Questionnaire

for

NUCLEAR REGULATORY COMMISSION
RELIABILITY STUDY

of

Standby Diesel Generator Units

Date Questionnaire Completed: ____________

Plant Name: Browns Ferry Nuclear Plant Unit No. 1, 2 and 3

Diesel Manufacturer: General Motors - EMD Model: 20-645E4

Number of Units: 8

Size Kw/Unit: 2850 Full Rated Speed: 900 RPM

Average Operating Hours Per Unit to Date: Supplemental Report Item

DIESEL GENERATOR STATUS

A. Engine:

1. Problems are caused chiefly by (give estimated number)

   a. Defective parts 10%
   b. Installation errors: 10%
   c. Failure of system to respond properly in function or sequence: 10%
   d. Faulty adjustment: 70%

2. Would more stringent inspection and testing requirements during acceptance or preoperational tests significantly improve the diesel-generator power plant performance?
   Yes ______ No X

B. Starting Systems (indicate which):

1. Air-to-cylinder cranking. ______
   Air cranking motor X Mfr. ______ Model No. ______
   Electric cranking motor ______ Mfr. ______ Model No. ______

2. If air cranking, then:

Give size of starting air tank: Length 6-1/2' Diameter 2-1/2'

Normal standby air tank pressure 200 psi.

Is pressure reducer used? Yes ____ No X
Reducer pipe size? ______ inches.

Starting air control admission valve pipe size in air piping system, 1-1/2 inches.

Minimum air tank pressure for engine cranking Approximately 175 psi. Alarm setpoint 165 psi.

Number of five-second cranking periods between above pressures with no tank recharging 2.

Number of air tanks per engine 10.

Can starting air tanks serve more than one engine?
Yes ______ No x

Is air pipe to engine from top of air tank? Yes ____ No X

Does starting air tank have water condensate drain?
Yes X No ___

Does starting air pipe have water condensate trap and drain near engine? Yes X No ___

Is starting air piping horizontal? Yes X No ____

Does it slant toward drain? Yes ____ No X

If water condensate drains are provided, then is draining:

a. Automatic through float valve? Yes ___ No x
b. Manual by hand valve? Yes x No ___
c. If manual, then is draining water condensate done:

daily? ____
weekly? ____
monthly? X
before each start if manual? ____
no procedure? ____

Is dirt and rust filter provided in starting air pipe?
Yes ____ No X Strainer is provided.

If provided, where installed? Immediately before air starting valve to engine

How is it cleaned? Opening of strainer blow off valve.

How often and when? Monthly

Give pipe size of filter: 1-1/2" inches.

How is it known whether filter is plugged or has high pressure drop? Starting failure

Is starting air pipe to engine positioned:

a. Below floor? ____
b. On the floor? ____
c. Overhead? X

What is air pressure drop from air tank to engine during cranking 14-22 psi

Give approximate length (nearest ten feet) of starting air pipe for individual engine or all engines from air tank to:

a. Nearest engine 50 feet
b. Furthest engine N/A feet

Diameter of starting air pipe from:

a. Air tank to starting valve 1-1/2 inches
b. At air starting valve 1-1/2 inches
c. At engine 1-1/2 inches

What is the primary source of power for the starting air system? Compressors driven by both A-C and D-C motors 480V Diesel Aux. Boards

Is there a duplicate and redundant motor and air compressor set? Yes X No ___

What is the time required to recharge one air tank? 25 minutes from low air-pressure point

Does starting air supply system have independent secondary power supply for compressor? Yes X No ___

If yes, then by:

a. Gasoline engine? ___
b. Motor driven? X
c. Other? (Specify) ___

N/A 3. If electric (Battery powered) cranking, then:

a. Battery charging: Continuous trickle charger ___
Intermittent charging ___

If so, how is charging requirement determined?

Time cycle ___
Test ___
Other ___

b. Battery used: Common Plant ___
Individual Unit ___
Other ___

Starting cable size ___ ; Length: Battery to engine (longest) ___

C. Fuel Oil System: Bulk Tank to Day Tank

1. Does the bulk tank to day tank fuel supply system (viz: pump, motor, etc.) have redundant independent power supplies? Yes ____ No __X__

   Does this system have a hand-operated emergency fuel pump? Yes ____ No __X__

N/A If yes, is this hand-operated pump and piping in immediate operating condition? Yes ____ No ____

2. Is there a water and sediment drain from the very bottom of the:

   a. Bulk tank? Yes __X__ No ____
   b. Day tank? Yes __X__ No ____

3. Is the regular functional fuel oil outlet slightly above (two to three inches) the bottom of the:

   a. Bulk tank? Yes __X__ No ____
   b. Day or integral tank? Yes __X__ No ____

4. Is bottom of day tank and/or integral tank above all parts and piping of the engine fuel injection systems? Yes ____ No __X__

   If yes,

   Give approximate amount inches __N/A__ feet ____

5. Does the engine fuel system have a fuel bleed return line to the fuel day tank and/or integral tank? Yes __X__ No ____

   During extended operation, such as more than two to three hours, does the fuel in the day tank become: (yes or no)

   a. Warm? ____
   b. Hot? ____ (above 130°F)
   c. Room temperature __X__

What is fuel oil return line size (nominal)?

a. Pipe size 1-1/4 inches
b. Tubing size ____ inches

6. Do engine fuel oil filters have air bleed or vent valves readily accessible? Yes ____ No X

7. How is fuel transferred from day tank to engine fuel system?

a. By gravity ____
b. Engine driven pump X
c. Electric motor driven pump X
d. Is a manual pump also provided for injection system filling and/or air venting after servicing or replacement of parts in the fuel injection system? Yes ____ No X

N/A If yes, is the manual pump in immediate operating condition? Yes ____ No ____

