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THREE MILE ISLAND NUCLEAR STATION  
UNIT #1 SURVEILLANCE PROCEDURE 1303-4.16  
EMERGENCY POWER SYSTEM

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Unit 1 Staff Recommends Approval

Approval N/A Date \_\_\_\_\_  
Cognizant Dept. Head

Unit 2 Staff Recommends Approval

Approval N/A Date \_\_\_\_\_  
Cognizant Dept. Head

Unit 1 PORC Recommends Approval

A. Hartman Date 6/13/77  
VICE Chairman of PORC

PORC comments of \_\_\_\_\_ included  
(date)

By \_\_\_\_\_ Date \_\_\_\_\_

Unit 2 PORC Recommends Approval

N/A Date \_\_\_\_\_  
Chairman of PORC

PORC comments of \_\_\_\_\_ included  
(date)

By \_\_\_\_\_ Date \_\_\_\_\_

Approval J. P. [Signature] Date 6-22-77

Station Superintendent/  
Unit Superintendent

TMI-55-A 11-74

7910100487

THREE MILE ISLAND NUCLEAR STATION  
UNIT #1 SURVEILLANCE PROCEDURE #1303-4.16  
EMERGENCY POWER SYSTEM

1.0 PURPOSE

To verify the Emergency Diesel Generators capable of being manually started and synchronized with other power sources and loaded to 3000 KW in accordance with T. S. 4.6.1.A.

2.0 PLANT STATUS

Operating or Shutdown

3.0 LIMITS AND PRECAUTIONS

3.1 As listed in OP 1107-3.

3.2 Upon completion of testing, the Diesel Generator must be left in the automatic standby mode as described in OP 1107-3, Section 3.3.1.3.1.

3.3 Extended operation of diesel generator at no load is not recommended.

4.0 LOCATION OF SYSTEM

Diesel Generator Building.

5.0 EQUIPMENT REQUIRED

Maintenance & Instrument Communication Headsets.

6.0 PROCEDURE

6.1 After major/significant maintenance, align the diesel generator per OP 1107-3, prerequisites and alignment for ES standby, then follow the balance of this procedure starting at 6.2.1.

Alignment complete per 1107-3

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

or Not Required

\_\_\_\_\_  
Shift Foreman

\_\_\_\_\_  
Date

6.2 After minor maintenance, routine testing per surveillance scheduling, or to verify operability prior to maintenance on the other diesel, perform the following prerequisites, as a minimum, with the Shift Foreman's concurrence:

6.2.1 Align controls:

Generator Voltage Control (Auto/Manual)	Manual
Generator Manual Voltage Control (0-100%)	0%
Diesel Generator Mode Control (Stby/Exercise)	Exercise
(Observe diesel blocked alarm and governor low speed light)	
Generator Voltage Droop (Unit/Parallel)	Parallel
Diesel Speed Droop (0-100%)	70%

6.2.2 Check fluid levels:

Diesel lube oil sump	Above minimum for stopped diesel
Diesel coolant expansion tank	$\frac{1}{2}$ - $\frac{3}{4}$

6.2.3 Place on computer trend log the following points at 5 minute intervals for the duration of the test:

- a. 372(373) Diesel Generator 1A(1B) Lube Oil Temp
- b. 374(375) Diesel Generator 1A(1B) Jacket Water Temp
- c. 376(379) Diesel Generator 1A(1B) Stator Temp ( $^{\circ}$ C)
- d. 377(380) Diesel Generator 1A(1B) Stator Temp ( $^{\circ}$ C)
- e. 378(381) Diesel Generator 1A(1B) Stator Temp ( $^{\circ}$ C)
- f. 382(383) Diesel Generator 1A(1B) Generator Bearing Temp
- g. 384(385) Ambient Diesel Generator Room A(B) Temp

6.2.4 Test the Panalarm panel.

- 6.2.5 Trip the fuel racks and observe the overspeed alarm. Reset the fuel racks and reset the engine at the EMIP, and the exciter at EMMSB.
- 6.2.6 Observe that the diesel, generator, auxiliary systems are apparently in good condition by general inspection.
- 6.2.7 Verify that SDR and 5A relays are deenergized.
- 6.3 Startup of the Diesel Generator
- 6.3.1 Obtain clearance from the dispatcher to generate 3 MW for duration of exercise period (at least one hour, preferably four hours) into the grid.
- 6.3.2 If required, prelube the diesel for 1 minute (not required if the diesel has been operated within the previous 7 days).
- 6.3.3 Start the diesel by depressing the start pushbutton, release when tachometer indicates a minimum of 250 rpm. The "Engine Cranking" light will initially energize, then extinguish at 250 rpm; above 250 rpm, the "Engine Running" light will energize and remain on while the diesel is running.
- 6.3.4 Observe that the diesel comes up to an idle speed of 400 rpm; monitor engine for normal conditions.
- 6.3.5 Upon receipt of a report by the Auxiliary Operator that conditions appear normal, raise engine speed to approximately 900 rpm. Stop increasing speed when generator frequency reaches 60 Hz (the governor high speed light may, or may not be, energized).
- NOTE: Carefully observe engine and auxiliary systems for normal indications both in the control room and at the diesel.

