

Revision 1

BYRON NUCLEAR POWER STATION

UNIT I

PRESERVICE TESTING

(PSI)

Program Plan for Pumps

Table of Contents

	<u>Page</u>
1.0 Pre-Service Testing Program for Pumps	
1.1 Program Description	3
1.2 Tables for Pre-Service Pump Testing Program	4
1.3 Relief Requests and Allowable Ranges of Test Quantities.	10

1.1 - Byron Unit 1 Pump Pre-Service Inspection Program Plan.

The Pump Pre-Service inspection (PSI) program for Byron Nuclear Power Plant Unit 1, is implemented in accordance with the requirements of subsection IWP of section XI of the ASME Boiler and Pressure Vessel Code, 1977 edition, through the summer of 1978 addenda. Where these rules are determined to be impractical, specific relief is requested and is referenced in the tables.

Pumps which are identified in the Byron Station FSAR as Category 1 pumps, which are active and have an emergency power source, are the pumps subject to PSI/ISI testing. Active pumps are defined as those pumps which are called on to perform a safety function as well as to accomplish and maintain a safe reactor shutdown. The only exception to this is diesel driven auxiliary feedwater pump, (1AF01PB) which is included in the program although it is not supplied by an emergency power source.

Lubrication level will be observed through sight glasses for the pumps listed in the PSI/ISI programs, except diesel oil transfer pumps (1D001PA, 1D001PB) which are lubricated by the pumped fluid. Also the speed will not be measured for pumps operating at nominal motor nameplate speed for constant speed drives, but it will be measured through tachometers for variable speed drives, (i.e., Diesel) such as Essential Service Water Makeup pumps (OSX02PA, OSX02PB).

Reference values shall be determined from the results of an inservice test which may be run during preoperational testing or from the results of the first inservice test run during power operation. Reference values shall be at points of operation readily duplicated during subsequent inservice testing.

SECTION 1.2

TABLES FOR PRE-SERVICE PUMP TESTING PROGRAM

BYRON UNIT 1

The pre-service test quantities shown below will be measured or observed in accordance with IWP-3100 of ASME Section XI '77 edition, summer '78 addenda:

1. Speed (if variable speed)
2. Inlet pressure
3. Differential pressure
4. Flow rate
5. Vibration
6. Bearing temperature
7. Lubrication level

Wherever these quantities will not be measured or observed, the relief request number pertaining to the item is given on the program summary tables.

The following information is included in the summary tables:

The first four columns include the unique Byron Station Equipment Piece Number, the code class, and the P & ID on which the pumps are located, including the x-y coordinates which specifically locate the pumps on the P & ID.

Speed: The speed will not be measured for the pump operating at nominal motor nameplate speed for constant speed drives, but it will be measured through the tachometer for variable speed drives.

Inlet pressure: Inlet pressure will be measured via permanently installed gauges or through readings taken from pressure taps provided for using temporarily installed calibrated gauges.

Differential pressure: Differential pressures will be measured using calibrated differential pressure gauges, or by recording the difference between calibrated inlet and outlet pressure gauges.

Flow rate: Flow rates will be measured using permanently installed instrumentation.

Vibration: Vibration measurement shall be made using hand held instruments.

Bearing Temperature: Bearing temperature will be measured by permanently installed devices or thermocouples where such devices are present. Similar temporary measurement devices will be used where temperature wells are provided.

Lubrication Level: Lubrication level will be observed through sight glasses for the pumps listed in the PSI/ISI programs, except diesel oil transfer pumps (1D001PA, 1D001PB) which are lubricated by the pumped fluid.