8. Type of fuel (e.g., #1, #2, #3, JP-4, etc.) #2.

9. Approximate bulk tank capacity, 71,000/tank (2 tanks) outside 39,000 gallons.
Day tank = 550 gal/diesel gal/diesel (7 day tanks)

10. Typical frequency of refilling (weekly, monthly, etc.) UN.

11. Typical refill (gallons), UN.

D. Lube Oil System

1. Lube oil

a. Type Shell - Tornus 40
Atlantic Richfield - Cascon GL Supreme
b. Viscosity SAE 10-50
c. Specification number See attachment
d. Oil change determined by:

Time interval: Yes X No ____
Give interval yearly monthly, yearly
By oil analysis: Yes X No ____

2. Lube oil filters are:

   a. Full flow X
   b. Bypass ______
   c. Combination ______

3. Interval and/or basis for changing filter cartridge:

   a. Monthly X
   b. Yearly ______
   c. By running time ______ hours
   d. By oil analysis. Yes X No ____
   e. By pressure drop. Yes ____ No X
   f. Does provisions exist for changing cartridges during engine operation? Yes ___ No ___ (Supplemental Report)

4. Oil Pressure Monitoring

   a. Normal operating pressure 100-117 psi
   b. Alarm 20 psi and 44 psi
   c. Shutdown NA psi

5. Oil temperature control:

   a. By standby heater in engine sump 145 °F.
   b. Heating means for maintaining standby temperature:

      Direct in oil ______
      Oil-to-water heat exchanger X
      Other (Specify) ______

E. <u>Cooling System - Engine Water</u>

1. Temperature control by:

   a. By thermostat in water? Yes X No ____

      If yes, then:

      Bypass thermostat? Yes X No ____
      Throttle thermostat? Yes ____ No ____

N/A b. By radiator shutter:

Automatic ____
Manual ____
Other (give type) ____

2. Corrosion control (water additive)? Yes X No ____

If yes, give chemical additive or name of compound.

Inhibitor Corrosion Resist.

Proportion or concentration control:

a. By additive measurement? Yes X No ____
b. By water coolant analysis? Yes X No ____

3. Engine cooling water cooled by:

a. Radiator? ____
b. Heat exchanger from sea, river or other water? X
c. Other? (give type) ____

4. Engine cooling water temperature-monitoring

a. Standby temperature ≈ 75 °F
b. Normal operating temperature 165 °F
c. Alarm temperature 190 °F
d. Shutdown temperature None °F
e. Water circulation during standby:

Thermo-syphon ____
Pump X

5. Water Pressure Monitoring: Yes ____ No X

a. Alarm ____
b. Shutdown ____
c. Both ____

6. Water temperature Sensor Position:

   a. In piping from engine X
   b. In engine piping ____
   c. In engine direct ____

7. Water surge or supply tank in system. Yes X No ____

   If yes, then bottom connected to:

   a. Water pump suction? Yes X No ____
   b. Top of system? Yes ____ No X
   c. Both of above? Yes ____ No X
   d. Is bottom of surge tank above top of engine system? Yes ____ No X
   e. Does engine have constant air bleed from top of engine water piping to surge or supply tank? Yes X No ____
   f. Give size of bleed or vent line, 4 inches.
   g. Manual air bleed only? Yes ____ No X

F. Governor - Speed Control

Manufacturer Woodward
Electric (speed sensing) EGA elec. governor control box
Hydraulic EGB-10 actuator
Type or code (such as EGB-35, LSG-10, etc.) EGB-10
Automatic load sharing? Yes X No ____

1. Is compensation or stability control and/or speed of response manually adjustable? Yes X No ____

   If yes, adjusted by:

   a. Eye and ear?
   b. Test and specification? X
   c. Other? (Specify) ____

2. Engine - generator normal shutdown or stopping means and method.

Is the engine stopped:

a. Manually? Yes X No ___

If yes, then:

Directly at engine? Yes X No ___
Through local control panel? Yes X No ___

b. Automatically through the controls in the control room? Yes X No ___

c. By setting governor to "fuel-off" position? Yes ___ No X

d. By over-ride of governor settings and control position directly to fuel injection pumps? Yes X No ___

e. Other means. Describe briefly. ___

3. When engine is stopped, is fuel control in:

a. Full fuel or maximum fuel position? ___
b. Full off or no fuel position? Yes
c. Intermediate? ___
d. Random? ___

(If not consistent and typical in above, then give the usual.)

4. When starting from the standby condition after shutdown for at least 24 hours, give number of seconds from start-to-crank to full fuel or maximum fuel position of governor and fuel control, N/A seconds.

Engine governor is positioned at full fuel flow

G. Governor - Overspeed (shutdown)

1. Speed sensing?

a. Electrical __X__
b. Flyball _X__ - Overspeed
c. Other (Specify) ____________

2. Fuel shutoff force generated by: (Supplemental Report)

a. Spring? ____
b. Air? ____
c. Hydraulic? ____
d. Electrical? ____
e. Other? (Specify) ____________

3. Overspeed sensing setting? (in terms of full speed)

a. 115% _X__
b. 110% ____
c. Other (Specify) ____________

4. Is overspeed tripping set point tested periodically?
Yes __X__ No ____

If yes, then how often? __Yearly__ (yearly, monthly, etc.)

