

(i) Name and address of the individual or individuals informing the Commission.

Mr. Martin T. Kurr
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701 White Avenue
Beloit, WI 53511

(ii) Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.

Facility:

Arkansas Nuclear One Unit 2 returned one SA-3176-D mini-gen to Fairbanks Morse (FM) that was identified as having a defect. The other facilities supplied with the SA-3176-D mini-gen are Limerick, Angra (Brazil), Hatch, Farley and Prairie Island.

Basic component which fails to comply or contains a defect:

Synchro-Start mini-gen signal generator, Woodward part number SA-3176-D; Fairbanks Morse part number 16302997; Installed on FM Opposed Piston (OP) Emergency Diesel Generators (EDG).

(iii) Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect.

Fairbanks Morse (FM)
701 White Avenue
Beloit, WI 53511

(iv) Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.

Nature of defect:

Arkansas Nuclear One Unit 2 reported to Fairbanks Morse: "We had a failure of a mini-gen signal generator that was installed for 7 years (approximately 210 hours total operating time) on our OP emergency diesel generator (EDG). The bench testing showed an erratic signal after removing off the engine."

The mini-gen was returned to FM and the erratic signal was confirmed. FM destructive analysis revealed wear of the dynamic surface on the stator bushing inside diameter. The rotating magnet / shaft assembly was found to have a loose fit with the mating stator bushing. The shaft had 0.013" total movement within the worn stator bushing, which means the air gap between the stator and magnet would oscillate from direct contact (0) to 0.0065" while the magnet was rotating. This continually variable airgap produced the erratic output signal.

The cause of the worn stator bushing is most likely due to inadequate lubrication on the dynamic surfaces, outside diameter of the shaft and inside diameter of the stator bushing. A majority of the inside diameter of the worn bushing had no visibly detectable lubrication.

1. One possible cause of inadequate lubrication is failure to apply a significant quantity of lubrication to the dynamic surfaces during the manufacturing process.
2. A second possible cause of inadequate lubrication is deterioration / evaporation over time. All lubricants will evaporate over time and will be consumed during dynamic operation of the bearing. The mini-gen that failed was manufactured by Woodward approximately 15 years ago.

Safety hazard which could be created by such defect:

The mini-gen signal generator is used to produce a frequency input to the Tach Relay switch to initiate flashing of the generator. When an erratic unreliable signal is being produced by the defective mini-gen, the tachometer relay switch may not activate the Low-Speed Relay (at 250 rpm) during EDG starting and will not flash the generator field during engine ramp up, preventing the EDG from meeting the design bases function for generator output voltage. The defective mini-gen may also cause unreliable activation of the "Engine at Normal Speed Relay" used as a backup to flash the generator field at 810 rpm. In addition, the operator may have unreliable Tachometer readings.

It should be noted, the mini-gen initiated field flashing functions are backed up by an engine coolant pressure switch. However, the pressure switch actuated field flashing time will occur approximately 3 seconds later, postponed by the amount of time it takes the engine speed to accelerate from 250 rpm to 810 rpm. With a non-functioning signal generator, the redundant field flashing system initiates electrical generation and the EDG still achieves its primary function, generating the required output voltage [4160V].

(v) The date on which the information of such defect or failure to comply was obtained.

On December 22, 2023, FM discovered the worn stator bushing during the destructive failure analysis of the mini-gen.

(vi) In the case of a basic component which contains a defect or fails to comply, the number and location of all such components in use at, supplied for, or being supplied for one or more facilities or activities subject to the regulations in this part.

Facility:

FM is not requesting the return of any mini-gens. However, the following is the FM sales history for the past 15 years for the Synchro-Start mini-gen signal generator, Woodward part number SA-3176-D; Fairbanks Morse part number 16302997

Company	Facility	Quantity
Constellation	Limerick	12
Eletronuclear	Angra, Brazil	1
Entergy	Arkansas Nuclear One	3
Southern Company	Georgia Power (Plant Hatch)	1
Southern Company	Alabama Power (Plant Farley)	4
Xcel Energy	Prairie Island	4

(vii) The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action.

1. As a corrective action, FM will add lubrication as a critical characteristic to the CGID plans for the mini-gen. Source inspection (CGID method 3) will be conducted during the manufacturing assembly process on the next production run of mini-gens to verify a sufficient quantity of lubrication is applied to the dynamic surfaces. Source inspection will be the preferred method for ongoing verification of adequate application of lubricant.
2. As a corrective action, FM engineering will work with the current mini-gen manufacturer, QCC, to determine the service life of the lubrication within the mini-gen. FM engineering will provide all OP users with a suggested time interval for replacing the mini-gen.
3. All the above corrective actions are estimated to be completed by May 23, 2024.

(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.

The mini-gen is a dynamic component that has a finite life expectancy and should be replaced on a scheduled maintenance interval. FM will provide replacement interval guidance by May 23, 2024.

The mini-gen identified to have the defect was manufactured by Woodward. QCC, the current manufacturer, bought the Synchro-Start line of products from Woodward in February of 2016. Therefore, the QCC manufactured mini-gens have a lower risk of lubrication deterioration over time. mini-gens manufactured after February 2016 are clearly identifiable by the QCC logo on the part label.