Engineer to verify coupling alignment.

6.4.18 Craftsman to check alignment of motor coupling to pump coupling by clamping a dial indicator on the motor coupling half and placing the indicator button on the O.D. of the pump coupling half. Rotate the motor shaft and measure the runout. The runout should not exceed .007" T.I.R. To check for squareness, measure the gap between the adjusting plate and motor coupling half in four places. Squareness is satisfactory if the gap measurement does not vary more than .003". Maintenance Engineer to verify coupling alignment is satisfactory by signing data sheet in Appendix A, page 26.

6.5 Set impeller clearance

HOLD POINT: Maintenance Engineer to witness the setting of the impeller clearance and verify the setting is satisfactory by signing data sheet in Appendix A, page 26.

6.5.1 The engineer will compute the total area of the ram pistons and divide the element weight by the total ram piston area to find the approximate required gage pressure.

6.5.2 Connect the jacks by suitable length of hose to the pressure source. Set coupling adjusting plate even with top end of shaft. Hold the pump half coupling against the adjusting plate and shim up the split jacking plate on the stuffing box so that the rams are just in contact with the underside of the coupling hub. If full contact is achieved, it may be necessary to add another split plate on top of the rams, just under the coupling. Alternately, I-beam may be laid across window opening to support jacking plate.

6.5.3 Set a dial indicator (at zero) on adjusting plate face so that movement of jacking plates can be observed.

6.5.4 Apply pressure to raise the rams and coupling until gage pressure is approximately equal to the required reading furnished by engineering. Since the weights are approximate, the pressure reading may be higher or lower than specified. Read total movement of dial indicator going from "static" to "balance" position and back again. Repeat several times. Pressure gage will level off as balance point is reached. Determine average reading which will place rotating element in weight balance.

6.0 PERFORMANCE OF WORK (Continued)

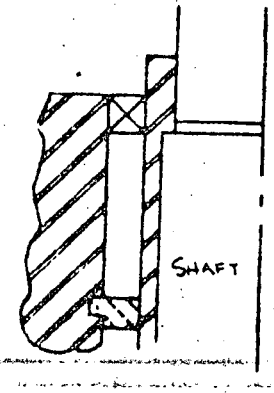
6.5.5 A gap should exist between adjusting plate and driver half coupling. If coupling gap has closed before balance was achieved (step 6.5.4), lower jacks and rotate adjusting plate until shafts project 1/4" above end of plate. Repeat step 6.5.4. Measure gap between adjusting plate and motor half coupling. When jacks are not in contact with pump half coupling, this gap should exactly equal the sum of dial indicator reading from step 6.5.4, plus two times the lift (2 x .073" = 0.146"). If gap is less than this amount, lower jacks and rotate adjusting plate downward the amount of this difference. If gap is more than this sum, raise the adjusting plate the amount of this difference.

6.5.6 Rotate adjusting plate slightly in either direction until holes line up with pump half coupling. Rotate drive shaft slightly in either direction until drive half coupling holes line up with adjusting plate holes. If drive shaft is difficult to turn, make sure it is not in contact with pump shaft (or coupling parts) and "bump" driver start button momentarily. Then, a chain-tong applied to drive shaft should allow shaft to turn. Insert bolts through the coupling halves and tighten nuts slowly and evenly in opposite pairs until secure. Maintenance engineer to verify that the impeller has been properly set as described in steps 6.5.1 through 6.5.6 by signing data sheet in Appendix A, page 26.

6.6 Install packing and piping

6.6.1 Remove gland (46) and check stuffing box and sleeve are clean.

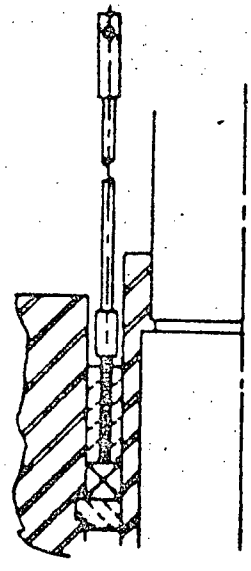
6.6.2 Insert one ring of packing (45) pressing by hand to point of maximum entrance. (Refer to Sketch-01).



SKETCH-01

6.0 PERFORMANCE OF WORK (Continued)

6.6.3 Insert spacer ring with packing tools attached and press on the packing tool handles to guide and tamp the packing ring solidly and squarely against the back of the stuffing box. Retract packing tools (refer to Sketch-02).



