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THREE MILE ISLAND NUCLEAR STATION  
 UNIT #2 OPERATING PROCEDURE 2104-6.2  
 EMERGENCY DIESELS AND AUXILIARIES

Table of Effective Pages

Page	Date	Revision	Page	Date	Revision	Page	Date	Revision
1.0	06/14/77	0	26.0	09/13/78	7	51.0	03/14/79	9
2.0	07/27/78	6	27.0	09/13/78	7	52.0	03/14/79	9
3.0	11/15/77	2	28.0	09/13/78	7	53.0	03/14/79	9
4.0	06/14/77	0	29.0	09/13/78	7	54.0		
5.0	09/13/78	7	30.0	09/13/78	7	55.0		
6.0	09/13/78	7	31.0	09/13/78	7	56.0		
7.0	09/13/78	7	32.0	09/13/78	7	57.0		
8.0	09/13/78	7	33.0	09/13/78	7	58.0		
9.0	09/13/78	7	34.0	09/13/78	7	59.0		
10.0	09/13/78	7	35.0	09/13/78	7	60.0		
11.0	09/13/78	7	36.0	09/13/78	7	61.0		
12.0	09/13/78	7	37.0	09/13/78	7	62.0		
13.0	09/13/78	7	38.0	03/14/79	9	63.0		
14.0	09/13/78	7	39.0	09/13/78	7	64.0		
15.0	10/16/78	8	40.0	09/13/78	7	65.0		
16.0	10/16/78	8	41.0	09/13/78	7	66.0		
17.0	09/13/78	7	42.0	09/13/78	7	67.0		
18.0	10/16/78	8	43.0	09/13/78	7	68.0		
19.0	09/13/78	7	44.0	09/13/78	7	69.0		
20.0	09/13/78	7	45.0	09/13/78	7	70.0		
21.0	10/16/78	8	46.0	09/13/78	7	71.0		
22.0	09/13/78	7	47.0	09/13/78	7	72.0		
23.0	09/13/78	7	48.0	03/14/79	9	73.0		
24.0	09/13/78	7	49.0	03/14/79	9	74.0		
25.0	09/13/78	7	50.0	03/14/79	9	75.0		

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THREE MILE ISLAND NUCLEAR STATION  
UNIT #2 OPERATING PROCEDURE 2104-6.2  
EMERGENCY DIESELS AND AUXILIARIES

Table of Contents

<u>SECTION</u>	<u>PAGE</u>
1.0 <u>REFERENCE</u>	3.0
1.1 Drawings Applicable for Operation	3.0
1.2 System Descriptions	3.0
1.3 Operating Procedures	3.0
1.4 Manufacturer's Instruction Manuals	3.0
1.5 Curves, Tables, etc.	4.0
2.0 <u>LIMITS AND PRECAUTIONS</u>	4.0
2.1 Equipment	4.0
2.2 Administrative	6.0
3.0 <u>PREQUISITES</u>	7.0
4.0 <u>PROCEDURES</u>	11.0
4.1 Diesel Generator Auxiliary Equipment Startup	11.0
4.2 Placing the Diesel Generator in Emergency Standby Mode	13.0
4.3 Diesel Generator Manual Start for Exercise	14.0
4.4 Normal Operation	17.0
4.5 Diesel Generator Unloading and Shutdown	18.0
4.6 Diesel Generator Shutdown to Emergency Standby	19.0
4.7 Diesel Generator Shutdown for Maintenance	20.0
4.8 Local Operation of Diesel Generation	20.0
4.9 Diesel Generator Automatic Start on Loss of AC Power	22.0
4.10 Diesel Generator Automatic Start Upon Engineered Safety Features Actuation	22.0

POOR ORIGINAL

768 141

4.11 Diesel Generator Automatic Start Upon Coincident Engineered Safety Features Actuation and Loss of AC Power.	23.0
4.12 Emergency Operations.	23.0
ATTACHMENT I Diesel Generator, DF-X-1A, Auxiliary Power Sources	30.0
ATTACHMENT II Valve Line-up	34.0
ATTACHMENT III Lube Oil System Fill and Vent.	43.0
ATTACHMENT IV Fuel Oil Tank Fill Procedure.	45.0
ATTACHMENT V G2-1E2 (G22-2E2) Closing Procedure	47.0

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THREE MILE ISLAND NUCLEAR STATION  
UNIT #2 OPERATING PROCEDURE 2104-6.2  
EMERGENCY DIESELS AND AUXILIARIES

1.0 REFERENCES

1.1 Drawings Applicable for Operation.

- 1.1.1 Electrical One Line and Relay Diagram, B&R Drawing No. 3004 Sheet 2.
- 1.1.2 Fuel Oil Flow Diagram, B&R Drawing No. 2038.
- 1.1.3 Jacket Cooling System Flow Diagram B&R Drawing No. 2550.
- 1.1.4 Lube Oil System Flow Diagram B&R Drawing No. 2551.
- 1.1.5 Starting Air System Flow Diagram, B&R Drawing No. 2552.
- 1.1.6 Diesel Generator Breakers-Elementary Diagram, B&R Drawing No. 3073 Sheets 52 & 57.
- 1.1.7 Fairbanks Morse, B&R File No. 43-00-0101 thru 0147.
- 1.1.8 Bassler Electric Co., B&R File No. 43-01-0101 thru 0112.

1.2 System Descriptions.

- 1.2.1 Class 1E Electrical Systems (Index No. 59).
- 1.2.2 Diesel Fuel - Emergency Diesel (Index No. 32).
- 1.2.3 Diesel Generator Building - H&V (Index No. 46).

1.3 Operating Procedures.

- 1.3.1 Diesel Building Heating & Ventilation System, 2104-5.7.
- 1.3.2 Fire Protection System, 2104-6.1.
- 1.3.3 Class 1E Electrical System, 2107-1.2.

1.4 Manufacturer's Instruction Manual.

Colt Industries, Fairbanks Morse Power Systems Division, Engine  
Generating Set and Accessories, B&R Spec. 43.

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1.5 Curves, Tables, etc.

1.5.1 Generator Capability Curve.

1.5.2 Diesel Fuel Oil Consumption Rate.

2.0 LIMITS AND PRECAUTIONS

2.1 Equipment.

2.1.1 Diesel Engine and Generator.

2.1.1.1 Monitor generator MVAR loading as indicated on Panel 26/29 in the Control Room whenever loading or unloading the generator to insure that the MVAR load does not exceed + 2.5 MVAR. Refer to the capability curve, reference 1.5.1.

2.1.1.2 When the Exciter control is in "MANUAL", adjust the Manual Voltage Control whenever the Governor is adjusted, as required to maintain Generator Voltage and MVAR loading constant.

2.1.1.3 If at any time during engine operation excessive vibration, noise, overheating, or other unusual condition is observed, the engine should be shut down if not required for plant operation.

NOTE: Excessive vibration is defined as more than .006 inch displacement measured on the generator shaft at the outboard bearing, or more than .011 inch displacement measured at the top of the engine.

2.1.1.4 Do not run the Diesel Generators unloaded for extended periods. Unload operation causes carbon deposits in the exhaust system which cause exhaust system overheating as the carbon burns off when full load is resumed. Unloaded operation for periods of one half hour can be considered completely safe if they are followed by a period of operation under load.

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768 144

- 2.1.1.5 Do not load the generator beyond its rating:  
Continuous Full Load Rating 3750 KVA, 0,8 p.f. (3,000KW and 2,250KVAR).  
Overload Rating (2 Hours in 24) 4125 KVA, 0.8 p.f. (3,300KW and 2,475KVAR).
- 2.1.1.6 If the Diesel Generator is tripped manually or automatically while under load; prior to returning the diesel to emergency standby, the diesel must be started and speed reduced to 60 Hz by using the speed adjuster on Panel 26 (29).
- 2.1.2 Auxiliary Equipment.
- 2.1.2.1 Coolant System.  
Cooling medium shall be water mixed thoroughly with sufficient ethylene glycol to protect against freezing at temperatures of -25°F and above.
- 2.1.2.2 Lube Oil System.
- 2.1.2.2.1 SAE 40 high detergent lube oil shall be used.
- 2.1.2.2.2 Lube oil colder than 65°F shall not be added to the engine sump.
- 2.1.2.2.3 The engine should be prelubed for 1 1/2 minutes IMMEDIATELY prior to starting. Delays between prelube and engine starting will negate the effect of prelube due to system drain down and possibly place a hydraulic lock on the engine.
- 2.1.2.2.4 If the diesel has been shutdown for less than one hour, pre-lube is not required. This applies to multiple starts for troubleshooting, etc.

- 2.1.2.2.5 The prelube pump may be operated into the starting cycle; however, it must be secured when the engine - driven oil pump discharge pressure reaches 30 psig.
- 2.1.2.2.6 Prelubing longer than three minutes is not necessary; however, in the event of a longer pre-lube, bar the engine several revolutions with starting air to throw oil out of the upper end of the cylinder liner.
- 2.1.2.2.7 Provide additional prelube time to refill the drained system following filter or strainer drain down for element changes. A two hour power run is also recommended to assure proper system functioning. Oil system drain valves should be checked for closed position prior to the prelube sequence. An open drain valve will reduce effective prelube flow, possibly over 60 percent.

## 2.2 Administrative.

- 2.2.1 Ear protection is required for all personnel that are present in the engine room while the engine is operating. Follow standard safety practices for working on or near rotating equipment.
- 2.2.2 Whenever the diesels are started and loaded manually an auxiliary operator should be at the engine to monitor the operation. Communication with the control room should be available. After starting and loading, hourly readings should be taken. In addition, the diesel generator computer points should be printed out on an hourly interval. This printout should be attached to the data sheet.



