

FERMI 2 MAIN TURBINE-GENERATOR VIBRATION MONITORING AND BALANCING DURING START-UP AFTER RFO4

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TMTB-94-0021, Rev. 1

Since the Main Turbine-Generator (MTG) will be returned to service after major rebuilding at the completion of RFO4, required field balancing during start-up is anticipated. Monitoring of MTG vibration will be performed during MTG initial roll-up, synchronization and power ascension.

The Low Pressure (LP) Turbine rotors are being returned to service following rotor straightening work and stage 7 and stage 8 blade removal. These rotors have been overspeed tested and balanced at full speed, 1800 rpm in a spin box. Shaft vibration for each rotor after final balancing at 1800 rpm was less than 2.0 mils P-P.

Based on previous Fermi 2 operating experience, it is anticipated that field balancing to reduce shaft vibration amplitudes at 1800 rpm will be required. The established shaft vibration displacement (d) criteria (at 1800 rpm steady conditions) based on previous Fermi 2 operating experience and manufacturer and insurer recommendations is as follows:

| | |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $d \leq 4$ mils | Action not required. |
| $4 \text{ mils} < d \leq 7$ mils | Compute balance shot; install during future outage when MTG is offline for approximately 24 hours. |
| $7 \text{ mils} < d \leq 9$ mils | Compute balance shot; <u>schedule</u> balance shot installation shutdown within 6 months. |
| $d > 9$ mils | Obtain balance vibration data, if less than 14 mils can remain in operation for <u>not more than 30 minutes</u> for data acquisition, then take action to reduce vibration. |
| $d > 14$ mils | Shutdown immediately. |

The above criteria have been utilized for previous start-ups after major MTG work and was established for engineering decisions during start-up regarding the need for balancing. These criteria do not supersede Alarm Response Procedures. The Alarm Response Procedures (ARP 4D9 and 4D13) are the operator's procedures for response to MTG vibration alarms.

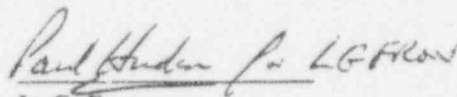
During start-up from a cold condition, it is not unusual for LP Turbine shaft vibration to be approximately 10 mils at 1800 rpm prior to synchronization. With synchronization and load increase (increased temperature of LP Turbine) shaft vibration, generally, trends to acceptable amplitudes. Therefore, during start-up at 1800 rpm, if shaft vibration is approximately 10 mils or less, the effects of synchronization and increasing load will be established prior to shutdown for balancing.

Balancing at 1800 rpm is expected to be required in coupling balance planes and/or LP Turbine end balance planes. Balance weights have been installed at these locations in the past without releasing condenser vacuum. The coupling balance planes are accessed by removing the coupling cover. Access to the LP Turbine end planes is made by removal of small access cover plates.

It is anticipated that shaft vibration levels similar to those experienced during Fermi 2 operating cycle 4 will be achievable at full load steady-state after balancing. Shaft vibration during operating cycle 4 (RFO3 to December 1993) was generally less than 5 mils at each bearing at full load, steady-state conditions.

The MTG automatic trip on vibration will be activated after at least 60-90 days of full power operation. The automatic trip will have a specific set point for amplitude, time delay and adjacent bearing vibration amplitude requirement. These criteria are preliminarily set at 10 mils setpoint, 10 second delay and adjacent bearing requirement of exceedance of 6 mils. The criteria are currently under review and will be finalized before return to service.

Written by:



L. G. Fron

Vibration Analysis and Diagnostics
Technical & Engineering Services

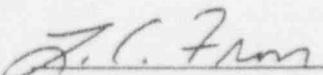
Concurred by:



R. S. Craft

ISI/PEP, Technical Engineering
Fermi 2

Approved by:



L. C. Fron

Director, Turbine & Special Projects
Fermi 2