H. 1. Generator Mfr. (GM) Electromotive Div. Model No. __A20__
Single bearing or two bearings? __X__
Does generator have damper windings? Yes _X_ No ____

2. Does generator have any obvious fault or difficulty?
Yes ____ No _X__

Is problem repetitive? Yes ____ No _X__

If yes, then describe briefly. ________________

I. Exciter and Voltage Regulator

1. Exciter Manufacturer: Basler Model N/A

Type: Rotating ______ Static X

If rotating drive? Direct ____
Belt or Chain ______
DC with field control ______
Brushless with rectifier ______

2. Voltage Regulator: Manufacturer Basler Model 90-49000100

Type: Mechanical ______ Static X

3. Are paralleled units of automatic load sharing control of fully automatic type? Yes X No ____

If yes, has any obvious influence or interrelationship been noted between the stability and response time of the engine governor and the stability and voltage control of the generators? Yes X No ____

4. Have engine governor and voltage regulator/exciter adjustments been made on the site or under any conditions since any of the units have been placed in service? Yes X No ____

If yes; by means of what tests and what standards? Give name or very brief description. Vendor instructions and tests or guidance from vendor representatives

5. If any difficulties have occurred, give approximate number of problems.

a. Components ____
b. Wiring ____
c. Other (damage in service or dropping of miscellaneous hardware into switchboard, etc.) X
(Design wiring problem affecting voltage regulation)

J. Paralleling: Engine-Generator Units

1. Do all units consistently have the proper voltage output? Yes _X_ No ___

2. Do all units automatically share both the "real" or in-phase load and also the reactive load reasonably well? Yes _X_ No ___

3. At the same Kw load, are both the field and the armature line currents of the several units consistently close to the same value? Yes _X_ No ___

   If no, approximate percent difference. ________

4. Synchronizing

N/A a. In automatic synchronizing do circuit breakers close immediately after reaching full synchronous speed? Yes ____ No ____

b. If "no" above then, does speed of some units drift slowly while failing to synchronize and close circuit breakers?

   How many seconds? ________

   Occasionally ____
   Always ____
   Never ____

K. Switch Gear and Electrical Controls (other than exciter/ voltage regulator)

1. If any difficulties have occurred, then give approximate number of problems.

   a. Components _3_
   b. Wiring _1_
   c. Other (damage in service or dropping of miscellaneous hardware into switchboard, etc.) ____
   d. Design concept faults. That is, does the switch gear and its controls perform the proper functions and in proper sequence and timing. ____

DIFFICULTIES:

1 - false failure
1 - speed sensing relay failure
1 - broken stud on circuit breaker
1 - loose wire

2. a. Do the on-site diesel generator units and related support equipment have any storage battery power systems for any service whatsoever? Yes _X_ No ___

   b. Identify each storage battery power system associated with the on-site diesel generator unit and its function. Units 1 and 2 - C and D
   Unit 3 - Exide; each diesel has 125V DC battery

   c. Does each system identified above adequately fulfill the service requirements for which it is intended? Yes _X_ No ___

   If no, briefly describe. ___

   d. Is there a DG battery maintenance program? Yes _X_ No ___

L. Safety Shut downs

Give safety shut down settings compared to equilibrium operating conditions.

1. Engine and generator speed. Give rpm or hertz:

   a. Synchronous and usual 900 rpm or 60 Hz
   b. Overspeed shutdown setting 1035 rpm or --- Hz

2. Engine cooling water (see E.4)

   a. Equilibrium 165 °F
   b. Alarm 190 °F
   c. Shut down --- °F - None

3. Lube oil pressure (see D.4)

   a. Equilibrium 100 psi
   b. Alarm 20 psi and 44 psi
   c. Shut down --- psi NONE

4. Lube oil temperature

a. Equilibrium 130 °F
b. Alarm 115 °F
c. Shutdown ---- °F None

5. Indicate all other protective interlocks (give name and;) 1) Field failure 2) Loss of field excitation 3) Reverse power 4) Voltage/Current restraint relay 5) Differential relay

a. Usual or proper condition ____________

b. Shutdown condition N/A

6. a. What source of power is provided to operate alarms and shutdown controls? (See G.2) 125V DC Battery system

b. Do the generator units automatically shutdown in case of the electrical power loss to its control system? Yes ____ No x

M. Emergency or Alert Conditions

1. Are all safety shutdown and safety interlocks bypassed during emergency conditions? Yes ____ No x

2. If "no" above, then which are not bypassed. Name items.

Differential generator trip, failure of field to flash, overspeed trip

3. For each interlock not bypassed is coincident logic used? Yes ____ No X

N/A If yes, is it testable? Yes____ No ____

N. Maintenance

1. Does plant have regularly scheduled maintenance procedures? Yes

If so, return copy of these procedures with questionnaire.

MMI 30	SI 4.9.A.1.a
EMI 3	SI 4.9.A.1.b
	SI 4.9.A.1.d

2. When need for minor adjustments obviously exists, then:

   a. Is remedial action taken immediately or at earliest practical opportunity? Yes X No ____

   b. Is remedial action taken only at periodic prescheduled or programmed times and conditions? Yes ____ No X

   c. For best performance record which of above appears better:

      immediate or early action? X
      as scheduled only? ____

   d. Must permission for minor maintenace be obtained from some higher out-of-plant authority? Yes ____ No X

   e. Is maintenance referred to above allowed and encouraged? Yes X No ____

   f. In periodic surveillance tests, simulated alert standby tests, etc., is the criteria "pass/not pass" the test used? Yes X No ____

   g. Is there a conscious continuing policy to detect and remedy marginal conditions or imminent trouble: for examples: lube oil pressure shutdown only two to five psi below operating pressure or, perhaps overspeed governor setting only one or two percent above starting speed surge or etc.? Yes X No ____

   h. Are efforts to remedy marginal or questionable conditions as mentioned above encouraged by plant management? ____

      Yes X No ____

   i. Are remedial steps on items similar to the above taken or allowed when the unit has started and operated satisfactorily within specified limits or conditions? Yes ____ No X

O. Starting Conditions

1. Give starting or necessary cranking time as experienced.

   a. Starting time per specification 10 seconds
   b. Usual starting time 6 seconds
   c. Maximum starting time observed 8 seconds

2. Give usual time intervals as follows:

   a. Time from start-to-crank to first firing of any cylinder. __2__ seconds approximately

   b. Time from start-to-crank to approximate full firing of all cylinders. __≤5 to 7__ seconds

3. Give maximum speed surge when starting; use both tachometer and frequency meter if possible.

   a. Usual conditions ______ rpm ______ Hz   Supplementary check to be made if possible

   b. Maximum observed ______ rpm ______ Hz

4. During a surveillance test, give time from start-to-crank to when steady synchronous speed is attained and maintained.

   a. Usual __5 to 7__ seconds
   b. Maximum __8__ seconds
   c. As specified __10__ seconds.