2.2.3 The requirements of Technical Specifications 3.8.1.1 or 3.8.1.2 must be met depending upon the mode of operation. In modes 1,2,3 and 4, two separate and independent diesel generators each with: A separate day fuel tank containing a minimum volume of 500 gallons of fuel, a fuel storage system containing a minimum 19,000 gallons of fuel in DF-T-2A and 19,000 gallons of fuel in DF-T-2B, and a separate fuel transfer pump must be operable. In Modes 5 and 6, one diesel generator and its associated fuel oil system must be operable. If the above requirements can not be met, proceed as outlined in the applicable Action Statement.

2.2.4 Starting Air Manual shutoff valves (AVC1 and AVC2 on the diesel skid) must be closed whenever automatic start of the engine cannot be tolerated.

2.2.5 Ensure that the Control knobs on the governor for the "A" diesel generator are set as follows:

Droop knob - 2.5

Speed knob - 21.4

Fuel knob - Max

If these settings are not adhered to the diesel may be load restricted by the governor and the starting time may be longer than 10 seconds.

2.2.6 Ensure that the control knobs on the governor for the "B" diesel generator are set as follows:

Droop knob - 3.5

Speed knob - 21.04

Fuel knob - Max

768 147  
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If these settings are not adhered to the diesel may be load restricted by the governor and the starting time may be longer than 10 seconds.

- 2.2.7 If the air bottles are required for starting air, each bottle's isolation valve must be opened, and also the manifold isolation valve.
- 2.2.8 A minimum of 200 psig pressure must be maintained in the Starting Air Receivers.
- 2.2.9 Prior to resetting the engine trip lever at the diesels, insure the governor is at the zero fuel position. Operating the reset lever too soon may cause the fuel racks to open to some mid-position.

3.0 PREREQUISITES

NOTE: Equipment associated with the B Diesel are in paranthesis.

- 3.1 Diesel Generator Building Ventilation System is in normal operation per 2104-5.7.
- 3.2 Fire Service System equipment in the Diesel Generator Building is operable in accordance with 2104-6.1.
- 3.3 Nuc. Service River Water system is in operation per 2104-3.1.
- 3.4 The following instrument isolation valves on the right side of the Engine Mounted Gauge Panel are OPEN:

		<u>Diesel</u>	
		<u>DF-X-1A</u>	<u>DF-X-1B</u>
3.4.1	SAP-1/ADL-1	_____	_____
3.4.2	SAP-2/APL-2	_____	_____
3.4.3	Scavenging Air Pressure Gauge	_____	_____
3.4.4	Fuel Oil Pressure to Strainer	_____	_____

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- 3.4.5 Fuel Oil Pressure to Pumps. \_\_\_\_\_
- 3.4.6 CPLA Switch \_\_\_\_\_
- 3.4.7 Coolant Pressure Gauge \_\_\_\_\_
- 3.4.8 Crankcase Vacuum \_\_\_\_\_
- 3.4.9 Lube Oil HDR Pressure \_\_\_\_\_
- 3.4.10 Fuel Oil Pressure to Filter \_\_\_\_\_
- 3.4.11 Fuel Oil Pressure to Engine \_\_\_\_\_

3.5 Valves in the Diesel Generator Auxiliary Systems are aligned in accordance with Attachment 2.

3.6 Verify the following fluid levels:

<u>Level to be Verified</u>	<u>Normal Range</u>	<u>Diesel</u>	
		<u>DF-X-IA</u>	<u>DF-X-1B</u>
Diesel Lube Oil	Between "FULL" & "ADD" on dip stick	_____	_____
Governor Oil	Between two marks on sight glass	_____	_____
Coolant Expansion Tank	Approx. middle of sight glass	_____	_____
Starting Air Compressor Lube Oil (Single Drive) DF-P-2A(2C)	Between two marks on dip stick	_____	_____
Starting Air Compressor Lube Oil (Dual Drive) DF-P-2B(2D)	Between two marks on dip stick	_____	_____
Diesel Compressor Engine Lube Oil	Between two marks on dip stick	_____	_____
Diesel Compressor Fuel Oil (2 tanks each)	Full	_____	_____

3.7 Dual drive air compressor drive belt is installed to drive the compressor with the electric motor.

768 147  
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NOTE: If the electric motor cannot be used connect the compressor belt to the Lister diesel engine.

3.7.1 Verify that the upstream pressure indicators at DF-V51A, DF-V51B, DF-V51C is greater than 1500 psig and that the pressure regulators are set at 200 psig.

3.7.2 Verify that the upstream pressure indicators at DF-V52A, DF-V52B, DF-V52C is greater than 1500 psig, and that the pressure regulators are set at 200 psig.

3.8 The following controls are in the indicated position:

3.8.1 Diesel Generator Control Room Panel (Panel 26 and 29).

	<u>Control</u>	<u>Position</u>	<u>Diesel</u>	
			<u>DFX-1A</u> (Panel 26)	<u>DF-X1B</u> (Panel 29)
3.8.1.1	Sync Switches for			
3.8.1.1.1	2B-1E2 (2B-2E2)	OFF	_____	_____
3.8.1.1.2	2A-1E2 (2A-2E2)	OFF	_____	_____
3.8.1.1.3	G2-12 (G22-12)	OFF	_____	_____
3.8.1.2	Fuel Oil Transfer Pump No. 1, DF-P-1A (1C)	OFF	_____	_____
3.8.1.3	Fuel Oil Transfer Pump No. 2, DF-P-1B (1D)	OFF	_____	_____
3.8.1.4	D.G. Breaker Control Switch	PULL-TO-LOCK	_____	_____
3.8.1.5	Emergency Stand-by/Maintenance	MAINTENANCE Exercise	_____	_____
3.8.1.6	Governor Mode	ISOCHRONOUS	_____	_____
3.8.1.7	Manual Auto Selector	MANUAL	_____	_____
3.8.1.8	WATT/VAR Switch	WATT	_____	_____

760 150  
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3.8.2 Diesel Generation Local Control Panel, Panel 308 and (309).

<u>Control</u>	<u>Position</u>	<u>Diesel</u>	
		<u>DF-X-1A</u>	<u>DF-X-1B</u>
Temperature Indicator	OFF	_____	_____
Engine Generator Control (Key locked switch)	AUTO-REMOTE	_____	_____
Starting Air Compressor No. 1, DF-P-2A (2C)	OFF	_____	_____
Starting Air Compressor No. 2, DF-P-2B (2D)	OFF	_____	_____
Lockout Relays, 86-1/G2-12-(G2-22) 86-2/G2-12-(G2-22)	RESET	_____	_____
Unit-Parallel Switch (inside rear of panel)	UNIT	_____	_____

3.8.3 Engine Mounted Gauge Panel, EMGP.

<u>Control</u>	<u>Position</u>	<u>Diesel</u>	
		<u>DF-X-1A</u>	<u>DF-X-1B</u>
Control	AT ENGINE	_____	_____
Prelube	OFF	_____	_____

3.8.4 Skid Mounted Starter Box.

<u>Control</u>	<u>Position</u>	<u>Diesel</u>	
		<u>DF-X-1A</u>	<u>DF-X-1B</u>
Coolant Pump	OFF	_____	_____
Lube Oil Pump	OFF	_____	_____
Coolant Heater	OFF	_____	_____
Lube Oil Heater	OFF	_____	_____

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3.9 The Power Sources outlined in Attachment I are energized and the breakers listed are closed.

\_\_\_\_ 3.10 Diesel Generator Building Sump Pumps are in operation per 2104-2.5.

\_\_\_\_ 3.11 Verify that the Generator Space Heater is energized as indicated by the warmth of the housing.

\_\_\_\_ 3.12 Ensure that diesel generator DF-X-1A governor settings are as follows: Droop knob - 2.5, Speed knob - 21.4, and Fuel knob - Max.

\_\_\_\_ 3.13 Ensure that diesel generator DF-X-1B governor settings are as follows: Droop knob - 3.5, Speed knob - 21.04 and Fuel knob - Max.

\_\_\_\_ 3.14 Diesel generator breaker G2-12 (G2-22) is racked in and the associated "69" switch is in NORMAL-AFTER-CLOSE.

\_\_\_\_ 3.15 Diesel generator BUS 2-1E (2-2E) breaker, G2-1E2 (G22-2E2), is racked in and closed, per Attachment V.

NOTE: These breakers must be closed by manually charging the stored energy mechanism, then lifting the close lever on the breaker.

#### 4.0 PROCEDURE

Procedure is written for the A Diesel Generator with component numbers for the B Diesel Generator shown in ( ). Each section of the procedure must be repeated for the B Diesel.

4.1 Diesel Generator Auxiliary Equipment Startup.

4.1.1 Lube Oil Circulating Pump and Heater.

\_\_\_\_ 4.1.1.1 Lube Oil System is filled and vented per Attachment III.

- \_\_\_ 4.1.1.2 PRESS the Lube Oil Pump Reset Button, located on the skid mounted starter Box.
- \_\_\_ 4.1.1.3 PLACE the Lube Oil Pump Control Switch in AUTO.
- \_\_\_ 4.1.1.4 PLACE the Lube Oil Heater Control Switch in AUTO.
- \_\_\_ 4.1.2 Engine Coolant Circulating Pump and Heater.
- \_\_\_ 4.1.2.1 Jacket Coolant System and Scavenging Air Coolant System are filled and vented.
- \_\_\_ 4.1.2.2 PRESS the Coolant Pump Reset Button.
- \_\_\_ .2.3 PLACE the Coolant Heater Control Switch in AUTO.

NOTE: The Jacket Coolant Pump and the Lube Oil Pump will run continuously when the engine is shutdown, and the Jacket Coolant Heater and Lube Oil Heater will cycle on and off as required to maintain the respective fluid temperatures above 110°F and 135°F.

#### 4.1.3 Engine Prelube Pump.

- \_\_\_ 4.1.3.1 PRESS the Prelube Pump Reset Button (located on the skid mounted starter box).

NOTE: The Prelube Pump Control Switch (located on the skid mounted Engine Gauge Panel) should remain in the "OFF" position. The pump will then run automatically when the Diesel is started.