- 6.2.6 Slowly increase generator output voltage to line voltage.  
(Observe that the "Ready to Load" light energizes).
- 6.3.7 Turn the synchroscope on and adjust generator speed to produce a slow rotation of the synchroscope in the fast direction.  
Adjust generator voltage to match line voltage. Verify that Diesel Generator output voltage is within +50.0 volts and -0.0 volts of 4160 V ES Bus 1D (1E) voltage.
- 6.3.8 Place the 1A(1B) Diesel Exciter switch in the AUTO position and verify again that Diesel Generator output voltage is within the limits specified in step 6.3.7.
1. If D.G. output voltage is within the above limits continue with step 6.3.9.
  2. If D.G. output voltage is not within limits specified in step 6.3.7, return 1A (1B) Diesel Exciter switch to the MANUAL position, reverify D.G. output voltage is within the above limits, and then continue with step 6.3.9.
- 6.3.9 After a report by the auxiliary operator that diesel generator conditions are normal, parallel the generator with the bus:
- 6.3.9.1 When the synchroscope approaches the "12 o'clock" position (at about "5 minutes to 12") moving in the "fast" direction, observe the synchroscope indicating lights are off and close the generator output breaker.
- 6.3.9.2 Immediately pick up approximately .3 to 1 MW load by going to "raise" on diesel speed control switch to prevent tripping on reverse power. Switch off the synchroscope.
- 6.3.10 Load the diesel generator to 3.0 MW by intermittently going to raise on the diesel speed control switch.



6.3.11 Verify the following conditions:

- a.  $3.0 \pm .1$  MW output
- b. Approximately .5 to 1.0 MVar out (Maximum 2.25 MVar at 3.0 MW-refer to capability curve, Table 2. If adjustments are required, do so carefully. Switch to the manual mode, if in auto, and adjust the manual voltage control.
- c. Approximately 520 amps output current.

6.4 Operate the diesel generator at load for the required interval.

6.4.1 Monitor diesel generator for normal indications per Table I and general conditions.

6.4.2 Record data as required on Data Sheet I 1 hour after start and hourly thereafter.

6.5 Shutdown the Diesel Generator

6.5.1 Notify dispatcher of intent to take generator off of the grid.

6.5.2 Unload the generator to approximately .3MW (approximately 50 amps).

6.5.3 Open the generator output breaker.

6.5.4 Return to manual voltage control, if in auto, and reduce voltage to minimum.

6.5.5 Reduce engine speed to idle (approximately 400 rpm).

CAUTION: Do not drive the generator below 400 rpm idle speed; the unit could trip on low speed.

6.5.6 After 1-2 minutes at idle speed, stop the unit by momentarily depressing the stop pushbutton.

6.6 Return the unit to ES standby.

6.6.1 Switch line up

Generator Voltage Control (Auto/Manual)      Auto  
Generator Manual Voltage Control (0-100%)      45%  
Diesel Generator Mode Control (Exersixe/Standby) Standby  
    (Observe "Diesel Blocked" alarm clears & governor  
    high speed light on)

Generator Voltage Droop (Unit/Parallel)      Unit  
Diesel Speed Droop (0-100%)      0

6.6.2      Fluid Levels

Diesel lube oil sump      Above minimum for stopped  
   diesel

Diesel coolant expansion tank       $\frac{1}{2}$  -  $\frac{3}{4}$

6.6.3      Monitor general condition of diesel, generator, and auxiliaries  
            for proper indications and line up.

6.6.4      Test local panalarm panel.

6.6.5      Verify that no flags appear on any of the generator protective  
            relays (located below the Panalarm panel). Contact electrical  
            maintenance if a flag is present.

6.6.6      Trip the fuel racks by depressing the mechanical emergency  
            stop pushbutton and observe the overspeed alarm; reset the  
            fuel racks.

6.6.7      Reset the exciter at the EMMSB and reset the engine at the  
            EMIP.

6.6.8      Open the relay cabinet and verify that the SDR and SA relays  
            are de-energized (black tit is sticking out of relay), if not  
            refer to OP 1107-3.

6.6.9      Verify all Panalarm and appropriate control room alarms cleared.

6.6.10 Verify fuel oil tank level indicating lights on console CR:

Diesel Fuel                      On  
Tank Full

Minimum                      Off  
Allowable  
Fuel Reserve

Less Than                      Off  
Minimum Fuel

The Diesel Generator is now aligned for automatic startup on  
loss of 1D or 1E 4160V power or in the event of an E.S. condition.