5. Give briefly the most troublesome problems in starting.

   a. Most troublesome __Air relay valves stick__.

   b. Next to most troublesome __Corrosion coming out of air__ tanks.

P. <u>Air Cleaner or Air Filter - Combustion Air</u>

1. Combustion air source: taken from engine room or inside the building, or from outdoors?

   a. Indoors ______
   b. Outdoors __X__

2. Give type and make of air cleaners or air filters:

a. Oil bath X Make Cycoil type P-Model D
b. Oil wetted screen ____ Make ____
c. Paper ____ Make ____
d. Other ____ Make ____
e. Precleaner: Yes ____ No ____

3. Excessive air flow restriction and servicing need determined by?

a. Instrument such as:

manometer ____
If other give type ____
b. Personal judgement by appearance, etc. ____
c. By smoking exhaust X
d. Time schedule ____
e. Other (Specify) ____

4. Are climatic extremes normally experienced such as:

a. Air heavily loaded with water mist, high humidity and low temperature? Yes ____ No X
b. Blowing sand and dust? Yes ____ No X
c. Blowing snow (blizzards)? Yes ____ No X
d. Other-Name ____

5. Are climatic extremes potentially possible such as:

a. Air heavily loaded with water mist, high humidity and low temperature? Yes X No ____
b. Blowing sand and dust? Yes ____ No X
c. Blowing snow (blizzards)? Yes ____ No X
d. Other-Name ____

Q. Temperature Conditions

1. Ambient outside hottest 98 °F.

2. Ambient outside coldest 0 °F.

3. Engine-generator room hottest 85 °F.

4. Engine-generator room coldest 50 °F.

5. Inside switch gear hottest 90° F

6. Supplemental Report Item

7. Supplemental Report Item

R. Operator Qualifications (as presently exists, and suggested minimums if different)

1. Minimum education required (check)

	Existing	Suggested
a. High School	X	
b. Trade School		
c. Technical School		
d. No minimum		

2. Minimum Years of operating experience (diesel electric generator)

	Existing	Suggested
a. 0-3	X	
b. 3-6		
c. 6-10		
d. 10-15		

3. Operator training

	Existing	Suggested
a. Military		
b. Industrial		
c. On-the-job	X	
d. Combination of a, b, and c (indicate which)		

4. Licensing required

	Existing	Suggested
a. State		
b. Federal		
c. Utility or self		
d. None	X	

S. Are any foreign gases such as propane, freon, halon, carbon dioxide, etc. stored in the: Diesel Engine room?
Yes ____ No X ____ or adjacent buildings? Yes X No ____

If yes, (other than hand portable fire extinguishers), then identify gases and give approximate tank size.

Gases	Volume (ft³) Tons
Liquid CO_2 - U1 and 2	17 tons
Liquid CO_2 - U3	6 tons

T. Does control system automatically bypass, in emergency starting, any engine temporarily out of service for maintenance? Yes ____ No X

If yes, then how many failures to bypass have occured?

____

U. Does the control system automatically override the test mode under emergency conditions? Yes X No ____

V. Have repetitive mechanical failures occurred in any component part or subsystem of the engine, generator, or switch gear, etc.?
Yes X No ____

If yes, then which part or subsystem? Air start motor system

How many failures? UN

Give nature of failure. Foreign material in air-start system gets in valves and air start motor vanes.

W. Would periodic (yearly or other) evaluation and/or testing by "outside experts" contribute significantly to the diesel-generator reliability? Yes ____ No X

Give brief reasons for the answer. We have developed a good maintenance program with trained personnel. Vendors are contacted upon need basis.

X. 1. Give the accumulated time-load operating record for each diesel-generator unit from installation to the present (Running Hours):

Preoperational test Date ____________ Supplemental report if data exists.

Engine Serial No.	Surv. Testing & Maintenance Hrs. No Load	Surv. Testing & Maintenance Hrs. Loaded	Emergency and Other Service Hrs.	Total Hours

2. Surveillance test load (percent of continuous rating) 75%

3. Give the projected or planned time-load operation for each diesel-generator unit during the next 12 months. - Approximate

Surveillance & Maintenance Hrs.	Emergency and other Service Hrs.	Total Hours	
13	5	18	

4. Provide the following summary of the periodic surveillance testing experience:

a. Starting date of surveillance testing (OL date) U1 and 2 - 1/28/73; U3 - 11/21/75

b. Periodic test interval Monthly

c. Total number of surveillance tests performed U1 and 2 - 262; U3 - 113

d. Total number of test failures 7 (See Abnormal Occurrence Reports)

failure to start 5 failure to accept load 0

failure to carry load 0 failures due to operator error 0

failure due to equipment not being operative during emergency conditions 0

e. Supply a copy of the surveillance test procedures with this completed questionnaire. - (attached)

Additional Comments

Y. General Suggestions

Briefly give constructive criticism or suggestions as to improvement in reliability of the diesel generators. These remarks may cover tests, maintenance, practices, orders, policy, adjustments, etc.

ELECTRO-MOTIVE DIVISION • GENERAL MOTORS CORPORATION

EMD SERVICE DEPARTMENT

MAINTENANCE INSTRUCTION

LUBRICATING OIL SPECIFICATIONS DIESEL ENGINE AND GOVERNOR-EMD AND CDED

The necessity for correctly lubricating the moving parts of any piece of apparatus is so apparent that further comment should be unnecessary. This instruction is therefore confined to listing specifications for particular lubricants which we have learned from experience are best suited to the application.