#### 4.1.4 Fuel Oil Pumps.

- \_\_\_ 4.1.4.1 VERIFY, that sufficient Diesel Fuel is available in the Storage Tanks, DF-T-2A (2B), each containing 19,000 gallons.

4.1.4.2 PLACE Fuel Oil Transfer Pump No. 1, DF-P-1A (1C) in Auto.

4.1.4.3 PLACE Fuel Oil Transfer Pump No. 2, DF-P-1B (1D) in Auto.

NOTE: The Fuel Oil Transfer Pumps in AUTO will maintain the day tank level between 34" and 26".

4.1.4.4 PLACE the DC. Fuel Oil Auxiliary Pump in AUTO and PRESS the Reset button. The Control Switch and Reset Button are mounted on the small Starter Box on the base of the skid near the DC Pump.

NOTE: The DC Fuel Oil Auxiliary Pump will automatically start if the fuel supply header pressure drops below 10 psig, and the Diesel Generator is running.

The Clean Fuel Return Pump is placed in service when its breaker is closed. There is no control switch for this pump. The pump is controlled by the level in the Clean Fuel Return Tank mounted on the engine skid and returns the fuel to the Day Tank.

#### 4.1.5 Starting Air Compressors.

4.1.5.1 Place Air Compressor No. 1 DF-P-2A (2C) (single drive) into service by placing the Starting Air Compressor No. 1 control switch (located on the Control Room Diesel Panel) in "AUTO" position.

4.1.5.2 Place Air Compressor No. 2 DF-P-2B (2D) (dual drive) into service by placing the Starting Air Compressor No. 2 control switch (located on the Control Room Diesel Panel) in "AUTO" position.



NOTE: Air Compressor No. 1 will start when the Air Receiver Pressure drops below 200 psig. and shuts off when the pressure rises to 250 psig. Air compressor No. 2 will start when the Air Receiver Pressure drops below 200 psig and shuts off when the pressures rises to 250 psig.

4.2 PLACE the 1A (1B) Diesel Generator in Emergency.

Standby Mode.

- 4.2.1 VERIFY that the Fuel Oil Day Tank contains 500 gallons per Tech. Spec. 3.8.1.1.
- 4.2.2 VERIFY that the starting air pressure is greater than 200 psig.
- 4.2.3 VERIFY that no flags are showing on the generator protective relays.
- 4.2.4 TEST the alarms located on the Local Control Panel by PRESSING the "TEST" button.
- 4.2.5 PRESS the "EXCITER RESET" pushbutton at either the Local Control Panel or the Control Room Remote Control Panel.
- 4.2.6 OPEN starting air manual isolation valves AVCI and AVC2.
- 4.2.7 PLACE the Engine Mounted Gauge Panel CONTROL (NORMAL/AT ENGINE) switch in NORMAL.
- 4.2.8 At Panel 26 (29) the EMERGENCY STANDBY/MAINTENANCE EXERCISE switch in EMERGENCY STANDBY.
- 4.2.9 PLACE the Exciter AUTO/MANUAL switch in AUTO.
- 4.2.10 VERIFY the Red and Green Lights above the Manual Voltage Adjuster and the Red and Green lights above the Automatic Voltage Adjuster are lit. This corresponds to a diesel generator voltage of 4200 volts.

168-155  
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NOTE: The red light is off when the voltage setting is below the set point, and the green light is off when the voltage setting is above the setpoint required for Emergency Standby.

- 4.2.11 PLACE the Generator Breaker Control Switch for G2-12 (G22-12). Switch in NORMAL-AFTER-TRIP.
- 4.2.12 VERIFY that the ANY SWITCH NOT IN AUTOMATIC POSITION alarm 26.A8 (29.A8) and the OPERATE ENGINE ALARM RESET alarm 26.C8 (29.C8) are clear.
- 4.2.13 Place or verify Unit/Parallel switch in Unit Position.
- 4.2.14 Assure SDR and 5A relays are de-energized (by depressing Diesel Generator reset pushbutton and observing relay Tit is protruding-SDR de-energizes shortly after reset pushbutton is depressed, 5A relay will not reset for approximately 100 sec.). Alarm 26.C8 (29.C8) will not clear until the SDR relay resets.
- 4.2.15 Place or assure Governor Mode switch on Panel 26 (29) is in the ISOCHRONOUS position.
- 4.2.16 If the Diesel Generator was tripped manually or automatically while under load; prior to returning the diesel to emergency standby, the diesel must be started and speed reduced to 60 Hz by using the speed adjuster.
- 4.2.17 INSURE the G2-1E2 (G22-2E2) is closed. If not close the breaker per Attachment V.

#### 4.3 Diesel Generator Manual Start For Exercise.

- 4.3.1 ENSURE an NR pump is in operation in the associated NR header.

768 156

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\_\_\_\_ 4.3.2 Diesel Generator is in the Emergency STANDBY Mode per Section 4.2.

\_\_\_\_ 4.3.3 PLACE the Exciter UNIT-PARALLEL Switch, inside rear of Panel 308 (309) in the PARALLEL POSITION.

\_\_\_\_ 4.3.4 Manually START the DC Aux. Fuel Oil Pumps, and run it for about 30 seconds to ensure the Fuel Oil Heater is filled.

\_\_\_\_ 4.3.5 PLACE the Governor Mode switch in the DROOP position.

CAUTION: When the engine is prelube it should be started as soon as possible. If it is not, lube oil in the cylinders will drain past the upper piston rings and could place a hydraulic lock on the engine. The length of the prelube interval is not significant if the engine is started immediately after the prelube period.

NOTE: If the diesel has not been shutdown for more than one hour, prelube is not required.

4.3.6 At the engine mounted panel START the prelube pump and run for 1.5 minutes.

4.3.7 PRESS the START Pushbutton on Panel 26 (29).

4.3.8 VERIFY that the engine starts and reaches normal running speed as indicated by the yellow "Engine Running" lamps and the green "Engine Ready to Accept Load" lamp on Panel 26(29).

NOTE: Monitor all engine and auxiliary System parameters. Any abnormal conditions should be investigated and correction action taken prior to load unit.

4.3.9 OBTAIN clearance form the Dispatcher before synchronizing and load the generator.

- 4.3.10 SYNCHRONIZE and LOAD the Diesel Generator as follows:
- \_\_\_ 4.3.10.1 PLACE the Diesel Generator Sync Switch in the ON position.
  - \_\_\_ 4.3.10.2 Using the Automatic Voltage Adjust Control, MATCH the Incoming (Generator) Voltage and the Running (BUS 2-1E (2-2E)) Voltage.
  - \_\_\_ 4.3.10.3 Using the Speed Control, ADJUST the engine speed so that it is slightly above synchronous speed (60HZ).
  - \_\_\_ 4.3.10.4 VERIFY that the Synchroscope on Panel 26 (29) is rotating and the Sync lights are alternately bright and dim.
  - \_\_\_ 4.3.10.5 ADJUST diesel engine speed, using the Speed Adjust switch, until the Synchroscope is rotating slowly (less than one revolution per ten seconds) in the fast (clockwise) direction.
  - \_\_\_ 4.3.10.6 VERIFY that the Diesel Generator output voltage (Incoming) and V160V BUS 2-1E (2-2E)(Running) voltage are matched.
  - \_\_\_ 4.3.11 VERIFY that no problem exists with the engine, as reported by the Auxiliary Operator.
  - \_\_\_ 4.3.11.2 As the Synchroscope needle approaches the 12 O'clock position (at about 5 minutes to 12) moving in the fast direction (clockwise), and the two Sync lights are OFF, PLACE G2-12 (G2-22) control switch in the CLOSE position and RELEASE.

NOTE: If the Diesel Generator is not synchronized with the BUS the associated Sync. Check (25) Relay will block Diesel Generator Breaker closure.

- \_\_\_\_ 4.3.11.3 The Diesel Generator is now in parallel with the system  
VERIFY that the Generator pick up (approximatley .3 to 1  
MW).
- \_\_\_\_ 4.3.11.4 TURN the Synchronizing Switch OFF.
- \_\_\_\_ 4.3.12 LOAD the Diesel Generator as follows:
- \_\_\_\_ 4.3.12.1 Slowly move the speed Adjust switch to the RAISE position.  
OBSERVE Diesel Generator Megawatts on Panel 26 (29).
- \_\_\_\_ 4.3.12.2 Use the Speed Adjust Switch intermittently in the RAISE  
position until 3.0 Megawatts is indicated by the Megawatt  
Meter or as desired.
- \_\_\_\_ 4.3.13 VERIFY the following by observing 1A (1B) diesel generator  
meters on panel 26 (29)
1. With the KW/KVAR selector switch in the KVAR position,  
the KW/KVAR meters should indicate approximately 500  
to 1000 KVAR out. If adjustment is necessary, KVAR  
can be adjusted using the AUTOMATIC voltage adjuster.  
CAUTION: If KVAR are adjusted to the maximum limits  
of the capability curve and the diesel  
generator breaker trips an over voltage  
condition will exist and damage to the  
electronic governor controls may result.  
Do not increase KVAk loading (outgoing or  
(+)) unless absolutely necessary or for  
testing purposes.
  2. Frequency meter indicates system frequency (approx.  
60 Hz).

3. Ammeter indicates approximately 520 amperes (amperes will vary according to the MW loading).
4. Voltmeter indicates approximately 4160 volts.

#### 4.4 Normal Operation.

During most normal unit operations, the diesel generators will be in Emergency Standby or operating for Surveillance Testing. Emergency Standby and operation at full load will be covered in this section.

#### 4.4.1 Emergency Standby Mode.

4.4.1.1 Auxiliary equipment must be running in automatic mode.  
(See section 4.1).

4.4.1.2 The following parameters should be maintained within the range shown;

<u>Parameter</u>	<u>Range</u>
Coolant temperature	100 <sup>o</sup> F Min to 110 <sup>o</sup> F Max.
Lube Oil Temperature	130 <sup>o</sup> F Min. to 135 <sup>o</sup> F Max.
Air Receiver Pressure	200 psig Min. to 250 psig Max.