#### 7.0 ACCEPTANCE CRITERIA

The Diesel Generator carried  $3.0 \pm 1$  MW for a minimum of 1 hour.

Complete Data Sheet.

EGY1 \_\_\_\_\_ Date \_\_\_\_\_

Time                      Time  
Loaded                      Unloaded  
(at 3 MW)                      (Before decreasing load)

Signed \_\_\_\_\_ Date \_\_\_\_\_



TABLE 1

EMIP PARAMETERS

<u>Parameter</u>	<u>Indicating Device</u>		<u>Normal Range</u> (100% Power)	
	<u>1A</u>	<u>1B</u>	<u>1A &amp; 1B</u>	
Crankcase Vacuum	PI-J-504A	PI-J-504B	1.6 in H <sub>2</sub> O	± 3
Lube Oil Pressure	PI-501A	PI-501B	31	± 1 psig
Fuel Oil Pressure	PI-J-500A	PI-500B		
Pressure to filter	Black hand		20.0	+ .5-10
Pressure to engine	Red hand		10.0	+ 10-.5 psig
Jacket Coolant Temperature	TI-J-504A	TI-J-504B	100-140	°F
Starting Air Pressure	PI-535A	PI-535B	225-250	psig
Scavenging Air Pressure	PI-J-503A	PI-J-503B	16.5	± .5 psig
Jacket Coolant Pressure	PI-J-502A	PI-J-502B	19.5	± .5 psig
Engine RPM	SI-500A	SI-500B	900 RPM	900 RPM
Individual Cylinder Exhaust				
Cylinder 1	Pyrometer	Pyrometer	880	± 20
2	"	"	880	± 20
3	"	"	800	± 20
4	"	"	900	± 20
5	"	"	910	± 20
6	"	"	760	± 20
7	"	"	980	± 20
8	"	"	980	± 20
9	"	"	800	± 20
10	"	"	910	± 20
11	"	"	920	± 20
12	"	"	830	± 20

TABLE 1 (Continued)

EMIP PARAMETERS

<u>Parameter</u>	<u>Indicating Device</u>		<u>Normal Range</u> (100% load)	
	<u>1A</u>	<u>1B</u>	<u>1A &amp; 1B</u>	
			<u>°F</u>	<u>°F</u>
Turbocharger Inlet Governor Side	Pyrometer	Pyrometer	1015 $\pm$ 5	1015 $\pm$ 5
Turbocharger Inlet Opposite Governor Side	Pyrometer	Pyrometer	960 $\pm$ 10	960 $\pm$ 10
Combined Exhaust	Pyrometer	Pyrometer	770 $\pm$ 10	770 $\pm$ 10

NOTE: Maximum Permissible Temperatures

Individual Cylinder Exhaust Temperature . . . . . 1100°F

Variation Between Cylinders . . . . . 300°F

Turbocharger Inlet Temp . . . . . 1200°F

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# DIESEL GENERATOR OPERATING LOG

**REQUIRED DATA:** Record data from engine mounted instrument panel. Data should be taken 2. an hourly basis whenever the engine is operating. 450, printout and attach computer points specific in step 3.2.2.C. on hourly basis.

EO-Y-1

Date

Engine Hrs.  
at Start

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Time	Units	Recommended Range	Remarks
Engine Hours	hrs.		
Lube Oil Pressure	psi	31 ± 2	
Jacket Coolant Temp.	°F	120 - 180	
Starting Air Pressure	psi	226 - 250	
Scavenging Air Pressure	psi	10.5 ± 1.5	
Jacket Coolant Pressure	psi	10.5 ± 1.5	
Crankcase Vacuum	"Hg	16 ± 5	
*Fuel Oil Pressure Drop	Δpsi	< 9	
Black Hand (B.H.) to Filter	psi	20 ± 5 - 10	
Red Hand (R.H.) to Engine	psi	15 ± 5 - 10	
CYL No. 1 Exh. Temp.	°F	880 ± 20	
CYL No. 2 Exh. Temp.	°F	880 ± 20	
CYL No. 3 Exh. Temp.	°F	880 ± 20	
CYL No. 4 Exh. Temp.	°F	900 ± 20	
CYL No. 5 Exh. Temp.	°F	910 ± 20	
CYL No. 6 Exh. Temp.	°F	760 ± 20	
CYL No. 7 Exh. Temp.	°F	930 ± 20	
CYL No. 8 Exh. Temp.	°F	880 ± 20	
CYL No. 9 Exh. Temp.	°F	880 ± 20	
CYL No. 10 Exh. Temp.	°F	910 ± 20	
CYL No. 11 Exh. Temp.	°F	870 ± 20	
CYL No. 12 Exh. Temp.	°F	850 ± 20	
I* Charge Inlet Gov. Side	°F	1015 ± 20	
I* Charge Inlet opp. Gov. Side	°F	940 ± 20	
Combined Exhaust	°F	770 ± 20	
*Maximum ΔT Between Cylinders	°F	< 300	
Load	kW	3.0 ± 1	

\* Submit Work Report to show values entered the recommended range.