DIESEL ENGINE

OIL QUALITY

It should be recognized that the only real measure of quality in a lubricating oil is its actual performance in the diesel engine. This is so because of the impossibility of establishing limits on all physical or chemical properties of oils which can affect their performance in the engine.

The responsibility for recommending and consistently furnishing a suitable heavy-duty oil must rest with the individual oil supplier.

OIL TYPE

An SAE #40 heavy-duty additive type lubricating oil, which conforms to the following specifications, should be used in all engine applications.

Physical Properties	ASTM Designation	Limits
Saybolt Universal	D88 or D446	
1. Seconds at 100° F.		1350 Maximum
2. Seconds at 210° F.		70 Minimum 85 Maximum
Viscosity Index	D567	35 Minimum 75 Maximum
Flash Point, ° F.	D92	420° Minimum
Fire Point, ° F.	D92	475° Minimum
Pour Point, ° F.	D97	40° Maximum
Zinc		10 ppm Maximum

The oil should be a heavy-duty additive type having a high resistance to oxidation, a low tendency toward the formation of carbon deposits, and shall be noncorrosive to silver metal at 285° F. The silver corrosion evaluation should be made according to EMD laboratory test method #L.O. 201 (latest revision).

*This bulletin is revised and supersedes previous issues of this number.

We strongly recommend that zinc dithiophosphate or similar additives not be present in the engine lubricating oil. Oils containing more than 10 ppm zinc are considered excessively contaminated with zinc dithiophosphate additive and should not be used since they may not satisfactorily lubricate the reciprocating bearings used in these engines.

MIXING OF OILS

Our recommendation against mixing different kinds or brands of heavy-duty oils is substantially supported by numerous recorded cases where various mixtures of incompatible oils were detrimental to engine operation. Unfortunately, expensive failures or abnormally high wear rates caused by incompatible oil mixtures cannot be predicted by laboratory procedures.

The mixture of oils usually results in a lubricant that is less stable than any of its constituents. Sludge and lacquer formation caused by this instability results in excessive wear and in shorter oil and filter life.

Ordinary laboratory techniques cannot be used to analyze samples of lube oil mixtures because it is impossible to establish a starting base line condition against which to measure the level of oil deterioration. As a result, problems caused by unsatisfactory lubrication are difficult to diagnose when using an oil mixture.

OIL CHANGES

Engines intended for export, marine, industrial, or other special installations are often treated with rust preventive material which need not be removed. Oil meeting the specifications given should be used when placing the units in service. This oil should be changed and the lubricating system maintained as specified in the applicable Scheduled Maintenance Program. Laboratory analysis may dictate oil changes at shorter intervals than those specified in the Scheduled Maintenance Program.

The oil change intervals prescribed in the applicable Scheduled Maintenance Program are based on average operating conditions. When oil change intervals are extended, serious and costly engine problems usually result. This occurs when the heavy-duty lubricating oil loses its detergent-dispersant properties, allowing partially oxidized oil and other contaminants to form deposits in the engine.

Replacing old oil with a fresh charge of heavy-duty oil in a contaminated engine will result in the new oil picking up some of these deposits and rapidly losing its detergency and dispersancy. With the oil losing these properties quickly, and with continued operation, the deposits will become progressively worse and will ultimately lead to serious engine problems.

Laboratory analysis should not be used as the only guide to the condition of a lubricating oil. Of equal importance is the condition of the engine, which could be poor even though the oil appears satisfactory. Both engine and oil condition should be considered when attempting to arrive at oil change intervals beyond those recommended.

FILTER CHANGES

Oil filter element replacements should be made as specified in the applicable Scheduled Maintenance Program, unless a laboratory lube oil analysis dictates earlier replacement.

Where highly dispersant oils are employed, carbonaceous matter may be suspended so finely in the oil that it is essentially unfilterable. In such situations, it might appear that an extension of the filter element replacement interval would be practical. Caution should be exercised when contemplating such action. Filter materials have not yet been developed to tolerate prolonged exposure to lube oil without deterioration and possible disintegration of the filter elements.

OIL DILUTION

Engines found to have lubricating oil diluted with fuel oil should be serviced in the following manner:

1. From 0 to 3% dilution

   Within this range there is generally no need for concern or corrective action.

2. From 3% to 5% dilution

   Engine operation may continue until the next scheduled shutdown, provided total dilution does not exceed 5%. However, repairs should be made as soon as practical.

3. Above 5% dilution

   When dilution exceeds 5%, the engine should be removed from service until the fuel leak is repaired and the oil is changed.

GOVERNOR

An SAE 20W-40 oil which will meet American Petroleum Institute (A.P.I.) Engine Performance Evaluation DG or MS is recommended for all governor applications. The oil selected should conform to the following specifications:

Properties	Minimum	Maximum	Typical
Viscosity, ASTM D88* or D2161*			
at 0° F	-	25,000	20,000
at 210° F	71.0	75.0	73.0
Viscosity Index, ASTM D567*	125	-	132

*Latest Revision

Litho in U.S.A.

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

MECHANICAL MAINTENANCE INSTRUCTION 30

DIESEL AIR STARTING SYSTEM PIPING, VALVES, ACCUMULATORS; COMPRESSORS AND AIR MOTORS (INSPECTION, MAINTENANCE, AND REPAIR)

UNITS 1 AND 2 OR 3

(Do not implement this procedure until revised to include an isolation-tag out-equipment alignment section, and it has been approved by the plant superintendent.)