SKETCH-02

6.6.4 Insert sufficient spacer rings to fill the stuffing box.

6.6.5 Install and pull in the gland, tightening stud nuts evenly and firmly so that gland does not cock on the shaft. Remove gland and spacer rings.

6.6.6 Repeat steps 6.6.2 through 6.6.5 to install each reamining ring of packing.

NOTE: Each ring of packing must be rotated so the joint of the preceding ring does not line up with one being installed.

6.6.7 When all rings of packing are installed, loosen the gland stud nuts, then secure stud nuts finger tight.

6.6.8 Clean piping flanges, install gasket, and install studs and nuts hand tight.

QC Hold Point: QC Inspector to witness and verify final torquing of all bolted connections by signing data sheet, page 27.

6.6.9 Install auxiliary and main piping to the discharge header using new gaskets if required.

6.0 PERFORMANCE OF WORK (Continued)

6.6.10 Torque the disconnected conflictive bolted connections to the torque value as shown in the chart on the bolted connection data sheet. All bolted connections are to be tightened and torqued using a criss-cross pattern. QC Inspector and craftsman shall sign the data sheet in Appendix A, page 27 after each connection has been torqued.

6.6.11 Install supports and restraints that were removed during disassembly. Note each support and restraint was match marked at disassembly. The craftsman is to verify the supports and the restraints were installed in the proper location by signing the data sheet in Appendix A, page 28.

6.6.12 Clear the work area and properly dispose of all potential fire hazards such as rags, flammable and combustible liquids, clothing, and plastic. The craftsman is to verify the area is clear and material properly disposed of by signing data sheet in Appendix A, page 26.

6.6.13 List all parts that were replaced on parts data sheet in Appendix A, page 21.

6.6.14 Check the oil level in the motor. If level is low, refill as necessary.

7.0 POST MAINTENANCE CHECKOUT AND RETURNING EQUIPMENT TO SERVICE

7.1 Remove any material left in pump area.

7.2 Arrange for replaced parts in container and any new parts not used to be surveyed for contamination.

7.3 Return all unused new parts to the storeroom.

7.4 Release Hold Order to shift engineer for filling and pressurizing as described in the tagging procedure in Appendix B, page 29.

7.4.1 Have an operator start the pump. The discharge gauge should show an increase in the pressure as the pump picks up speed. If it does not, shut down the pump and investigate.

NOTE: If any loud or unusual noise is heard coming from the pump, shut it down and investigate.

7.4.2 While the pump is running, adjust the shaft packing by tightening gland nuts. It is suggested that this be done slowly, one flat at a time until leakage is satisfactory.

NOTE: Do not make final adjustment of gland until pump has been in operation at operating temperature and pressure conditions for approximately four (4) to eight (8) hours.

PARTS LIST (Cont.)

ITEM NO.	REF. NO.	PART DESCRIPTION	QTY	NOTES	MATERIAL
34	403	Top Column Shaft	1	2	ASTM A-276 Tp. 410 H.T.
35	795-2	Lock Screw - Throttle Bushing	1	3	ASTM A-276 Tp. 316
36	232	Throttle Bushing	1	3	ASTM B-584 Alloy 938
37	050	Stuffing Box	1	1	ASME SA-216 GR. WCB
38	217	Shaft Sleeve	1	3	ASTM A-276 Tp. 410 H.T.
39	678-1	Gib Key - Sleeve	1	3	ASTM A-582 Tp. 416 H.T.
40	334	Retaining Ring - Sleeve	1	3	AISI Type 302
41	676-2	Key - Coupling	1	3	ASTM A-582 Tp. 416 H.T.
42	747-3	"O" Ring - Stuff. Box.	1	3	ASTM D-2000 - 2 BG 720
43	747-4	"O" Ring - Sleeve	1	3	ASTM D 2000 - 2 BG 720
44	236	Cage Ring	2	3	ASTM B-584 Alloy 932
45	742	Rings of Packing	5	3	John Crane 100 M
46	111	Split Gland	1	3	ASTM B-584 Alloy 836
47	530	Coupling - Pump Half	1	3	ASTM A-575 or 576 GR. 1018/1022 Parkerized
48	532	Adjusting Plate	1	3	ASTM A-575 or 576 GR. 1018/1022 Parkerized
49	529	Coupling - Motor Half	1	3	ASTM A-575 or 576 GR. 1018/1022 Parkerized
50	256-3	Split Ring - Motor	1	3	ASTM A-276 Tp. 410 H.T.
51	747-5	"O" Ring - Stuff. Box.	1	3	ASTM D-2000 - 2 BG 720
52	816	PIPE (Bleed Off)	1	(C) 3	(C) ASTM A-106 GR B
53	814	FITTINGS	(C) 5	(C) 3	(C) ASTM A-105
(B) 54	816-1	PIPE (BLEED OFF)	1	3	ASTM A-106 GR. B
55	814-1	FITTINGS	(C) 2	3	ASTM A-105
(C) 56	799	SIGHT FLOW INDICATOR	1	3	BRONZE, CARBON STEEL OR STAINLESS STEEL