DATE

PERFORMED BY

DATE

REVIEWED BY SS/SF

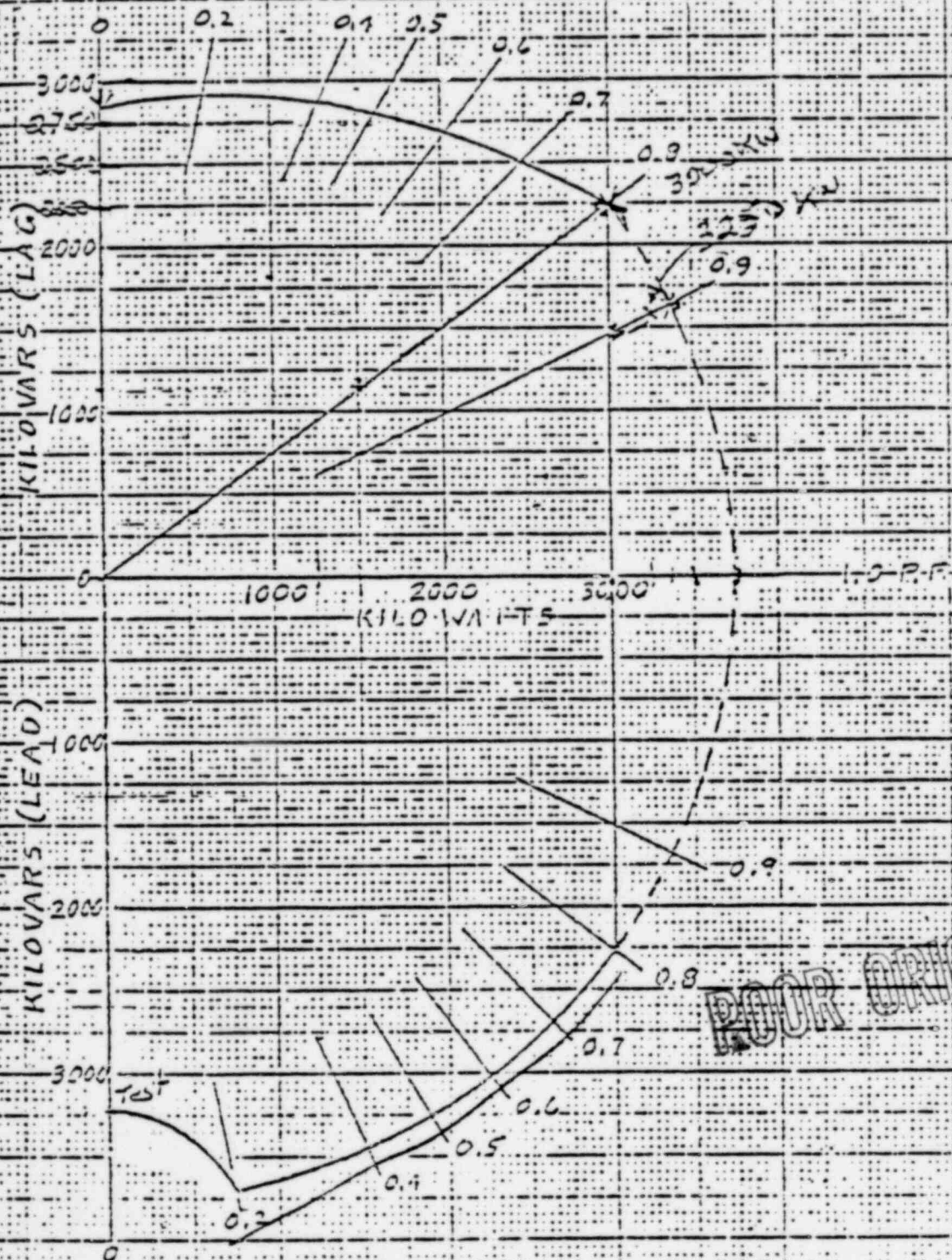
RETURN TO SHIFT FOREMAN

FILE IN OPERATOR'S OFFICE

# FAIRBANKS MORSE INC. REACTIVE CAPABILITY CURVE

3750 KVA, 3000 KW, 900 RPM, 3/60/4160V.  
520A., 0.8 P.F., SYNCHRONOUS GENERATOR  
FRAME 966-30  $X_d = 1.19$ ,  $X_d' = 0.23$ ,  $X_d'' = 0.12$   $SCC = 97$

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POOR ORIGINAL

REV. 12/71