4.4.1.3 While the Diesel is in Emergency Standby it should be prelubed as a minimum at least once per 7 days. Prelubing should be accomplished per the following steps. This method insures that lube oil is removed from the top of the upper pistons.

1. PLACE the Diesel in Maintenance Exercise.
2. DEPRESS the Voltage Shutdown Pushbutton.
3. TRIP the Fuel Racks.
4. PLACE THE local control in "AT Engine".
5. RUN the Prelube Pump for 1.5 minutes.

6. DEPRESS and HOLD the Engine Alarm Reset Pushbutton.
7. BAR the Diesel with starting air for approximately 5 to 10 seconds by depressing the local start pushbutton.
8. RELEASE the Engine Alarm Reset Pushbutton.
9. Ensure that the governor is at the minimum fuel position and Reset the Fuel Racks.
10. DEPRESS the Engine Alarm Reset Pushbutton, and VERIFY that the SDR and 5A Relays drop out.
11. PLACE the local control in "Remote".
12. PLACE the Mode Selector in Emergency Standby.
13. DEPRESS the Exciter Reset Pushbutton.

4.4.2 Full Load Operation.

- 4.4.2.1 The following parameters should be maintained within the range shown:

<u>Parameter</u>	<u>Range</u>
4.4.2.1.1 Coolant temperature	170 <sup>0</sup> F Min. to 185 <sup>0</sup> F Max.
4.4.2.1.2 Lube Oil temperature	195 <sup>0</sup> F Min. to 215 <sup>0</sup> F Max.
4.4.2.1.3 Crankcase Vacuum	0.4" to 4.0" H <sub>2</sub> O.
4.4.2.1.4 Lube Oil filter Δ P	18 psi Max.
4.4.2.1.5 Lube Oil strainer Δ P	10 psi Max.
4.4.2.1.6 Exhaust temp. (individual cyl.)	1100 <sup>0</sup> F Max.
4.4.2.1.7 Exhaust temp. variation between cylinders.	250 <sup>0</sup> F Max.
4.4.2.1.8 Turbocharger inlet temp.	1200 <sup>0</sup> F Max.

- 4.4.2.2 A Diesel Generator Data Sheet should be completed after the first half-hour of operation and hourly thereafter.

4.4.2.3 Check the level in the Dirty Fuel Return Tank and drain as required.

4.4.2.4 If possible ensure the clean fuel return pump is operating properly.

4.5 Diesel Generator 1A(1B) Unloading and Shutdown.

4.5.1 NOTIFY the dispatcher, that the Diesel Generator 1A(1B) will be taken off line.

CAUTION: Do not exceed +2.5 MVAR, INDICATED BY 1A (1B) DIESEL GENERATOR MW/MVAR METER on PANEL 26(29) OR THE LIMITS OF THE GENERATOR CAPABILITY CURVE.

4.5.2 REDUCE the VAR Load to approximately .5 to 1.0 MVAR's, by intermittently lowering the Automatic Voltage Adjuster.

4.5.3 UNLOAD the Unit by turning the Speed Control switch on Panel 26 (29) to the LOWER position. MAINTAIN the switch in the LOWER position until the WATT/VAR meter indicates a load of approximately 300 KW or 50 amps on the generator Ammeter.

4.5.4 OPEN the Generator Breaker G2-12 (G2-22).

NOTE: When G2-12 (G2-22) circuit breaker opens, the Diesel Generator is disconnected from 4100 V Bus 2-1E(2-2E) and the Diesel Generator may be shutdown to the Emergency Standby condition.

4.6 Diesel Generator 1A(1B) Shutdown to Emergency Standby.

4.6.1 VERIFY that both lights above the Manual Voltage Adjuster and that both lights above the Automatic Voltage Adjuster are ON.

768 162  
POOR ORIGINAL



NOTE: The red light is off when the voltage setting is below the set point, and the green light is off when the voltage setting is above the setpoint required for Emergency Standby.

- 4.6.2 RUN the engine for approximately 3 minutes but not more than 5 minutes to cool it down.
- 4.6.3 Ensure that the Generator output frequency is 60 HZ or slightly greater, or the Tachometer located on the Engine Gauge Panel indicates 900 RPM or slightly greater.
- 4.6.4 DEPRESS the STOP PUSHBUTTON on Panel 26(29).
- 4.6.5 BAR the engine with starting air per following steps. This assures that lube oil is removed from the top of the upper pistons.
1. PLACE the Diesel in Maintenance Exercise.
  2. DEPRESS the Voltage Shutdown Pushbutton.
  3. TRIP the Fuel Racks.
  4. PLACE the local control in "AT Engine".
  5. DEPRESS and HOLD the Engine Alarm Reset Pushbutton.
  6. BAR the Diesel with starting air for approximately 5 to 10 seconds by depressing the local start pushbutton.
  7. RELEASE the Engine Alarm Reset Pushbutton.
  8. Ensure that the governor is at the minimum fuel position and Reset the Fuel Racks.
  9. DEPRESS the Engine Alarm Reset Pushbutton, and VERIFY that the SDR and 5A Relays drop out.

10. PLACE the local control in "Remote".
11. PLACE the Mode Selector in Emergency Standby.
12. DEPRESS the Exciter Reset Pushbutton.

4.6.6 PLACE the Diesel Generator on Standby per Section 4.2.

4.7 Diesel Generator 1A(1B) Shutdown for Maintenance.

NOTE: Subsequent steps are based on the unit being in Emergency Standby.

CAUTION: ENSURE THAT TAG-OUT RULES IN AP 1002 ARE FOLLOWED.

4.7.1 PLACE the Mode Switch on Panel 26(29) in MAINTENANCE EXERCISE.

4.7.2 VERIFY that the "ANY SWITCH NOT IN AUTOMATIC" alarm is received 26.B7(29.B7).

4.7.3 PLACE the EGP control switch in the AT ENGINE position.

4.7.4 CLOSE Starting Air Manual Isolation Valves AVC1 and AVC2.

4.7.5 VERIFY that the STARTING AIR MANUAL VALVE NOT FULLY OPEN alarm 26.D5(29.D5) is received.

NOTE: If possible, the jacket coolant pump, coolant heater, lube oil pump and Lube Oil Heater should remain in automatic to maintain coolant and lube oil temperature.

4.8 Local Operation of Diesel Generator.

NOTE: This procedure is for initial checkout following maintenance.

CAUTION: ENSURE that DIESEL GENERATOR, DF-X-1A (DF-X-1B) IS IN EMERGENCY STANDBY per section 4.2 AND RESET.

4.8.1 Start the Diesel Generator as follows:

4.8.1.1 PLACE the Mode Switch on Panel 26(29) in the MAINTENANCE EXERCISE position.

768 164  
POOR ORIGINAL

NOTE: The ANY SWITCH NOT IN AUTOMATIC alarm 26.C8 (29.C8)\* should be received.

4.8.1.2 PLACE the selection switch on the Engine Group Panel (EGP) in the AT ENGINE position.

CAUTION: When the engine is prelubed it should be started as soon as possible. If it is not, lube oil in the cylinders will drain past the upper piston rings and could place a hydraulic lock on the engine.

NOTE: If the diesel has not been shutdown for more than one hour, prelube is not required.

4.8.1.3 If the engine has not been operated during the past seven days, PRELUBE the engine by PLACING the PRELUBE PUMP Switch on the EGP in the ON position and HOLDING for approximately two to three minutes, then RELEASE the switch.

4.8.1.4 START the engine by DEPRESSING and HOLDING the ENGINE START pushbutton on the EGP for approximately 8 seconds.

CAUTION: IF UNDER THESE CONDITIONS THE ENGINE CANNOT BE LOADED, THEREFORE, PROLONG OPERATION (LONGER THAN 15 TO 30 MIN) IS PROHIBITED AFTER WHICH, IF POSSIBLE, THE ENGINE SHOULD BE RUN UNDER LOAD.

4.8.1.5 Engine Speed and Voltage can be controlled as required for testing, by PLACING the key locked Engine Generator Control in the LOCAL position.

768 165

NOTE: The Generator may be synchronized and loaded from Control Room Panel 26(29) as per Section 4.3.

4.8.2 Local Shutdown.

\_\_\_ 4.8.2.1 If the engine was loaded, run the engine for 3 minutes to cool it down.

\_\_\_ 4.8.2.2 DEPRESS the stop Pushbutton on the EGP.

\_\_\_ 4.8.2.3 PLACE the Diesel Generator in Emergency Standby as per Section 4.2.

4.9 Diesel Generator Automatic Start on Loss of AC Power.

NOTE: Diesel Generator must be in EMERGENCY STANDBY and reset for auto start to occur.

\_\_\_ 4.9.1 ENSURE an NR pump is operating in the application heater and NR-V39A(B) is open.

\_\_\_ 4.9.2 Refer to 2107-1.2 Class IE Electrical System for automatic and operator actions.

\_\_\_ 4.9.3 Operator should monitor engine and generator parameters as displayed on Panel 26(29).

NOTE: Do not exceed the generators continuous rating of 3MW.

\_\_\_ 4.9.4 Engine parameters displayed on EGP and auxiliary systems should be checked as soon as possible by an auxiliary operator and data sheets filled out.

\_\_\_ 4.9.5 If synchronization to the system is necessary follow Section 4.3.9.

4.10 Diesel Generator - Automatic Start upon Engineered Safety Features Actuation.

NOTE: Unit must be in Emergency Standby and reset for auto start to occur.