ASME PRESSURE BOUNDARY BOLTING

DESCRIPTION		QTY	NOTES	MATERIAL
Suction Bell to Case, Case to Case, & Case to Col.	Studs 1-8UNC x 4-1/2 Lg.	72	1	ASME SA-193 GR. B6
	Hex Nuts - 1-8UNC	72	1	ASME SA-194 GR. 6
Column Flanges	Hex Hd. Cap Screws 1-8UNC x 5" Lg.	240	1	ASME SA-193 GR. B6
	Hex Nuts - 1-8UNC	240	1	ASME SA-194 GR. 6
Stuffing Box to Head	Studs 7/8 - 9UNC x 4" Lg.	4	1	ASME SA-193 GR. B6
	Hex Nuts - 7/8 -9UNC	4	1	ASME SA-194 GR. 6

STRUCTURAL BOLTING

DESCRIPTION		QTY	NOTES	MATERIAL
Discharge Head to Sole Plate	Studs 1-8UNC x 5 Lg.	24	1	ASME SA-193 GR. B6
	Hex Nuts - 1-8UNC	24	1	ASME SA-194 GR. 6
Motor to Discharge Head	Hex Hd. Cap Screws 1-8UNC x 2-1/2 Lg.	8	1	ASME SA-193 GR. B6

NOTES:
1) ASME Pressure Boundary Component
2) Actual Material Furnished, with Certified Material Test Reports.
3) Material Callout is for Reference Only. Actual material furnished meets or exceeds the requirements of that material referenced.
4) All Bolted Connections are secured with Type 18-8 Stainless Steel Lock Washers, on the nut end.

PARTS LIST

ITEM NO.	REF. NO.	PART DESCRIPTION	QTY.	NOTES	MATERIAL
1	795	Lock Screw - Bearing	1	3	ASTM A-276 Tp. 316
2	086	Suction Bell	1	1	ASME SA-216 GR. WCB
3	244	Sand Cap	1	3	ASTM B-584 Alloy 932
4	795-1	Lock Screw - Sand Cap	2	3	ASTM A-276 Tp. 316
5	226	Thrust Collar	1	3	ASTM B-584 Alloy 932
6	176	Impeller - 1st Stage	1	2	ASTM B-148 Alloy 952
7	207	Case Wear Ring	2	3	ASTM B-584 Alloy 932
8	104	Bottom Bearing	1	3	ASTM B-584 Alloy 938
9	256	Split Ring - Imp.	1	3	ASTM A-276 Tp. 410 H.T.
10	676	Key - Impeller	2	3	ASTM A-582 Tp. 416 H.T.
11	078	Series Case	1	1	ASME SA-216 GR. WCB
12	747	"O" Ring - Cases	2	3	ASTM D-2000 - 2 BG 720
13	039	Impeller Liner	2	2	ASTM B-148 Alloy 952
14	176-1	Impeller - 2nd Stage	1	2	ASTM B-148 Alloy 952
15	256-1	Split Ring - Imp	1	3	ASTM A-276 Tp. 410 H.T.
16	226-1	Thrust Collar - 2nd Stg.	1	3	ASTM B-584 Alloy 932
17	076	Top Case	1	1	ASME SA-216 GR. WCB
18	747-1	"O" Ring - Top Case	1	3	ASTM D-2000 - 2 BG 720
19	224	Case Bearing	2	3	ASTM B-584 Alloy 938
20	167	Pump Shaft	1	2	ASTM A-276 Tp. 410 H.T.
21	422	Outer Column Bottom	1		
				1	Flanges ASME SA-105 or SA-181 GR. II
22	420	Outer Column Intermediate (Bott. Seismic Support)	3		
				1	Shell & Ribs ASME SA-516 GR. 70 or SA-106 GR. B
23	420-1	Outer Column Intermediate (Center Seismic Support)	3		
				3	Bearing Retainers ASTM A-519 GR. 1018 or A-519 GR. 1022
24	420-2	Outer Column Intermediate (Without Seismic Support)	3		
25	402	Column Shaft - Intermediate	10	2	ASTM A-276 Tp. 410 H.T.
26	383	Column Bearing	10	3	ASTM B-584 Alloy 938
27	747-2	"O" Ring - Column	10	3	ASTM D-2000 - 2 BG 720
28	678	Gib Key - Coupling	22	3	ASTM A-582 Tp. 416 H.T.
29	256-2	Split Ring - Coupling	11	3	ASTM A-276 Tp. 410 H.T.
30	401	Shaft Coupling	11	2	ASTM A-276 Tp. 410 H.T.
31	676-1	Key - Coupling	22	3	ASTM A-582 Tp. 416 H.T.
32	429	Sole Plate	1	1	ASME SA-516 GR. 70
33	465	Discharge Head	1		
				1	Flanges ASME SA-105 or SA-181 GR. II
					Shell & Ribs
				1	ASME SA-516 GR. 70 or ASME SA-106 GR. B
					Base Plate Motor Mount Plate & Stuff. Box Plate
				1	ASME SA-516 GR. 70