PRESERVICE TESTING PROGRAM PLAN

UNIT-1

CLASS 1, 2, & 3 PUMP
BYRON NUCLEAR POWER STATIONREVISION - DATE
0 1-25-82PAGE
1 of 3

PUMP NUMBER	PUMP NAME	P & ID AND COORDINATES	TEST PARAMETERS						BEARING TEMP	TEST INTERVAL	LUBRI- CATION LEVEL	REMARKS
			SPEED	INLET PRES	DIFF PRES	FLOW RATE	VIBRATION					
OAB03P	Boric acid transfer pump	3	M-65-5	No	Yes	Yes	Yes	PR-1	PR-2		Yes	
1AB03P	Boric acid transfer pump	3	M-65-5	No	Yes	Yes	Yes	PR-1	PR-2		Yes	
1AF01PA	Auxiliary feedwater pump	2	M-37	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1AF01PB	Auxiliary feedwater pump (Diesel)	2	M-37	Yes	Yes	Yes	Yes	PR-1	Yes		Yes	
OCC01P	Component cooling pump	3	M-66-3	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1CC01PA	Component cooling pump	3	M-66-3	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1CC01PB	Component cooling pump	3	M-66-3	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1CS01PA	Containment spray pump	2	M-46	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1CS01PB	Containment spray pump	2	M-46	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1CV01PA	Centrifugal charging pump	2	M-64-3	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1CV01PB	Centrifugal charging pump	2	M-64-3	No	Yes	Yes	Yes	PR-1	Yes		Yes	

PRESERVICE TESTING PROGRAM PLAN

UNIT-1

CLASS 1, 2, & 3 PUMP
BYRON NUCLEAR POWER STATIONREVISION - DATE
0 1-25-82PAGE
2 of 3

PUMP NUMBER	PUMP NAME		P & ID AND COORDINATES	TEST PARAMETERS						TEST INTERVAL	LUBRI- CATION LEVEL	REMARKS
				SPEED	INLET PRES	DIFF PRES	FLOW RATE	VIBRATION	BEARING TEMP			
1RH01PA	Residual heat removal pump	2	M-62	No	Yes	Yes	Yes	PR-1	PR-2		Yes	
1RH01PB	Residual heat removal pump	2	M-62	No	Yes	Yes	Yes	PR-1	PR-2		Yes	
1SI01PA	Safety injection pump	2	M-61-1	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1SI01PB	Safety injection pump	2	M-61-1	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1SX01PA	Essential service water pump	3	M-42-1	No	Yes	Yes	Yes	PR-1	Yes		Yes	
1SX01PB	Essential service water pump	3	M-42-1	No	Yes	Yes	Yes	PR-1	Yes		Yes	
OSX02PA	Essential service water makeup pump (Diesel)	3	M-42-6	Yes	PR-3	Yes	Yes	PR-1	PR-2		Yes	
OSX02PB	Essential service water makeup pump (Diesel)	3	M-42-6	Yes	PR-3	Yes	Yes	PR-1	PR-2		Yes	
1D001PA	Diesel Oil Transfer Pump	3	M-50-1	No	Yes	Yes	Yes	PR-1	PR-2		No	
1D001PB	Diesel Oil Transfer Pump	3	M-50-1	No	Yes	Yes	Yes	PR-1	PR-2		No	
1D001PC	Diesel Oil Transfer Pump	3	M-50-1	No	Yes	Yes	Yes	PR-1	PR-2		No	
1D001PD	Diesel Oil Transfer Pump	3	M-50-1	No	Yes	Yes	Yes	PR-1	PR-2		No	

PRESERVICE TESTING PROGRAM PLAN

UNIT-1

CLASS 1, 2, & 3 PUMP
BYRON NUCLEAR POWER STATIONREVISION - DATE
0 1-25-82PAGE
3 of 3

PUMP NUMBER	PUMP NAME	P & ID AND COORDINATES	TEST PARAMETERS						BEARING TEMP	TEST INTERVAL	LUBRI- CATION LEVEL	REMARKS
			SPEED	PRES	DIFF	FLOW	RATE	VIBRATION				
OW001PA	Control Room Chilled Water	3 M-118-1	No	Yes	Yes	Yes		PR-1	PR-2		Yes	
OW001PB	Control Room Chilled Water	3 M-118-1	No	Yes	Yes	Yes		PR-1	PR-2		Yes	

SECTION 1.3

RELIEF REQUESTS FOR PRE-SERVICE PUMP

TESTING PROGRAM

RELIEF REQUEST NO. PR-1

1. PUMP NUMBER: All pumps in program plan.
2. NUMBER OF ITEMS: 23 pumps.
3. ASME CODE CLASS: 2 & 3
4. ASME CODE, SECTION XI: (Detection of mechanical change per IWP-1700 and table 2WP-1700 3100-2).

The requirements for which relief is being requested are the measurement and allowable ranges of vibration in mils displacement.

5. BASIS FOR RELIEF: Pump vibration is required to be measured to detect any changes in the mechanical characteristic of a pump.

This is to detect developing problems so repairs can be initiated prior to a pump becoming inoperable (i.e., unable to perform its function).
6. ALTERNATE TESTING: The ASME Code minimum standards require measurement of the vibration amplitude in mils, (displacement).