- 4.10.1 VERIFY that the Diesel Generator automatically started with the associated ESF Actuation and the frequency is approximately 60HZ and the Generator Voltage is approximately 4300 Volts.
- 4.10.2 No automatic Generator loading will occur as long as normal power is available to the ESF BUS 2-1E(2-2E).
- 4.10.3 Operating time of the Diesel Generator without a load should be kept to a minimum to avoid carbon accumulation.
- 4.10.4 Generator can be synchronized to the BUS as detailed in Step 4.3.9.
- 4.10.5 A Diesel Generator Data Sheet should be completed before the Diesel is shut down.
- 4.10.6 The Unit can be shut down after the ESF Actuation has been cleared. Safety Injection - Bypassed. R.B. Isolation & Cooling -Defeated.

4.11 Diesel Generator Automatic Start upon coincident Engineered Safety Features Actuation and Loss of AC Power.

NOTE: Unit must be in Emergency Standby for auto start to occur.

- 4.11.1 REFER to 2107-1.2 Class IE Electrical System for automatic and operator actions.
- 4.11.1.1 Monitor Engine and Generator parameters from Panel 26 (29). 768 167
- 4.11.2 Engine parameters and auxiliary systems should be monitored by observing local indications at EGP as soon as practical by an auxiliary operator and data sheets filled out.

ORIGINAL

4.12 Emergency Operation.

4.12.1 Operation of Air Compressor DF-P-2B(2D)

Using the Lister Diesel Engine Drive.

- \_\_\_ 4.12.1.1 INSTALL the Starting Air Compressor, DF-P-2B(2D) drive belt on the diesel engine.
- \_\_\_ 4.12.1.2 ENSURE the fuel and lubricating oil systems are primed.
- \_\_\_ 4.12.1.3 MOVE the decompressor lever over towards the flywheel.
- \_\_\_ 4.12.1.4 PULL the control lever outwards and allow it to rotate counter clockwise so that it butts against the top stop and is in a vertical position. (Located on the compressor end of the engine).
- \_\_\_ 4.12.1.5 Lightly oil the end of the camshaft extension and fit the starting handle.
- \_\_\_ 4.12.1.6 TURN the engine slowly approximately 20 turns on the camshaft, in order to prime the combustion chamber and lubricating oil system
- \_\_\_ 4.12.1.7 TURN the hand crank smartly in a clockwise direction and while still turning MOVE the Decompressor Lever toward the Fuel Tank.
- \_\_\_ 4.12.1.8 SLIP off the hand crank when the engine fires.
- \_\_\_ 4.12.1.9 When the engine reaches normal speed, TURN the control lever clockwise to the horizontal position so that it butts against the horizontal stop.
- \_\_\_ 4.12.1.10 VERIFY that the diesel engine automatically trips when the air receiver pressure reaches 250 psig.

NOTE: The engine must be manually restarted if required.

POOR ORIGINAL

4.12.2 Emergency Shutdown.

4.12.2.1 The Diesel Generator 1A(1B) may be shutdown in an emergency as follows:

4.12.2.1.1 DEPRESS the STOP pushbutton on Panel 26(29) or the Engine Mounted Gauge Panel.

NOTE: These pushbuttons are bypassed on an SFAS Actuation.

4.12.2.1.2 TRIP the overspeed governor latch so that fuel oil injection control racks move to the no fuel position. Red trip button is located near EMGP on the west side of the engine.

NOTE: Do not reset the engine trip level until the governor has returned to the zero fuel position.

4.12.2.2 Automatic shutdown results from any of the following:

4.12.2.2.1 Lube oil pressure of 16 psig, decreasing, during operation, sensed by 3 out of 3 pressure switches.

4.12.2.2.2 Crank case pressure of .5 inches of water, increasing, sensed by 2 out of 3 pressure switches.

4.12.2.2.3 Engine overspeed of 990 to 1010 RPM.

4.12.3 Use of Compressed Air Start Bottles.

NOTE: This should only be used after an air start failure and pressure must not be maintained by normal means.

4.12.3.1 Open each bottles's isolation valve.

4.12.3.2 Open header isolation valves DF-FV-27A, B, 28 A, B, and C).

768 169  
DND ORIGINAL

4.12.3.3 Insure regulators DF-V51A, B, and C (DF-V-52A, B, and C) are set to maintain approximately 200 psi to the diesel.

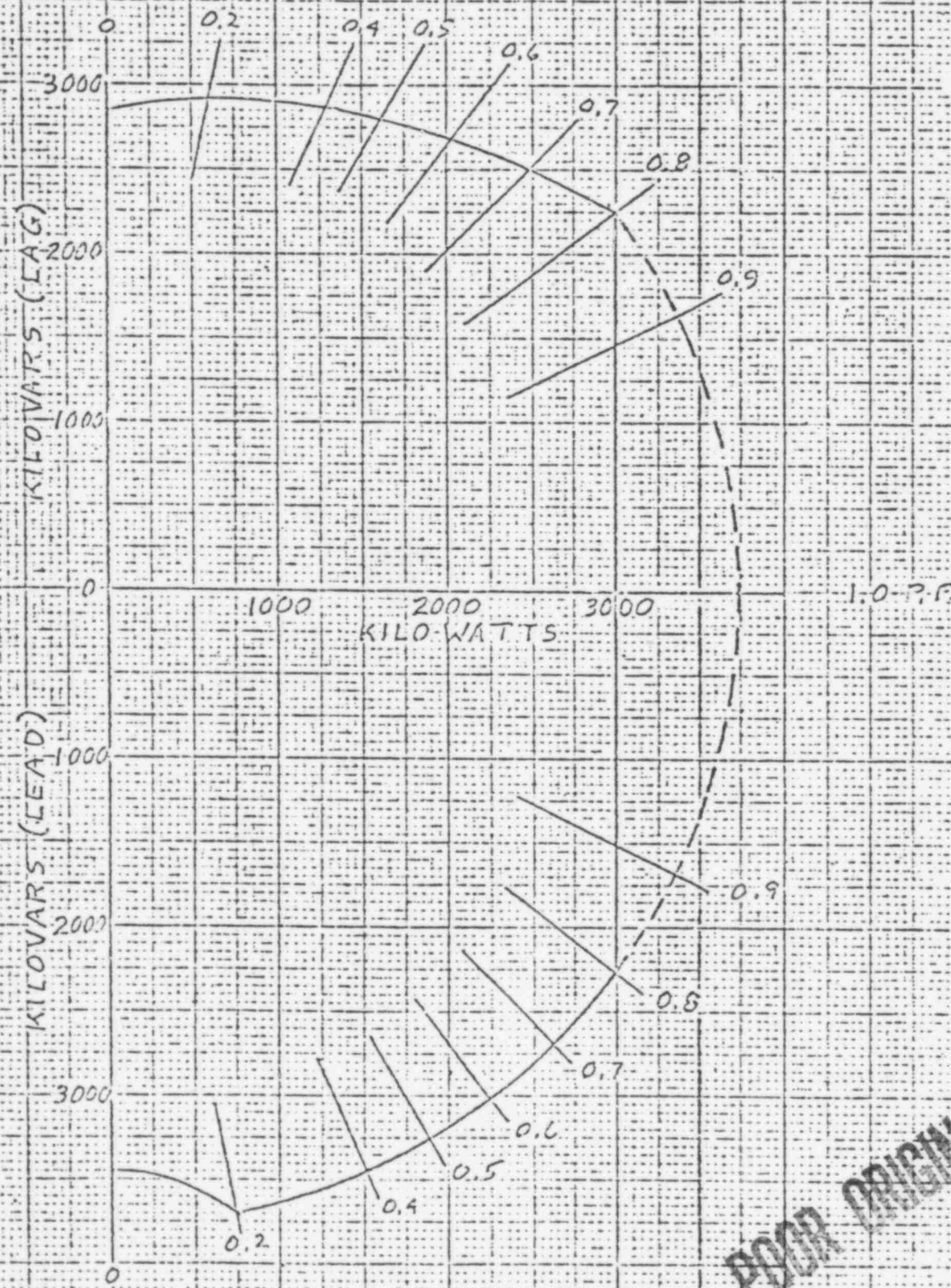
4.12.3.4 Insure DF-V49A (DF-V49B) is open.

NOTE: Once the air bottles are no longer required, reisolate them by closing the bottle isolation valves to prevent leakage past the pressure regulators.



FIGURE 1.5.1  
 FAIRBANKS MORSE INC.  
 REACTIVE CAPABILITY CURVE  
 3750 KVA, 3000 KW, 500 RPM, 3/60/410V  
 520A, 0.8 P.F., SYNCHRONOUS GENERATOR  
 FRAME 9CC-30  $X_d' = 1.22, X_d'' = .717, X_d''' = .12$

2104-6-2  
 Revision 7  
 09/13/78



POOR ORIGINAL

768 171

02/27/10

PERFORMANCE CURVE  
GENERATOR OUTPUT VS.  
FUEL CONSUMPTION  
3000 KW NUCLEAR UNIT

FAIRBANKS MORSE INC.  
BELOIT WISCONSIN

JULY 25, 1969

FUEL CONSUMPTION - LBS/KW-HR

560  
550  
540  
530  
520  
510  
500

7.16 #/gals

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0 1000 1500 2000 2500 3000

GENERATOR OUTPUT - KW

ATTACHMENT I

DIESEL GENERATOR, DF-X-1A, AUXILIARIES POWER SOURCES.

- I. At MCC 2-11EC, CLOSE the following breakers:
  1. Unit 1 CF - Starting Air Compressor, DF-P-2A.
  2. Unit 1EF - Starting Air Compressor, DF-P-2B.
  3. Unit 3EF - Fuel Oil Transfer Pump, DF-P-1A.
  4. Unit 3FF - Fuel Oil Transfer Pump, DF-P-1B.
  5. Unit 2ALF - Diesel Generator, DF-X-1A AC Auxiliaries.
- II. At DC BUS 2-1DC, CLOSE the following breaker.
  1. U213D 1DC-DI-X-1A - DC to Diesel Generator 1A.
- III. At the Engine Mounted 480V AC Breaker Cabinet, CLOSE the following breakers:
  1. Brk. #1 - Jacket Coolant Heater.
  2. Brk. #2 - Jacket Coolant Pump.
  3. Brk. #3 - Lube Oil Heater.
  4. Brk. #4 - Lube Oil Pump.
  5. Brk. #5 - Generator Space Heater.
  6. Brk. #6 - Prelube Pump.
- IV. At the Engine Mounted DC Breaker Cabinet, CLOSE the following breakers: (Behind AC Breaker Cabinet).
  1. Brk. #8 - Control Power Circuit #3.
  2. Brk. #9 - Control Power Circuit #2.
  3. Brk. #10 - Control Power Circuit #1.
  4. Brk. #11 - Control Power Circuit #4.