DATA COVER SHEET

REMOVAL, INSPECTION, AND REPAIR OF THE
ESSENTIAL RAW COOLING WATER PUMPS

Unit _____ Reference TR No. _____

Performed by _____ / _____ / _____
Title Date

All calibrated instruments and tools utilized in this instruction have been recorded in the CSSC Instrument and Tool Log.

_____ / _____
Toolroom Attendent Date

Results Reviewed By _____ / _____
Maintenance Engineer Date

Results Reviewed and Approved _____ / _____
Maintenance Supervisor Date

QA Review Completed _____ / _____
QA Supervisor Date

Return to Maintenance Section

REMARKS: _____

_____

_____

_____

Date _____

INSTRUMENT DATA

Test Equipment	TVA Tag No.	Calibration Due Date

Date _____

REPLACEMENT PARTS

Part Name	Part No.	"575" or "4421" No.

Step 6.1.1: Hold Point Maintenance Engineer
Driver Leads disconnected

_____ / _____
Craftsman Date

_____ / _____
Verified by Maintenance Engineer Date

Step 6.3.1 Craftsman to visually inspect the following parts for unusual wear or damage caused by erosion or corrosion. Parts are acceptable if there are no cracks, unusual wear, or damage visible.

Step	Part Name/Number	Acceptable	Unacceptable	Verified By	Date
6.3.1.1	Suction Bell (2)				
6.3.1.2	Thrust Collar (5)				
	Thrust Collar (16)				
6.3.1.3	Impeller 1st stage (6)				
6.3.1.4	Case Wearing Ring (7)				
6.3.1.5	Split Ring Impeller (9)				
	Split Ring Impeller (15)				
6.3.1.6	Series Case (11)				
6.3.1.7	Impeller Liner (13)				
6.3.1.8	Impeller 2nd Stage (14)				
6.3.1.9	Top Case (17)				
6.3.1.10	Column Shaft (21)				
	Column Shaft (22)				
	Column Shaft (34)				
6.3.1.11	Split Ring (29)				
6.3.1.12	Shaft Coupling (30)				
6.3.1.13	Throttle Bushing (36)				
6.3.1.14	Stuffing Box (37)				
6.3.1.15	Shaft Sleeve (38)				
6.3.1.16	Retaining Ring (40)				
6.3.1.17	Cage Ring (44)				
6.3.1.18	Pump Shaft (8)				

HOLD POINT: Maintenance Engineer

Step 6.3.2.1 The diametral clearance between the bottom bearing (8) and the pump shaft (20) is _____". Clearance is satisfactory if it is .010" to .013". If clearance exceeds .013", the bearing is to be replaced. Clearance was recorded by

_____ / _____
Craftsman Date

Hold Point Verified by _____ / _____
Maintenance Engineer Date

HOLD POINT: Maintenance Engineer

Step 6.3.2.2 The diametral clearance between the case bearing (19) and pump shaft (20) is as follows.
Upper bearing clearance is _____".
Lower bearing clearance is _____".
Bearings are satisfactory if they are .010" to .013". If the clearance on either bearing exceeds .013", both bearings must be replaced. Bearing clearances were recorded by