Byron Station proposes an alternate program of measuring vibration velocity (inches per second) which is more comprehensive than that required by section XI. This technique is an industry-accepted method which is much more meaningful and sensitive to small changes that are indicative of developing mechanical problems. These velocity measurements detect not only high amplitude vibrations that indicate a major mechanical problem but also the equally harmful low amplitude high frequency due to misalignment, imbalance, or bearing wear that usually go undetected by simple displacements.

The "General Machinery Vibration Severity Chart" published by IRD Mechanalysis, Inc., (see attached) will be used as an alternate to the "Allowable Ranges of Test Quantities" in ASME table IWP-3100-2 for vibration. The "Alert Range" will be $.314 \text{ in/sec} < V < .628 \text{ in/sec}$. The required action range will be $V \geq .628 \text{ in/sec}$. Evaluation of data, to assign equipment to the alert or action ranges, will be done within 96 hours (per IWP-3220 of Section XI). This will be done using industry accepted vibration analysis equipment, such as a full spectrum analyzer.

GENERAL MACHINERY VIBRATION SEVERITY CHART

For use as a GUIDE in judging vibration as a warning of impending trouble.

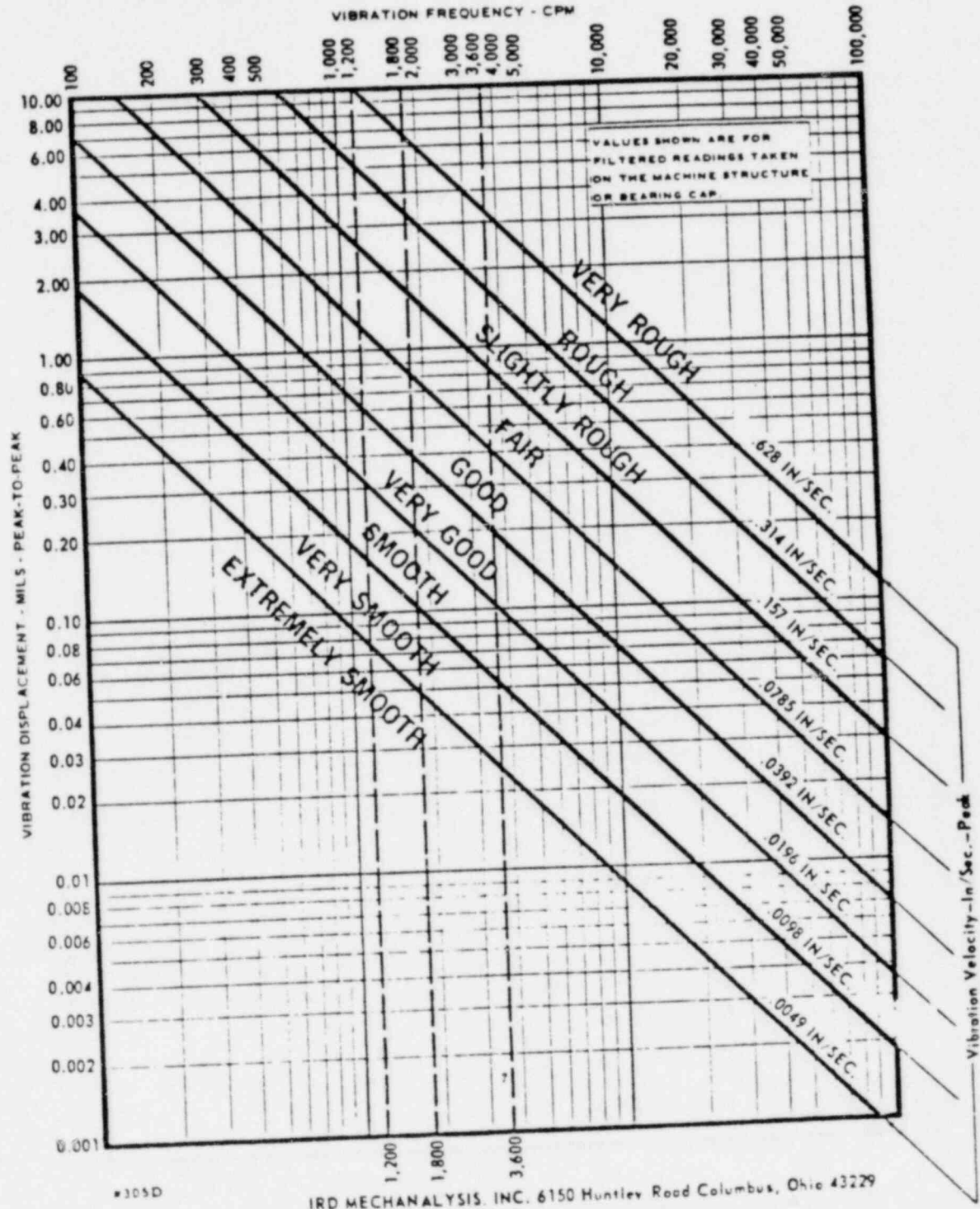


Figure 15. This chart can be used to cross-reference displacement with frequency to determine vibration severity.
Reprinted with permission of IRD Mechanalysis, Inc., 6150 Huntley Road, Columbus, Ohio

7. JUSTIFICATION: Measurements of vibration in mils displacement are not sensitive to small changes that are indicative of developing mechanical problems. Therefore, the proposed alternate of measuring vibration amplitude provides added assurance of the continued operability of the pumps.

RELIEF REQUEST NO. PR-2

1. PUMP NUMBER: OAB03P, 1AB03P, 1RH01PA, 1RH01PB, OSX02PA, OSX02PB, 1D001PA, 1D001PB, 0W001PA, 0W001PB
2. NUMBER OF ITEMS: 10 pumps
3. ASME CODE CLASS: 2 & 3
4. ASME CODE, SECTION XI REQUIREMENTS: (Detection of mechanical change per IWP-1700)

Pump bearing temperatures are required to be measured to detect any changes in the mechanical characteristics of the pumps' bearings. IWP-3500(b) requires three successive readings taken at ten minute intervals that do not vary more than 3%.

5. BASIS FOR RELIEF:

- a. These pumps' bearings are not provided with permanent temperature detectors or thermal wells. Therefore, gathering data on bearing temperature is impractical.