NOTE: This will energize the white control power on lights at EMGP.

768 173

POOR ORIGINAL

V. Close the following breakers mounted on the Engine Skid.

1. CB 13 - DC Auxiliary Fuel Oil Pump.
2. CB14 - Clean Fuel Oil Return Pump.

VI. At DC Distribution Panel DCA-1A, CLOSE the following breaker:

Brk #11 - DC Control Power to 4160V Diesel Generator Switchgear  
2DG-1.

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

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

**POOR ORIGINAL**

Diesel Generator, DF-X-1B, AUXILIARIES POWER SOURCES.

- I. At MCC 2-21EC, CLOSE the following breakers:
  1. Unit 2BF - Fuel Oil Transfer Pump, DF-P-1C.
  2. Unit 2CF - Fuel Oil Transfer Pump, DF-P-1D.
  3. Unit 3CF - Starting Air Compressor, DF-P-2C.
  4. Unit 3DF - Starting Air Compressor, DF-P-2D.
  5. Unit 3ARF - Diesel Generator, DF-X-1B AC Auxiliaries.
- II. AT DC BUS 2-2DC, CLOSE the following breaker U224B, 2DC-DF-X-1B-DC to Diesel Generator 1B.
- III. At DC Distribution Panel DCA-2A, CLOSE the following breaker:  
Brk. #11 - DC Control Power to 4160V Diesel Generator Switchgear 2DG-Z.
- IV. At the Engine Mounted 480V AC Breaker Cabinet, CLOSE the following breakers.
  1. Brk. #1 - Jacket Coolant Heater.
  2. Brk. #2 - Jacket Coolant Pump.
  3. Brk. #3 - Lube Oil Heater.
  4. Brk. #4 - Lube Oil Pump.
  5. Brk. #5 - Generator Space Heater.
  6. Brk. #6 - PreTUBE Pump.
- V. At the Engine Mounted DC Breaker Cabinet, CLOSE the following breakers: (Located at the rear of the AC Breaker Cabinet).
  1. Brk. #8 - Control Power Circuit #3.
  2. Brk. #9 - Control Power Circuit #2.
  3. Brk. #10 - Control Power Circuit #1.
  4. Brk. #11 - Control Power Circuit #4.

NOTE: This will energize the white control power on lights at EMGP.
- VI. CLOSE the following breakers mounted on the Engine Skid.

POOR ORIGINAL

768 175

1. CB13 - DC Auxiliary Fuel Oil Pump.
2. CB14 - Clean Fuel Oil Return Pump.

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

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

**POOR ORIGINAL**

768 176

ATTACHMENT 2  
Valve Line-Up  
Diesel Generator, DF-X-1A  
Fuel Oil

Valve #	Valve Name and/or Function	Position	Initial
DF-V1A	Diesel Fuel Oil Storage Tank 2A Outlet	OP	_____
DF-V20A	Diesel Fuel Oil Storage Tank 2A Drain	CL	_____
DF-V10A	Fill Pump to Storage Tank 2A	CL	_____
DF-V10B	Fill Pump to Storage Tank 2B	CL	_____
DF-V26	Root Valve to DF-P-3 Discharge Pressure	OP	_____
DF-V1B	Diesel Fuel Oil Storage Tank 2B Outlet	OP	_____
DF-V20B	Diesel Fuel Oil Storage Tank 2B Drain	CL	_____
DF-V3	Transfer Pumps Suction Crossconnect	CL	_____
DF-V27	Transfer Pumps Suction Crossconnect	CL	_____
DF-V5A	A Diesel Transfer Pump Suction Pressure	OP	_____
DF-V4A	DF-P-1A Suction	OP	_____
DF-V4B	DF-P-1B Suction	OP	_____
DF-V16A	DF-DPI-1706 Root Valve	OP	_____
DF-V17A	DF-DPI-1706 Root Valve	OP	_____
DF-V16B	DF-DPI-1707 Root Valve	OP	_____
DF-V17B	DF-DPI-1707 Root Valve	OP	_____
DF-V8A	DF-DPIS-791 Root Valve	OP	_____
DF-V9A	DF-DPIS-791 Root Valve	OP	_____

**POOR ORIGINAL**

768 177

ATTACHMENT 2  
Valve Line-Up  
Diesel Generator, DF-X-1A  
Fuel Oil

Valve #	Valve Name and/or Function	Position	Initial
DF-V8B	DF-DPIS-792 Root Valve	OP	_____
DF-V9B	DF-DPIS-792 Root Valve	OP	_____
DF-V7A	DF-P-1A Discharge	A-CL	_____
DF-V11A	DF-P-1A Discharge to Day Tank	OP	_____
DF-V7B	DF-P-1B Discharge	A-CL	_____
DF-V11B	DF-P-1B Discharge to Day Tank	OP	_____
DF-V13A	Day Tank Drain Valve	CL	_____
JF-FV1A	Dirty Fuel Tank Drain	CL	_____
DF-V25	Fuel Oil Tank Fill Valve	CL	_____
DF-V62	DF-P-3 Suction Valve	CL	_____
DF-V64	DF-P-3 Discharge Valve	CL	_____
DF-V63	DF-P-3 By Pass	CL	_____
DF-V60	Diesel Fuel Oil Fill Conn.	Locked closed	_____

**POOR ORIGINAL**

768 178



ATTACHMENT 2  
Valve Line-Up  
Diesel Generator, DF-X-1B  
Fuel Oil

Valve #	Valve Name and/or Function	Position	Initial
DF-V4C	DF-P-1C Suction	OP	_____
DF-V4D	DF-P-1D Suction	OP	_____
DF-V16C	DF-DPI-1704 Root Valve	OP	_____
DF-V17C	DF-DPI-1704 Root Valve	OP	_____
DF-V16D	DF-DPI-1705 Root Valve	OP	_____
DF-V17D	DF-DPI-1705 Root Valve	OP	_____
DF-V8C	DF-DPIS-789 Root Valve	OP	_____
DF-V9C	DF-DPIS-789 Root Valve	OP	_____
DF-V7C	DF-P-1C Discharge	A-CL	_____
DF-V11C	DF-P-1C to Day Tank	OP	_____
DF-V8D	DF-DPI-790 Root Valve	OP	_____
DF-V9D	DF-DPI-790 Root Valve	OP	_____
DF-V7D	DF-P-1D Discharge	A-CL	_____
DF-V11D	DF-P-1D to Day Tank	OP	_____
DF-V13B	Day Tank Drain Valve	CL	_____
DF-FV1B	Dirty Fuel Tank Drain	CL	_____

**POOR ORIGINAL**

768 179

ATTACHMENT 2  
Valve Line-Up  
Diesel Generator, DF-X-1A  
Lube Oil

Valve #	Valve Name and/or Function	Position	Initial
DF-V44A	Lube Oil Day Tank Fill	CL	_____
DF-V37A	Lube Oil Day Tank Drain	CL	_____
DF-V39A	Lube Oil Day Tank to Engine Sump	OP	_____
DF-FV2A	Root Valve to Crankcase Vacuum Man Meters	OP	_____
DF-FV3A	Root Valve to Lube Oil Pressure Switches	OP	_____
DF-FV4A	Suction to Standby L.O. Circ. Pump	OP	_____
DF-FV5A	Standby L.O. Circ. Pump Three Way Valve	OP RECIRC	_____
DF-V47A	Standby L.O. Circ. Pump Discharge Drain	CL	_____
DF-FV6A	Diesel Sump Drain	CL	_____
DF-FV7A	L.O. Filter Drain	CL	_____
DF-FV8A	L.O. Strainer Copped Drain	CL	_____
DF-FV9A	L.O. Strainer Drain	CL	_____
DF-FV10A	Root Valve to Crankcase Pressure Switches	OP	_____
Jacket Coolant			
DW-V177	Demin Water to Expansion Tank DF-T-9A	CL	_____
DF-V40A	Expansion Tank Outlet	Locked Open	_____
DF-V41A	Expansion Tank Drain	CL	_____
DF-V42A	Level Gauge Root Valve	OP	_____
DF-V43A	Level Gauge Root Valve	OP	_____
DF-V25	Fuel Oil Tank Fill Valve	Locked Closed	_____

768 180

**POOR ORIGINAL**

ATTACHMENT 2  
Valve Line-Up  
Diesel Generator, DF-X-1A

Jacket Coolant

Valve #	Valve Name and/or Function	Position	Initial
DF-FV11A	Cooler Air Vent	CL	_____
DF-FV12A	Cooler Drain Valve	CL	_____
DF-FV13A	Cooler Bypass Line Drain Valve	CL	_____
DF-FV14A	Engine Driven Pump Discharge Pressure Gauge	OP	_____
DF-FV15A	Filling Line bypass for Thermostatic Valve	CL	_____
DF-FV16A	Low coolant pressure switch root valve	OP	_____
DF-FV17A	Standby Coolant Pump Suction	OP	_____
DF-FV18A	Standby Coolant Pump Discharge	OP	_____

Air Coolant

DF-FV19A	Cooler air vent	CL	_____
DF-FV20A	Cooler drain	CL	_____
DF-FV21A	Engine driven pump drain	CL	_____
DF-FV22A	From discharge of Standby Coolant Pump to air cooler	OP	_____
DF-FV23A	From air cooler to suction of standby coolant pump.	OP	_____
DF-FV24A	Air pressure gauge root valve	OP	_____