_____ / _____
Craftsman Date

Hold Point Verified by _____ / _____
Maintenance Engineer Date

HOLD POINT: Maintenance Engineer

Step 6.3.2.2 The diametral clearance between the case wear rings (7) and 1st and 2nd stage impellers are as follows.
1st stage impeller (6) and wear ring (7) clearance is _____".
2nd stage impeller (14) and wear ring (7) clearance is _____".
Impeller clearance is satisfactory if it is .020" to .024".
If the clearance on either impeller exceeds .024", both wear rings must be replaced. Impeller clearances were taken and recorded by

_____ / _____
Craftsman Date

Hold Point Verified by _____ / _____
Maintenance Engineer Date

HOLD POINT: Maintenance Engineer

Step 6.3.2.4 The diametral clearance between the column bearings (26) and the shaft (25) are to be taken and recorded below. Bearing clearance is satisfactory if it is .010" to .013". If the bearing clearance exceeds .013", it must be replaced.

NOTE: Bearing number 1 is the bottom bearing.

Bearing No.	Actual Clearance	CONDITION		Recorded By	Date
		Sat	Unsat		
1	. "				
2	. "				
3	. "				
4	. "				
5	. "				
6	. "				
7	. "				
8	. "				
9	. "				
10	. "				

Hold Point Verified By _____ / _____
Maintenance Engineer Date

Hold Point: QC Inspector

Step 6.4.9 QC Inspector to verify that the outer column bolts have been installed with the bolt head on the bottom side of the flange and that the nuts have been torqued to 90 ft. lbs. ± 5%.

NOTE: The number 1 column is on the bottom.

Description of Bolts Torqued	Torqued By	Date	QC Inspector Inspect.By
Bowl Flange to Lower Column	_____	_____	_____
Lower Column to Inter Column No. 1	_____	_____	_____
Column No. 1 to Column No. 2	_____	_____	_____
Column No. 2 to Column No. 3	_____	_____	_____
Column No. 3 to Column No. 4	_____	_____	_____
Column No. 4 to Column No. 5	_____	_____	_____
Column No. 5 to Column No. 6	_____	_____	_____
Column No. 6 to Column No. 7	_____	_____	_____
Column No. 7 to Column No. 8	_____	_____	_____
Column No. 8 to Column No. 9	_____	_____	_____
Column No. 9 to Discharge Head	_____	_____	_____

Hold Point: Maintenance Engineer

Step 6.4.16 Driver leads re-connected.

_____ / _____
By Craftsman Date

_____ / _____
Verified by Maintenance Engineer Date

Step 6.4.17 Craftsman to check shaft rotation of motor shaft. Shaft rotation is correct if it rotates counterclockwise viewed from the coupling end.

Shaft Rotation Verified By _____ / _____
Craftsman Date

HOLD POINT: Maintenance Engineer

Step 6.4.18 Craftsman to check shaft runout by clamping a dial indicator on the motor coupling half and placing the indicator button on the O.D. of the pump coupling half. Rotate the motor shaft by hand and read the T.I.R. Shaft runout is satisfactory if the T.I.R. does not exceed .007". The craftsman is to check squareness of couplings by measuring the gap between the motor coupling half and the pump coupling half. The gap is to be measured in four places using feeler gauges. The squareness is satisfactory if the gap measurements do not vary more than .003".

	Sat	Unsat
Shaft runout is	/___/	/___/
Coupling square is	/___/	/___/

Performed By _____ / _____
Craftsman Date

Hold Point Verified By _____ / _____
Maintenance Engineer Date

HOLD POINT: Maintenance Engineer

Step 6.5.6 The maintenance engineer is to witness the impeller setting and verify that the impeller clearance is .146 (2 x .073") as described in steps 6.5.1 through 6.5.6.

Hold Point Verified By _____ / _____
Maintenance Engineer Date

Step 6.6.12 The work area has been cleared of all potential fire hazard materials and the same have been properly disposed of.

