

BYRON NUCLEAR POWER STATION

UNIT I

INSERVICE TESTING

(ISI)

Program Plan for Pumps

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1.1 - Byron Unit 1 Pump Inservice Inspection Program Plan.

The Pump Inservice inspection (ISI) 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, 1980 edition, through the winter of 1980 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 for the Diesel Oil Transfer pumps (1D001PA, 1D001PB), the Residual Heat Removal pumps (1RH01PA, 1RH01PB), and the Containment Spray pumps (1CS01PA, 1CS01PB), 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 a preservice 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 INSERVICE PUMP TESTING PROGRAM

BYRON UNIT 1

The inservice test quantities shown below will be measured or observed in accordance with IWP-3100 of ASME Section XI '80 edition, winter '80 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. More Pump Relief Requests may be necessary for the Pump Inservice Inspection Program and will be identified during the performance of the Preservice Inspections.

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: Speed will be measured by a 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 where such devices are present. Portable measurement devices will be used where temperature wells are provided.

Per IWP-3300, bearing temperatures are required only once per year. Byron Station takes the data for bearing temperatures once per year during the summer test.

Test Interval: An inservice test shall be run on each pump nominally every 3 months during normal plant operation, in accordance with IWP-3400.

Lubrication Level: Lubrication level will be observed through sight glasses for the pumps listed in the PSI/ISI programs.

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UNIT-1

CLASS 1, 2, & 3 PUMP
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PUMP NUMBER	PUMP NAME	CLASS	P & ID	TEST PARAMETERS							LUBRI-CATION LEVEL	REMARKS
				SPEED	*INLET PRES	DIFF PRES	FLOW RATE	VIBRATION	BEARING TEMP	TEST INTERVAL		
OAB03P	Boric acid transfer pump	3	M-65-5	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	Yes	Note 1
IAB03P	Boric acid transfer pump	3	M-65-5	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	Yes	Note 1
IAF01PA	Auxiliary feedwater pump	2	M-37	No	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
IAF01PB	Auxiliary feedwater pump (Diesel)	2	M-37	Yes	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
OCC01P	Component cooling pump	3	M-66-3	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	Yes	Note 1
ICC01PA	Component cooling pump	3	M-66-3	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	Yes	Note 1
ICC01PB	Component cooling pump	3	M-66-3	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	Yes	Note 1
ICS01PA	Containment spray pump	2	M-46	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	
ICS01PB	Containment spray pump	2	M-46	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	
ICV01PA	Centrifugal charging pump	2	M-64-3	No	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
ICV01PB	Centrifugal charging pump	2	M-64-3	No	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	

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

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PUMP NUMBER	PUMP NAME	C L A S S	P & ID	TEST PARAMETERS							LUBRI- CATION LEVEL	REMARKS
				SPEED	*INLET PRES	DIFF PRES	FLOW RATE	VIBRATION	BEARING TEMP	TEST INTERVAL		
OW001PA	Control room chilled water	3	M-118-1	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	Yes	
OW001PB	Control room chilled water	3	M-118-1	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	Yes	

NOTE: *Measure before pump startup and during test.

Bearing temperatures are exempted from quarterly test interval per IWP-3300, bearing temperatures are required only once per year.

SECTION 1.3
RELIEF REQUESTS FOR INSERVICE PUMP
TESTING PROGRAM

RELIEF REQUEST NO. PR-1

1. PUMP NUMBER: All pumps in program plan.
2. NUMBER OF ITEMS: 25 pumps.
3. ASME CODE CLASS: 2 & 3
4. ASME CODE, SECTION XI: (Detection of mechanical change per IWP-1500 and table IWP-3100-2).