Approved: H J Green
Plant Superintendent

Date: May 27, 1976
General Revision

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

MECHANICAL MAINTENANCE INSTRUCTION 30

DIESEL AIR STARTING SYSTEM PIPING, VALVES, ACCUMULATORS, COMPRESSORS AND AIR MOTORS (INSPECTION, MAINTENANCE AND REPAIR)

Purpose

The purpose of this maintenance instruction is to provide guidance, necessary information and data to be utilized in the mechanical maintenance program for the diesel generating unit starting air system. Every effort should be made to schedule and perform this work during the annual SI 4.9.A.1.d performance.

References

1. Electro-Motive Division, General Motors Corp., 645E4 Engine Manual
2. Electro-Motive Division, General Motors Corp., Operating Manual 999 System Generating Plant.
3. Electro-Motive Division, General Motors Corp., Special Tool Manual.
4. Surveillance Instruction 4.9.A.1.d.
5. Technical Specification 3.9.B-2.

Tools Required

Regular machinist hand tools.

One socket set 1/4" to 1-1/8" (3/8" square drive).

One set allen wrenches

Limitations

One diesel generator unit may remain inoperable for a period not to exceed

Limitations (Continued)

seven consecutive days provided the other three diesel generators, both 161-kV lines, both common station transformers, and all of the CS, RHR (LPCI and Containment Cooling) systems are operable (Ref. Tech Spec 3.9.B-2). If this requirement cannot be met, an orderly shutdown shall be initiated and both reactors shall be shutdown and in the cold condition within 24 hours.

Prerequisites

1. Obtain "Hold order" from shift engineer and permission to perform the work.
2. Before any work on air system components, i.e., air line strainers, air line lubricators, air relay valve, solenoid valve or accumulators have necessary hold tags and the system depressurized.

Work to be Performed

(See attached pages from EMD Engine Manual for general information)

A. Start Motor Maintenance

Each starting air motor will be replaced with a rebuilt air motor or disassembled, cleaned and reassembled. Complete data sheets MMI 30-1, Section A upon the completion of the inspection. See EMD Engine Manual, Section 13, page 22, for disassembly and reassembly.

B. Air Line Strainer

The air line strainer screen is to be checked and cleaned during the inspection of the unit. After inspection, complete data sheet MMI 30-1, Section B.

Work To Be Performed (Continued)

C. Air Line Lubricator

Check the oil level and add oil as required. Also check unit for leaks, damaged or worn gaskets or packing. Complete data sheet MMI 30-1, Section C after inspection. See EMD Engine Manual, Section 13, page 25.

D. Air Relay Valve

The valve should be inspected during the diesel air start motor operability test MMI 30-2 for air leaks, and tightness of all connections. Anytime the valve is not shutting off the main air supply properly, the valve should be disassembled and the seat removed and cleaned. After inspection record results on the data sheet MMI 30-1, Section D. See EMD Engine Manual, Section 13, page 28, for detailed instruction of disassembly.

E. Solenoid Valve

WARNING: Before performing any maintenance on the solenoid valve, make sure the electrical power and air pressure have been turned off.

Inspect and clean the solenoid valve, record results on the data sheet MMI 30-1, Section E. For detail instructions on the disassembly and assembly of the valve see EMD Engine Manual, section 13, page 27.

F. Accumulators

Visually inspect externally and drain the accumulators (5 per air starting system). Also, visually inspect the relief valves on the accumulators for external damage. Record the results of the inspections on the data sheet MMI 30-1, Section F.

G. Air Compressors

Inspect the compressors for damage to compressor components, leaks, condition of air intake filter. Compressor disassembly is not required. After inspection record results on data sheet MMI 30-1, section G. See

Work To Be Performed (Continued)

G. Air Compressors (Continued)

operating manual page 208 for air compressor information.

H. Piping and Valves

Inspect components for damage, leaks and in the case of valves the packing should be inspected for total take up of the follower and repacked as required. Record the results of the inspection on data sheet MMI 30-1, Section H.

Post Maintenance Checkout

1. Check oil levels, and fill as required.
2. Check to ascertain that all piping has been reconnected.
3. Release "Hold" tags with the shift engineer. Perform a diesel air start motor operability test specified on page MMI 30-2.
4. Any component of the diesel generating unit air starting system that has had maintenance performed on the system must be checked out for operational readiness.
5. Complete the data sheets (MMI 30-1 and 30-2).
6. If the air start system performs satisfactory notify the shift engineer that maintenance is completed.

TENNESSEE VALLEY AUTHORITY
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DATA SHEET MMI 30-1

DIESEL AIR STARTING SYSTEM PIPING, VALVE, ACCUMULATORS, COMPRESSORS AND AIR MOTORS
INSPECTION AND MAINTENANCE REPORT

NOTE: The left bank and the number one bank are the same.
The right bank and the number two bank are the same.

Section A - Air Starting Motors

Diesel Unit ______________ Bank ______________ Top Motor ____________

Bottom Motor ____________

Motor Inspection Satisfactory: Yes ________ No ________.

Motor Disassembled: Yes ________ No ________.

General Description of Maintenance Performed and Condition of Motor

____

____

____

____

Section B - Air Line Strainer

Diesel Unit ______________ Bank ______________

Strainer Cleaned ____________ Replaced ____________

COMMENTS: ____

____

____

Data Sheet MMI 30-1 (Continued)

Section C - Air Line Lubricator

Diesel Unit ____________ Bank ____________

Air Line Lubricator Inspection Satisfactory: Yes ____________ No ____________

Oil Level Satisfactory: Yes ____________ No ____________, Added Oil: Yes _____ No _____

COMMENTS: ____

____

____

Section D - Air Relay Valve

Diesel ____________ Bank ____________

Valve Inspection Satisfactory: Yes ____________ No ____________

Valve Disassembled: Yes ____________ No ____________

General Description of Maintenance Performed and Condition of Valve: ____________