Verified By _____ / _____
Craft Foreman Date

Hold Point: QC Inspector

Step 6.6.9 and 6.6.10

Bolted Connection Data Sheet

Torque Table for alloy steel stud bolts, ASME SA-193, Gr. B7 and SA-453, Gr. 660 used on gasketed flanged connections

Nominal Diameter (In.)	Torque (Ft.-Lbs.)	Nominal Diameter (In.)	Torque (Ft.-Lbs.)
1/4	6	1-1/4	750
5/16	12	1-3/8	1020
3/8	18	1-1/2	1200
7/16	30	1-5/8	1650
1/2	45	1-3/4	2250
9/16	68	1-7/8	3000
5/8	90	2	3300
3/4	150	2-1/4	4770
7/8	240	2-1/2	6600
1	368	2-3/4	8880
1-1/8	533	3	11580

NOTES: 1. Torque Tolerances = ± 10%

Bolted Connection Description	Dia. Bolts (Inch)	Torqued To (Ft.-Lbs.)	Torqued By/Date Craftsman	Torque Inspected By/Date QC Inspector

Support And Restraint Data Sheet

I.D. Number	Number Shims	Match Marked	Removed By/Date	Installed By/Date

All supports and restraints have been properly installed in the correct location verified by:

_____ / _____

Maintenance Engineer Date

Unit_____

Train_____

CLEARANCE INSTRUCTIONS - ERCW PUMP

A. Work To Be Done: Pump_____ Date_____

1. Maintenance on ERCW Pump

B. Initial COnditions: Date_____

1. Technical Specification 3.7.4 has been considered for outage.

C. Tagging Instructions: Pump_____ Date_____

1. Check open, make inoperable 6.9-kV breaker for applicable ERCW pump and tag with Hold Notice.

2. Close applicable ERCW pump discharge valve and tag with Hold Notice.

3. Tag applicable ERCW pump control switch in control room with Hold Order.

D. Releaseing and Aligning for Operation: Pump_____ Date_____

1. Hold Order is released.

2. Remove Hold Notice and slowly open applicable ERCW pump discharge valve.

3. Remove Hold Notice and place applicable ERCW pump 6.9-kV breaker and make operable.

4. Remove Hold Order from applicable ERCW pump control switch in the control room.

E. Post Maintenance Testing: Date_____

1. _____ Perform S.I.-4.0.5.67,P

F. Return completed Appendix B to maintenance section for inclusion in completed data package.

G. 47W845-1

_____ / _____
SE/ASE Date

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT
Hazard Control Instruction

ALCOHOL (ISOPROPYL)

Isopropyl alcohol is a highly flammable liquid used for a variety of purposes. It acts as a local irritant and in high concentrations as a narcotic. Serious eye damage can occur upon contact with isopropyl alcohol.

Precautions

1. All safety precautions for flammable liquids (HCI-HM1) shall apply to the use of isopropyl alcohol.

2. Chemical goggles, or faceshields shall be worn when handling isopropyl alcohol. Rubber gloves are also required where prolonged contact is necessary.

3. Good ventilation shall be provided where isopropyl alcohol is handled.

4. Proper respiratory equipment shall be required where concentrations produce irritation or other uncomfortable effects.

5. Fire protection shall be readily available in areas of use.

6. If the eyes are affected, they should be washed immediately with clean water for at least 15 minutes. After washing madical personnel shall be consulted.

Power Plant Superintendent

PRECAUTIONS FOR USING ACETONE

1. Acetone is highly flammable and its vapors form explosive mixtures with air.
2. Good ventilation shall be provided in the area where it is used.
3. Flame and heat producing activities shall be prohibited in the area.
4. Fire protection shall be made available in the area where it is used.
5. Spills shall be cleaned up immediately by flushing with water, or wiping up with rags. The rags shall be disposed in containers for that purpose.
6. Waste material shall be disposed of properly. Consult with the Chemical Engineer for disposal instructions.
7. Skin irritation may occur from prolonged contact with acetone.
8. Prolonged inhalation of vapors may cause nose, eye, and throat irritations. Chemical cartridge respirators shall be available for prolonged use with the liquid.
9. Chemical goggles or full face shield and rubber gloves shall be worn when using the liquid.
10. Acetone should be kept in a fireproof container.

FIRST AID

Chemical Burns--Dilute the contaminating substance immediately with large amounts of water. This can be done by emergency shower, hose, buckets, or other means.

Eye Burns--Wash the eye immediately with clean water. This can be done by an eyewash or other means of clean water. After the eye has been washed, medical personnel shall be consulted.