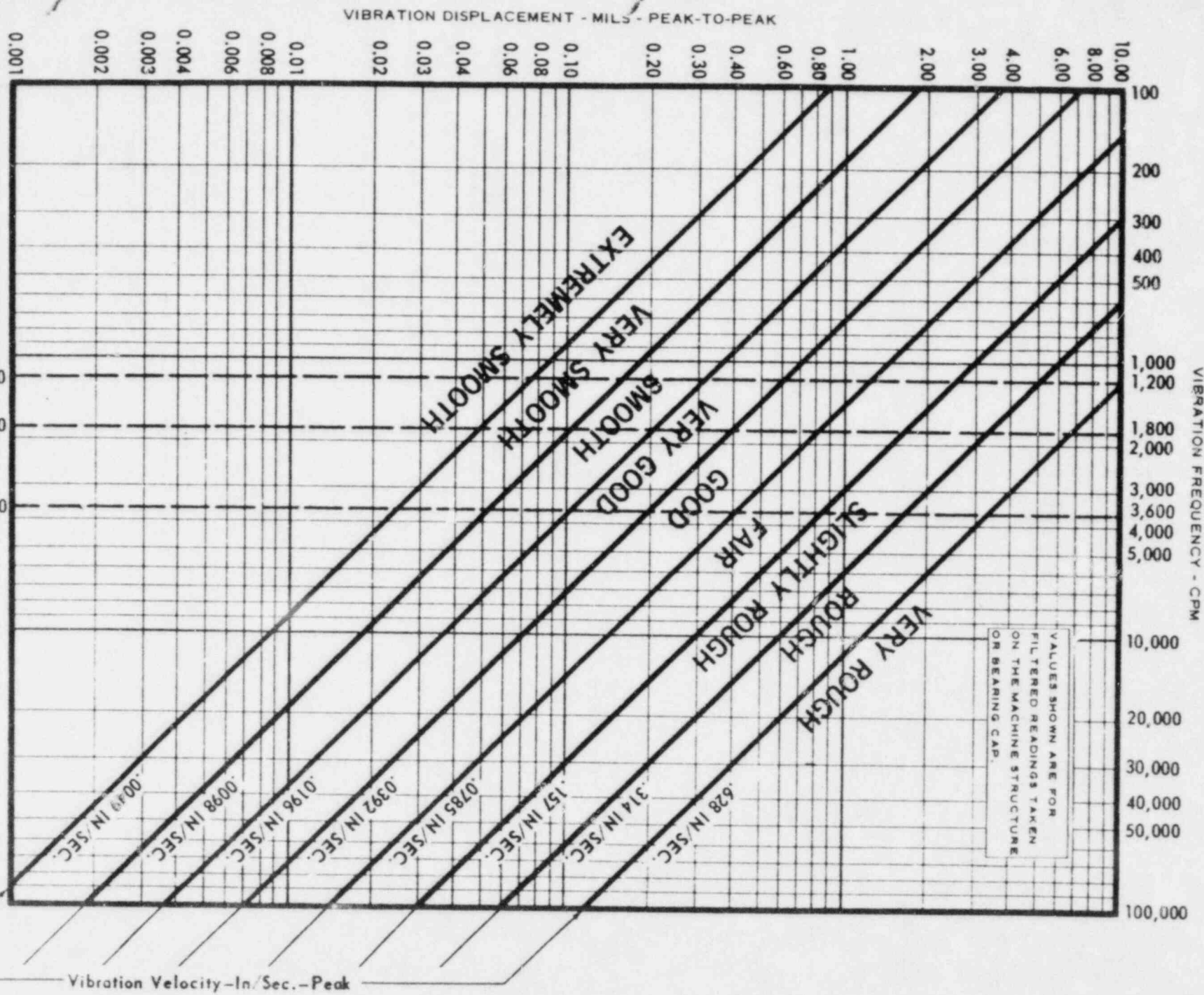
The requirements for which relief is being requested are the measurement and allowable ranges of vibration in mils displacement.

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 $.314 \text{ in/sec} \leq V < .628 \text{ in/sec}$. 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.



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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, LAB03P, OCC01P, ICC01PA, ICC01PB, ICS01PA, ICS01PB, IRH01PA, IRH01PB, OSX02PA, OSX02PB, IDO01PA, IDO01PB, IDO01PC, IDO01PD, OW001PA, OW001PB
2. NUMBER OF ITEMS: 17 pumps
3. ASME CODE CLASS: 2 & 3
4. ASME CODE, SECTION XI REQUIREMENTS: (Detection of mechanical change per IWP-1500)

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, the bearings on the Essential Service Water pumps (OSX02PA, OSX02PB) and Diesel Oil Transfer Pumps (IDO01PA, IDO01PB, IDO01PC, IDO01PD) are cooled by the fluid pumped.

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 quarterly, 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 and differential 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.

SECTION 1.4
NOTES FOR THE INSERVICE
PUMP TESTING PROGRAM

NOTE 1

These pumps have "pump" bearings and "shaft" bearings. The "pump" bearings are lubricated by the fluid which is being pumped, hence, they do not have any indication for lubrication level. Although, the "shaft" bearings are lubricated by oil and will be checked for lubrication level.