____

____

____

____

Section E - Solenoid Valve

Diesel ____________ Bank ____________

Valve Inspection Satisfactory: Yes ____________ No ____________

Valve Cleaned Satisfactory: Yes ____________ No ____________

Valve Disassembled: Yes ____________ No ____________

Data Sheet MMI 30-1 (Continued)

Section E - Solenoid Valve (Continued)

General Description of Maintenance Performed and Condition of Valve: ____________

____

____

____

____

Section F - Accumulators

Diesel ____________ Bank ____________

Accumulators Drained Satisfactory: Yes ________ No ________

Accumulators Inspection Satisfactory: Yes ________ No ________

COMMENTS: ____

____

____

____

Section G - Air Compressor No. 1

Diesel ____________

Air Compressor Inspection Satisfactory: Yes ________ No ________

Air Intake Filter Changed: Yes ________ No ________

General Description of Maintenance Performed and Condition of Compressor: ______

____

____

____

Data Sheet MMI 30-1 (Continued)

Section G - Air Compressor - No. 2

Diesel ____________

Air Compressor Inspection Satisfactory: Yes ________ No ________

Air Intake Filter Changed: Yes ________ No ________

General Description of Maintenance Performed and Condition of Compressor: ____

____

____

____

Section H - Piping and Valves

Diesel ____________

Pipe and Valves Inspection Satisfactory: Yes ________ No ________

General Description of Maintenance Performed and Condition of Pipe and Valves:

____

____

____

____

COMMENTS: ______________________________________

____

____

____

____

Data Sheet MMI 30-1 (Continued)

Trouble Report No. ____________

Approval Signatures

(Person Performing Checks)	Date
(Person Performing Checks)	Date
(Person Performing Checks)	Date
(Foreman)	Date
(Maintenance Supervisor)	Date

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

POST MAINTENANCE DATA SHEET
MMI 30-2

DIESEL AIR START MOTOR OPERABILITY TEST

D/G ________

Date: ______________________ Verified By Initials / Date

To test the left bank or number one bank starters, the following steps should be followed:

1. Turn start selector switch to position 1 ________
2. Turn start circuit breaker #2 OFF. ________
3. Give D/G A an auto start. ________
4. Verify that D/G A starts without a start failure alarm. ________
5. Stop diesel. ________

To test the right bank or number two bank starters, the following steps should be followed.

1. Turn start selector switch to position 2. ________
2. Turn start circuit breaker #1 OFF. ________
3. Give D/G A an auto start. ________
4. Verify that D/G A starts without a Start Failure alarm. ________
5. Stop diesel. ________

Use same test for all diesels.

Approval Signatures

______________________ ______________________
Maintenance Inspector Date

______________________ ______________________
Maintenance Supervisor Date

ensure freedom of movement for the engaging pinion.

After the Bendix drive (25) has been installed on the drive shaft (26), install the housing (20) with bolts and lockwashers (16). Be careful not to damage bushing (22) when installing housing.

DUAL AIR STARTING MOTOR SYSTEM

DESCRIPTION

The complete air starting system consists of two air starting motors, Fig. 13-15, air tanks, strainer, solenoid valve, air relay valve, check valve, shut-off valve, and a starting control valve.

When the starting control valve button is depressed, the solenoid valve is energized, allowing air from the tanks to pass through the solenoid valve to the pinion gear end of the lower starting motor. The entry of air moves the pinion gear forward to engage with the engine ring gear. Movement of the pinion gear uncovers a port allowing air pressure to be released to the upper starting motor which, in turn, engages its pinion gear with the ring gear. Both pinion gears being engaged, the air is released from the uncovered port in the upper motor. In addition to maintaining gear engagement, the air opens the air relay valve, releasing the main starting air supply. Starting air passes through the air relay valve and into the flexible hose assembly attached to each air starting motor. The multivane motors drive the pinion gears, rotating the ring gear, and cranking the engine.

Unless both pinion gears are engaged, the system is designed so that no attempt can be made to start the engine with one motor. There is also a shut-off valve in the system which is manually operated. When maintenance is being performed, the shut-off valve is closed to prevent inadvertent cranking of the engine.

STARTING MOTOR

DESCRIPTION

The engine air starting motor, Fig. 13-16, is a multivane type motor consisting of a rotor, which is supported at each end by ball bearings, a planetary gear train, and a Bendix drive. Air striking vanes which slide in the rotor, causes the rotor pinion to rotate and turn the Bendix drive through a set of planetary gears. The clutch drive pinion gear meshes with the engine ring gear and cranks the engine.

MAINTENANCE

The air starting motor requires very little maintenance other than lubrication. Any noticeable loss of power can usually be attributed to worn or damaged vanes. Rapid wear of the vanes is usually caused

