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October 11, 1982
EF2 - 59,486

Mr. L. L. Kintner
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Washington, D. C. 20555

Dear Mr. Kintner:

References: (1) Enrico Fermi Atomic Power Plant, Unit 2
NRC Docket No. 50-341

(2) Letter B. J. Youngblood to H. Tauber, July 30, 1982, "Long Term Operability of Deep Draft Pumps (IE Bulletin 79-15)"

Subject: Long Term Operability of Deep Draft Pumps

The Reference 2 letter requested additional information on the subject pumps. Attached are our responses to these questions. We will reference these responses in the FSAR in a forthcoming amendment.

Should you have any additional questions, please contact L. E. Schuerman, (313) 649-7562.

Sincerely,

Harry Tauber

Attachment

cc: Mr. B. Little

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Question #1

Provide a general description of pump design and the performance characteristics of the pumps. Provide natural frequencies of the pumps, either estimated by analyses or measured by tests.

Response

A detailed description of the pump parameters and system functions was submitted in the earlier response to IE Bulletin 79-15, EF2-50,633, October 25, 1979. For additional information, forty copies of the instruction manual and the seismic stress analysis for each pump is submitted.

Question #2

Discuss the approach taken for initial alignment and shaft straightness during installation.

Response

Alignment of the pump and motor is performed at three points in the course of normal installation and testing at the site. The first alignment is the preliminary alignment, performed with the pump/motor set on its soleplate and all anchor and base bolts torqued. The piping is not connected at this point in time. Parallel and angular misalignment is measured and compared to design values. The measurements are taken from shaft to shaft where possible and shaft to coupling halves if necessary. The pump is left in an acceptably aligned condition.

The next alignment check is the cold alignment performed after the piping is connected to the pump. The same procedures are followed for alignment checks (i.e. parallel and angular alignment). Data is taken in the same manner as in the preliminary alignment stage. The pump is again left in an acceptably aligned condition.

The third alignment check is the hot alignment performed after the pump lift settings have been optimized. The pump/motor set is brought up to normal operating temperatures and all data is taken before the unit cools down more than 10%. Parallel and angular alignment data is obtained in the same fashion as described earlier. Hot alignment is the final alignment performed. The pump motor set is left in an acceptably aligned condition.

During the Check Out and Initial Operation (CAIO) and preoperational testing, the pump/motor vibration is measured. In the event that an evaluation of the vibration data analysis indicates the possibility of a bent shaft or if satisfactory pump/motor alignment cannot be achieved by any normal or practical means, then disassembly of the pump and/or motor would be warranted. At that time shaft straightness would be determined. Disassembly of the pumps is not normally performed unless necessary, to limit the opportunity for inadvertent re-assembly errors.

Question #3

Describe in detail as to how vibration data base will be established, in the light of the guideline provided in ASME Code Section XI, Division I.

Response

The base vibration data will be taken after the final hot alignment has been completed. There will be a magnetic tape of the data taken using IRD vibration transducers and a 4 channel FM tape recorder. The data will be analyzed using an IRD model 320 and Nicolet 660A Dual Channel FFT analyser (or equivalent equipment). The equipment used measures vibration in velocity units and internally integrates the signal such that the output is in mils of amplitude peak to peak. Velocity vibration measurement is more sensitive to high frequency low amplitude vibration. Such vibration is indicative of developing problems. This technique is the current industry standard. ASME Section XI Division I provides guidelines for determining the operating status of rotating equipment based on changes in the vibration signatures of a piece of equipment. These changes are changes in the peak to peak amplitude values. By using the vibration velocity measurement technique, Detroit Edison is exceeding the intent of the Code.

Question #4

Describe the acceptance test procedure prior to full power operation, as well as after repair and reassembly.

Response

The acceptance testing performed occurs in two phases: the checkout and initial operation phase and the preoperational test phase. These phases individually incorporate electrical and mechanical testing. The electrical testing verifies the integrity and functionability of the electrical equipment and control systems. The mechanical testing verifies the equipment's ability to meet its design functions in accordance with the design specifications. This includes, but is not limited to vibration, alignment, and system capacity tests. The test data (i.e. results) are reviewed and approved by the Technical Review Committee. Successful completion of the acceptance testing implies that the system as installed will perform design functions in accordance with the design specifications.

The preoperational test will include 100 hours of operation with each pump pumping water at rated flow into the normal piping system. This run will simulate the important design conditions to detect a possible rapid bearing wear problem. The 100 hours of operation does

not have to be continuous. However, a continuous 24-hour vibration test will be run before 40 hours of operation is accumulated on the pump.

During this 24-hour test, test data will be taken every three hours and the test will not commence until the pump's primary parameters have stabilized. Test data includes all pertinant pump parameters, besides vibration readings. Similar data will also be taken at approximately the 50- and 100-hour points during the preoperation period.

Since the only safety-related deep draft pumps at Fermi 2 are Service Water Pumps, it is impractical to raise the reservoir temperature to the design temperature (90°F) since there is no convenient heat source. As a consequence, neither of the above tests will necessarily be run with water at the operating design (90°F) point, but will be run at ambient RHR reservoir water temperature (40-80°F). However, this small difference in temperature would not effect the pump bearing loads or wear characteristics.

Following repair and/or reassembly of a pump/motor unit, and/or during the Section XI inservice test, vibration base data will be taken prior to returning the unit to service. The data base will be taken at

full flow and pressure and after stable conditions have been reached on the primary pump parameters. This procedure is more stringent than the requirements of ASME Section XI Division I which allows testing within 96 hours of returning to service after a maintenance activity. During this test pump suction and discharge pressures, flow rate, and fluid temperatures will be recorded. The test data is reviewed by the plant Technical Group against the original data base. Any significant detremental deviations from previous test data or design specifications will initiate further investigations aimed at resolving those problems. The investigation may include but is not limited to special testing and/or equipment disassembly.

Question #5

Describe the in-service surveillance test procedure, including the vibration monitoring instruments used and their location. Also explain how pump degradation can be detected in such program.

Response

The in-service surveillance test procedure calls for testing to be performed quarterly. The parameters measured will be inlet pressure, differential pressure, flow rate and vibration. The initial vibration signatures will be measured with an IRD vibration analyzer using IRD vibration transducers and magnetic bases. The locations for the probe positions will either be clearly marked or metal tagged. These locations will be the same ones used when the base vibration data was obtained. The IRD analyzer senses vibration in velocity units and internally integrates the signal. Its readout is in terms of amplitude peak to peak.

The plant Technical Group will compare the data to the base vibration signature. Allowable ranges of vibration velocity are established from Table PR-1 of the Fermi 2 Inservice Testing Program. This table is conservative as compared to the ASME Code Section XI, Division 1, Table 1WP 3100-2. Monitoring of vibration velocity detects not only high amplitude vibrations that indicate a major mechanical problem, but also equally harmful low amplitude, high frequency vibrations resulting from misalignment, imbalance, or bearing wear that usually goes undetected by simple displacement measurements.