- b. The only temperature measurements possible are from the bearing housing. To detect high bearing temperature at the bearing housing requires that the bearings in question be seriously degraded.
- c. Measurement of housing temperature on many of these pumps does not provide information on bearing condition or degradation. For example, Essential Service Water pumps (OSX02PA, OSX02PB) and Diesel Oil Transfer Pumps (1D001PA, 1D001PB, 1D001PC, 1D001PD) are cooled by pumped fluid and Residual Heat Removal Pumps (1RH01PA, 1RH01PB) are cooled by external cooling systems.

Therefore, any heat generated by degraded bearings is carried away by the cooling fluid and would not be directly measured at the bearing housing.

6. ALTERNATE TESTING: No direct alternate test is proposed for bearing temperatures. However, measurement of hydraulic parameters and vibration readings do provide a more positive method of monitoring pump condition and bearing degradation.
7. JUSTIFICATION: By measuring pump hydraulic parameters and vibration velocity, (as described in PR-1), pump operability, and trending of mechanical degradation is assured. Also, since these parameters (i.e., Hydraulic parameters and vibration) are measured monthly, the pump mechanical condition will be more accurately determined than would be possible by measuring bearing temperature on a yearly basis.

RELIEF REQUEST NO. PR-3

1. PUMP NUMBER: OSX02PA, OSX02PB
2. NUMBER OF ITEMS: 2 pumps
3. ASME CODE CLASS: 3
4. ASME CODE, SECTION XI REQUIREMENT: (IWP-3100 measurement of inlet pressure per table IWP-3100-1).
5. BASIS FOR RELIEF: It is impractical to measure the inlet pressures of these pumps. Instrumentation for directly measuring the inlet pressure for these pumps does not exist. These pumps take a suction from the river.
6. ALTERNATE TESTING: These pumps will be evaluated using pump discharge pressure. Additionally, delta level across the traveling screens will be measured to assure adequate suction level. There is differential level instrumentation provided, which indicates the difference in level between the river height and the reservoir height in inches. This delta level will be recorded in lieu of inlet pressure for the pumps.
7. JUSTIFICATION: The level of plant safety is not affected by not taking suction pressure data on vertical well type pumps. These pumps cannot suffer from cavitation as long as their impellers are submersed in the pumped fluid reservoir. Recording the delta level across the traveling screens ensures that the pumps will be submersed in the river since no other possible obstructions between the river and pump bays exist.