Starting Air

DF-V35	Air Compressor Emergency interconnection	CL	_____
DF-V36A	Air Receiver Emergency interconnection	CL	_____
DF-V36B	Air Receiver Emergency interconnection	CL	_____
DF-V48A	DF-T-5A auto drain isolation	OP	_____
DF-V38A	DF-A auto drain valve	A-CL	_____
DF-V30A	Air Receiver, DF-T-5A inlet	OP	_____

168 181  
**POOR ORIGINAL**

ATTACHMENT 2  
Valve Line-Up  
Diesel Generator, DF-X-1A  
Starting Air

Valve #	Valve Name and/or Function	Position	Initial
DF-V33A	Air Receiver, DF-T-5A outlet	OP	_____
DF-V34A	Air Receiver PI root valve	OP	_____
DF-V48B	DF-T-5B auto drain isolation	OP	_____
DF-V38B	DF-T-5B auto drain	A-CL	_____
DF-V30B	Air Receiver, DF-T-5B inlet	OP	_____
DF-V33B	Air Receiver, DF-T-5B outlet	OP	_____
DF-V34B	Air Receiver PI root valve	OP	_____
DF-FV25A	AVC1 air start isolation	CL	_____
DF-FV26A	AVC2 Air start isolation	CL	_____
DF-IV47	DF-PI-2008 isolation	OP	_____
DF-IV53	DF-PI-2009 isolation	OP	_____
DF-IV54	DF-PI-2008 drain	CL	_____
DF-IV48	DF-PI-2009 drain	CL	_____
DF-V49A	Air bottles to air receivers iso	OP	_____
DF-FV27A	Left air bottle manifold iso	CL	_____
DF-FV27B	Middle air bottle manifold iso	CL	_____
DF-FV27C	Right air bottle manifold iso	CL	_____
	Left air bottle iso valve	CL	_____
	Middle air bottle iso valve	CL	_____
	Right air bottle iso valve	CL	_____

768 182  
**POOR ORIGINAL**

ATTACHMENT 2  
Valve Line-Up  
Diesel Generator, DF-X-1B  
Lube Oil

Valve #	Valve Name and/or Function	Position	Initial
DF-V44B	Lube Oil Day Tank Fill	CL	_____
DF-V37B	Lube Oil Day Tank Drain	CL	_____
DF-V39B	Lube Oil Day Tank to Engine Sump	OP	_____
DF-FV-2B	Root Valve to Crankcase Vacuum Man Meters	OP	_____
DF-FV-3B	Root Valve to Lube Oil Pressure Switches	OP	_____
DF-FV-4B	Suction to Standby L.O. Circ. Pump	OP	_____
DF-FV-5B	Standby L.O. Circ. Pump Three Way Valve	OP RECIRC	_____
DF-V47B	Standby L.O. Circ. Pump Discharge Drain	CL	_____
DF-FV-6B	Diesel Sump Drain	CL	_____
DF-FV-7B	L.O. Filter Drain	CL	_____
DF-FV-8B	L.O. Strainer Copped Drain	CL	_____
DF-FV-9B	L.O. Strainer Drain	CL	_____
DF-FV-10B	Root Valve to Crankcase Pressure Switches	OP	_____
Jacket Coolant			
DW-V178	Demin Water to Expansion Tank DF-T-9A	CL	_____
DF-V40B	Expansion Tank Outlet	Locked Open	_____
DF-V41B	Expansion Tank Drain	CL	_____
DF-V42B	Level Gauge Root Valve	OP	_____
DF-V43B	Level Gauge Root Valve	OP	_____

768 183  
**POOR ORIGINAL**

ATTACHMENT 2  
Valve Line-Up  
Diesel Generator, DF-X-1B

Jacket Coolant

Valve #	Valve Name and/or Function	Position	Initial
DF-FV11B	Cooler Air Vent	CL	_____
DF-FV12B	Cooler Drain Valve	CL	_____
DF-FV13B	Cooler Bypass Line Drain Valve	CL	_____
DF-FV14B	Engine Driven Pump Discharge Pressure Gauge	OP	_____
DF-FV15B	Filling Line bypass for Thermostatic Valve	CL	_____
DF-FV16B	Low coolant pressure switch root valve	OP	_____
DF-FV17B	Standby Coolant Pump Suction	OP	_____
DF-FV18B	Standby Coolant Pump Discharge	OP	_____

Air Coolant

DF-FV19B	Cooler air vent	CL	_____
DF-FV20B	Cooler drain	CL	_____
DF-FV21B	Engine driven pump drain	CL	_____
DF-FV22B	From discharge of Standby Coolant Pump to air cooler	OP	_____
DF-FV23B	From air cooler to suction of standby coolant pump.	OP	_____
DF-FV24B	Air pressure gauge root valve	OP	_____

Starting Air

DF-V48C	DF-T-5C auto drain isolation	OP	_____
DF-V38C	DF-T-5C auto drain valve	A-CL	_____
DF-V30C	Air Receiver, DF-T-5C inlet	OP	_____

**POOR ORIGINAL**

ATTACHMENT 2  
Valve Line-Up  
Diesel Generator, DF-X-1B  
Starting Air

Valve #	Valve Name and/or Function	Position	Initial
DF-V33C	Air Receiver, DF-T-5C outlet	OP	_____
DF-V34C	Air Receiver PI root valve	OP	_____
DF-V48D	DF-T-5D auto drain isolation	OP	_____
DF-V38D	DF-T-5D auto drain	A-CL	_____
DF-V30D	Air Receiver, DF-T-5D inlet	OP	_____
DF-V33D	Air Receiver, DF-T-5D outlet	OP	_____
DF-V34D	Air Receiver PI root valve	OP	_____
DF-FV25B	AVC1 air start isolation	CL	_____
DF-FV26B	AVC2 Air start isolation	CL	_____
DF-IV49	DF-PI-2010 isolation valve	OP	_____
DF-IV51	DF-PI-2011 isolation valve	OP	_____
DF-IV52	DF-PI-2010 drain valve	CL	_____
DF-IV50	DF-PI-2011 drain valve	CL	_____
DF-V49B	Air bottles to air receivers iso	OP	_____
DF-FV28A	Left air bottle manifold iso	CL	_____
DF-FV28B	Middle air bottle manifold iso	CL	_____
DF-FV28C	Right air bottle manifold iso	CL	_____
	Left air bottle iso valve	CL	_____
	Middle air bottle iso valve	CL	_____
	Right air bottle iso valve	CL	_____

**POOR ORIGINAL**

ATTACHMENT III

5.0 Lube Oil System Fill

Initial each step upon satisfactory completion.

5.1 Addition of Lube Oil to Lube Oil Day Tank (DF-T-3A/B).

CAUTION: SAE 40 OIL MUST BE USED.

5.1.1 CONNECT hose to the Lube Oil Day Tank Fill line at DF-V44A (B), and OPEN DF-V44A.

5.2.2 Use a hand pump to transfer oil from the 55 gallon drum to the Lube Oil Day Tank.

NOTE: Low level alarm for the lube oil day tank is set at the center of the tank or approx. 137 gallons. Therefore, approximately 138 gallons would be required to completely refill the tank.

5.1.3 When the Day Tank is filled disconnect and drain the hose, and CLOSE DF-V44A.

5.2 Addition of Lube Oil to Diesel Generator Sump.

CAUTION: SAE 40 OIL MUST BE USED. OIL TO BE ADDED MUST NOT BE COLDER THAN 65°F.

NOTE: If sump is empty, approximately three 55 gallon drums of oil will be required (185 gallon capacity). Ensure a hand pump is available to transfer oil from the drums to the engine sump.

5.2.1 REMOVE Engine sump fill line cap.

5.2.2 ATTACH the hand pump to a 55 gallon drum of SAE 40 lube oil and run a hose from the pump to the sump fill line.

5.2.3 FILL the engine sump using the hand pump.



- 5.2.4 While filling periodically check sump level, using dip stick gauge.
- 5.2.5 When sump level is at FULL mark  $\pm$  1/4 inch on dipstick gauge while operating, or at the punch mark  $\pm$  1/4 inch while shutdown, stop filling the sump.
- 5.2.6 REMOVE hose and replace fill line cap.
- 5.2.7 ENSURE DF-V39A(B) is open.
- 5.2.8 If the lube system is being filled following oil change-out:
  - 5.2.8.1 Remove lower crankcase component cover marked IC.
  - 5.2.8.2 RUN the pre-lube pump to fill system piping. When lube oil is observed at the lower crankcase compartment IC. Stop the prelube pump.
- 5.2.9 INSTALL cover removed in Step 5.2.8.

ATTACHMENT IV

Fuel Oil Tank Fill Procedure

5.0 FUEL OIL SYSTEM

Upon satisfactory completion initial each step.

5.0.1 This procedure provides instructions for filling DF-T-2A/B from two sources; (1) section 5-1, from Unit 1 storage tank using DF-P-3. And (2) Section 5.2 from fuel oil tank truck by-passing DF-P-3. If section 5.1 is used, inform Unit-1 shift foreman that Unit 2 will be using fuel from FO-T-1.

5.1 Filling Diesel Generator Fuel Storage Tanks using DF-P-3.

5.1.1 Check The Following Valves CLOSED.

DF-V60

DF-V63

5.1.2 Check the following valves OPEN

DF-V61 FO-V2 (Unit 1 FO-T-1 outlet)

DF-V62

DF-V64

5.1.3 OPEN DF-V25

5.1.4 OPEN DF-V10A (B) inlet valve to tanks, DF-T-2A(B) to be filled.

5.1.5 Start DF-P-3, Diesel fill pump.

5.1.6 Fill DF-T-2A(B), Ensure that both tanks contain at least 19,000 gallons (T.S. 3.8.1.1.b.2)

5.1.7 Stop pump DF-P-3 prior to overflowing tanks; CLOSE DF-10A(B), DF-V25, DF-V62 and DF-V64.

POOR ORIGINAL

768-183

5.2 Filling Diesel Generator Fuel Storage Tanks Using Fuel Oil Truck.

5.2.1 Connect hose from fuel oil tank to fill connection upstream of  
DF-V60

5.2.2 CLOSE the following valves

DF-V61

DF-V62

DF-V64

5.2.3 OPEN the following valves

DF-V60

DF-V63

DF-V25

5.2.4 OPEN DF-V10A(B) inlet valve to tanks, DF-T-2A(B), to be filled.

5.2.5 Start tank truck pump.

5.2.6 Fill DF-T-2A(B), Ensure that both tanks contain at least 19,000  
gallons (T.S.3.8.1.1.b.2)

5.2.7 Stop tank truck pump prior to overflowing tanks,  
CLOSE DF-V10A(B) and DF-V25.

5.2.8 CLOSE the following valves.

DF-V60

DF-F63

5.2.9 OPEN the following valves

DF-V61

5.3 Fill Day Tank, DF-T-2A (B).

5.3.1 PLACE the control switch for DF-P-1A (1C) or 1B(1D) On Panel  
26 (29) to MANUAL.

5.3.2 As tank is filling OBSERVE DF-LI 797 (793) located on the top  
of the tank.

POOR ORIGINAL

768 189

5.3.3 When the level gauge indicates full (550 gallons PLACE the control switch for the operating pumps to OFF or AUTO as required.

NOTE: DF-T-1A(B) must contain greater than 500 gallons per Tech Spec. 3.8.1.1.b.1

5.4 Fill Diesel Generator Fuel Storage Tanks (DF-T-2A/B) during max. probable flood.

5.4.1 ATTACH a hose to the fuel oil fill connection and run it up to the top of the Fuel Handling Building.

5.4.2 MAKE necessary arrangement to have fuel oil delivered to the roof of the FH Building via helicopters.

5.4.3 REMOVE the air ventilation gills (but not the fire dampers) in the air ducts between the Storage Tank Room and the Diesel Room.

5.4.4 Fill per section 5.1.

POOR ORIGINAL

768 190

EMERGENCY DIESEL GENERATOR A (B) DATA SHEET

Section Description of Required Data.

1.0 ENGINE DATA - ENGINE MOUNTED INSTRUMENT PANEL - Record Following  
Data After One Half Hour of Engine Operation and then Hourly

		<u>Normal Range</u>
Lube Oil Pressure	_____psi	25-35 psi
Jacket Coolant Temperature	_____°F	170-185°F
Starting Air Pressure No. 1	_____psi	200-250 psi
Starting Air Pressure No. 2	_____psi	200-250 psi
Scavenging Air Pressure	_____psi	~.3 psi at full load
Jacket Coolant Pressure	_____psi	30-40 psi
Crankcase Vacuum	_____in.	H <sub>2</sub> O 0.4-4" H <sub>2</sub> O
Fuel Oil Pressure		
Black Hand (B.H) to Filter	_____psi	{ Δp < 10 psi
Red Hand (R.H) to Engine	_____psi	
Black Hand (B.H.) to Strainer	_____psi	{ Δ P < 4 psi
Red Hand (R.H) to Pump	_____psi	

<u>Pyrometer Position</u>	<u>Function</u>		
1	CY1 #1 Exh. Temp.	_____°F	
2	CY1 #2 Exh. Temp.	_____°F	
3	CY1 #3 Exh. Temp.	_____°F	
4	CY1 #4 Exh. Temp.	_____°F	1100°F max
5	CY1 #5 Exh. Temp.	_____°F	1000°F normal
6	CY1 #6 Exh. Temp.	_____°F	< 250°F variation
7	CY1 #7 Exh. Temp.	_____°F	between cylinders
8	CY1 #8 Exh. Temp.	_____°F	

768 191  
**PGOR ORIGINAL**

9	CY1 #9 Exh. Temp	_____ °F	
10	CY1 #10 Ext. Temp	_____ °F	
11	CY1 #11 Ext. Temp.	_____ °F	
12	CY1 #12 Ext. Temp.	_____ °F	
13	T'charger Inlet Gov Side	_____ °F	NA
14	T'charger Inlet opp Gov Side	_____ °F	NA
15	Combined Exhaust	_____ °F	NA
	Engine hours (after engine has stopped)	_____ HR	
	Lube Oil Temperature (outlet from engine).	_____ °F	195°-215°F
	Stator Temperature	_____ °C	< 100°C
	Bearing Temperature	_____ °C	< 85°C

POOR ORIGINAL

768 192

ATTACHMENT V

G2-1E2 (G22-2E2) Closing Procedure

- A. Insert the manual spring charging lever (hockey stick) in the manual ratchet lever slot that projects through the slot on the front panel of the breaker to the left of the coil marked "Lift to Trip". (see figures)
- B. CHARGE the spring by using downward strokes on the spring charging lever until a "click" is heard. A few strokes will be required and do not attempt to charge any further after the click is heard.
- C. CLOSE the breaker by lifting the spring release trigger plunger marked "Lift to Close". (see figures).

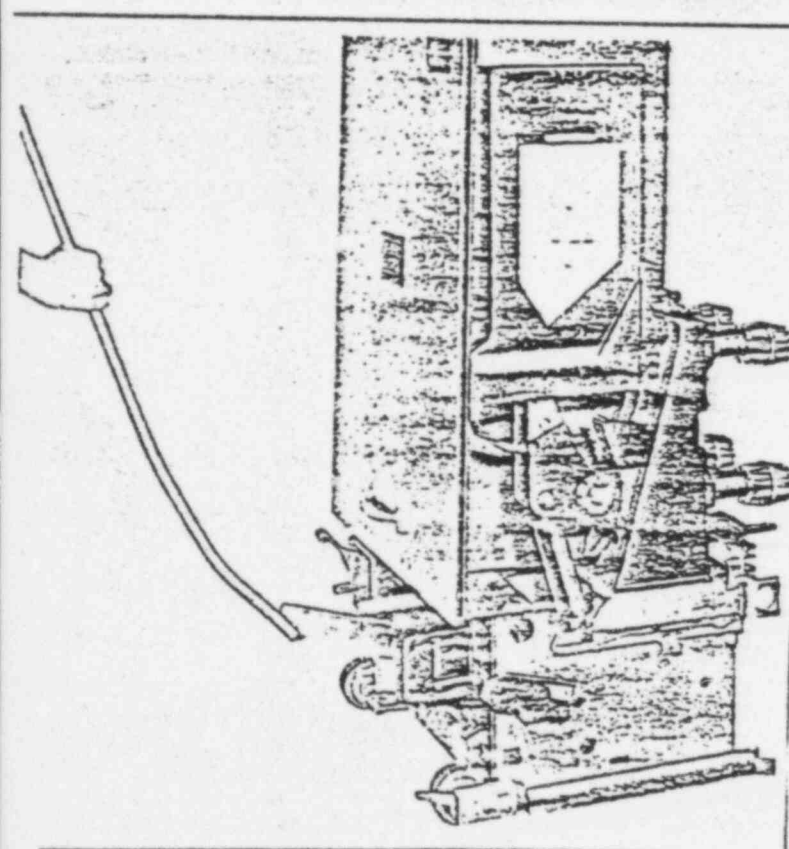


Fig. 5a. Charging Closing Spring by Hand

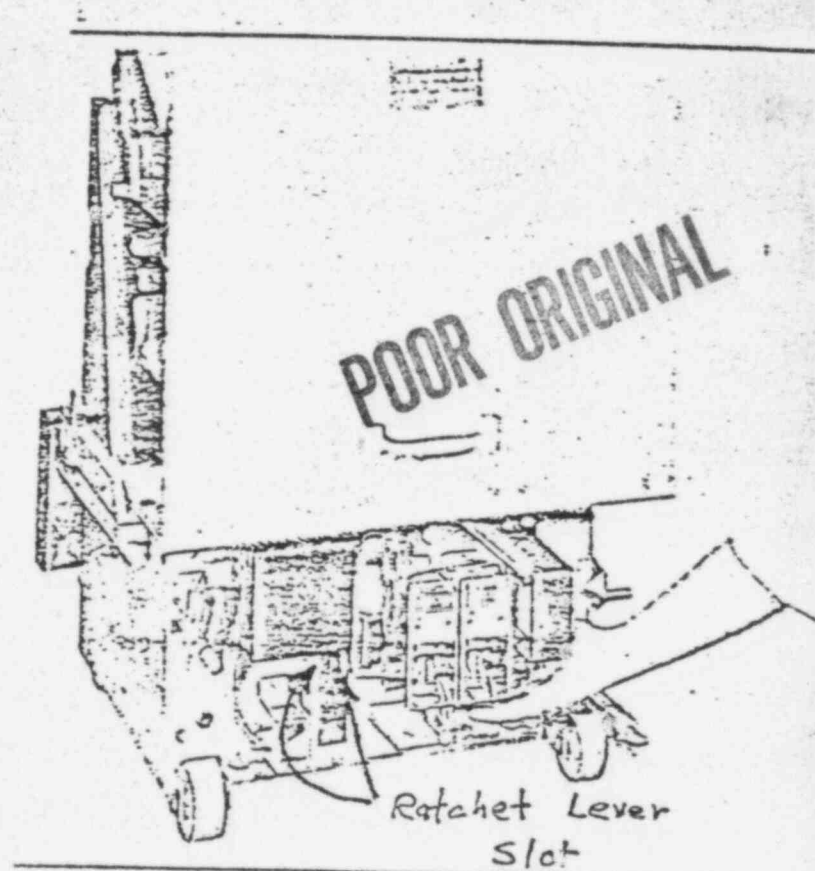


Fig. 5b. Spring Closing Breaker by Hand Release, 4.16 KV Breaker