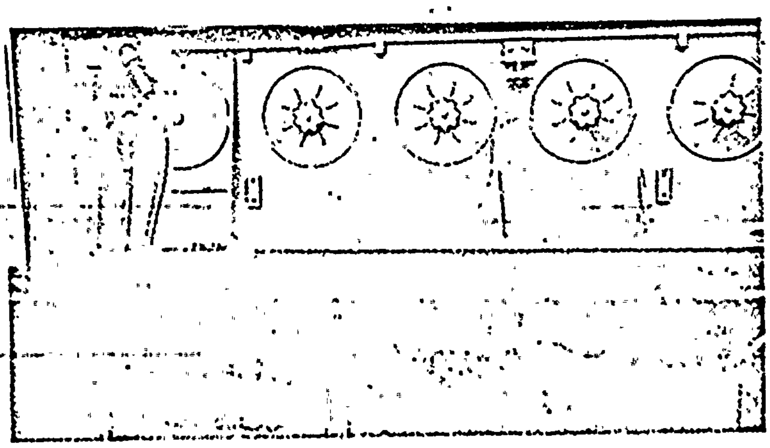
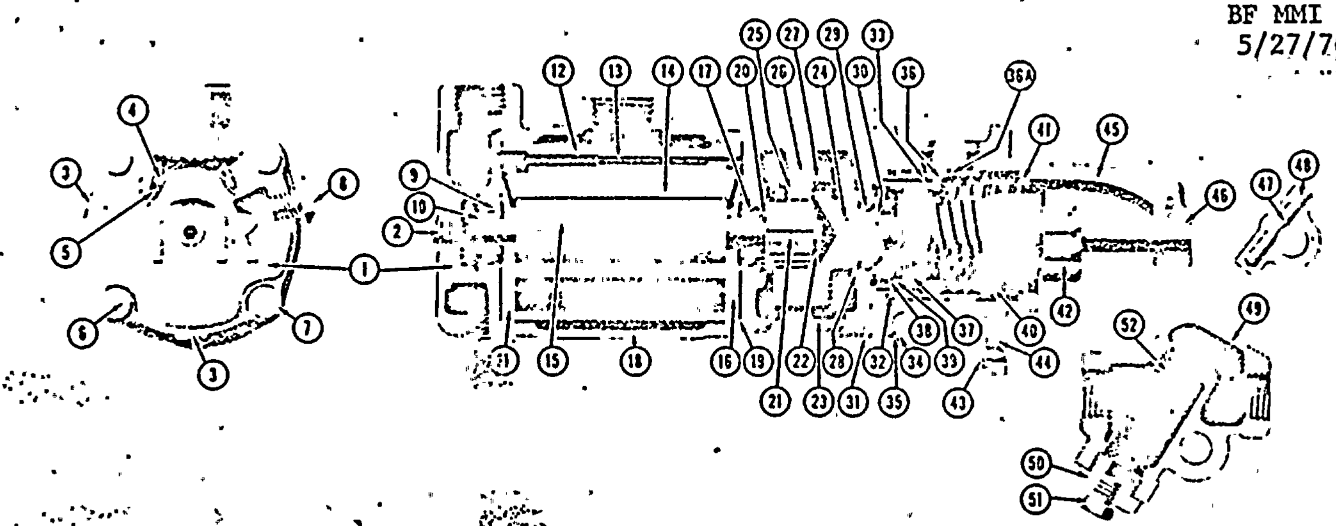


Fig. 13-15 — Dual Air Starting System



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1. Motor Housing Cover Assembly
2. Housing Cover End Plug
3. Oil Drain Plug (2)
4. Oil Adjusting Screw (2)
5. Oiler Felt (2)
6. Motor Housing Cover Cap Screw (4)
7. Cover Cap Screw Lockwasher (4)
8. Oil Filler Plug
9. Rear Rotor Bearing
10. Rear Rotor Bearing Retainer
11. Rear End Plate
12. Cylinder
13. Cylinder Dowel
14. Vane (5)
15. Rotor
16. Front End Plate
17. Front Rotor Bearing
18. Motor Housing
19. Gear Case Gasket
20. Rotor Pinion Spacer
21. Rotor Pinion
22. Rotor Pinion Retainer
23. Gear Case
24. Planet Gear Frame
25. Planet Gear Assembly (3)
26. Planet Gear Bearing (3)
27. Planet Gear Shaft
28. Planet Gear Frame Thrust Ring
29. Planet Gear Frame Bearing
30. Planet Gear Frame Retaining Ring
31. Gear Case Cover Assembly
32. Gear Case Cover Seal
33. Piston Seal
34. Drive Housing Cap Screw (12)
35. Drive Housing Cap Screw Lockwasher
36. Piston Assembly
36A. Piston Ring
37. Shift Ring
38. Shift Ring Retainer
39. Shift Ring Spacer
40. Piston Return Spring
41. Return Spring Seat
42. Bendix Starter Drive
43. 3/8" Mounting Bolt Lockwasher (3)
44. 3/8" Mounting Bolt Bushing (3)
45. Drive Housing Assembly
46. Drive Housing Bushing
47. Bushing Oiler
48. Bushing Oiler Plug
49. Air Strainer Assembly
50. Air Strainer Cap
51. Air Strainer Plug
52. Air Strainer Screen

Fig. 13-16 – Air Starting Meter

by inadequate lubrication or the presence of rust, scale, dirt, excessive moisture, or other foreign matter in the air supply. New vanes can be easily and quickly installed by disassembling the motor as described in subsequent paragraphs.

LUBRICATION

Before putting a new air motor into operation, pour about two teaspoonfuls of engine oil into the air inlet so that it will be carried into the multivane motor with the live air. Before storage or lay up, the motor should be fully lubricated with a light oil containing a rust inhibitor.

Remove the oil filler plug, (8) Fig. 13-16, weekly, and fill the oil reservoir in the motor housing cover with SAE 20W motor oil for temperatures above 30° F. or 10W motor oil for lower temperatures. Using the same oil as above, remove the bushing oiler plug, (48) Fig. 3-16, from the drive housing and fill.

MOTOR REMOVAL

1. Disconnect air supply and exhaust lines.

2. Remove three bolts securing the motor and drive assembly to the motor mounting bracket.

3. Remove starting motor and drive assembly.

MOTOR DISASSEMBLY
(Refer to Fig. 13-16)

1. Using a prick punch, mark adjacent spots on the motor housing cover (1), motor housing (18), gear case (23), gear case cover (31), and drive housing (45) so these members will be in the same relative position when the motor is assembled.

2. Unscrew and remove the motor housing cover cap screws (6), and pull the motor housing cover (1) from the motor housing (18).

3. Slide the motor housing off the motor assembly.

4. Pull the multivane motor from the gear case (23).

5. Position the motor assembly vertically, grasping the rotor pinion (21) in copper covered vise jaws. Using a pair of bearing retainer pliers, remove the rear rotor bearing retainer (10) being careful not to distort the retainer any more than necessary.

6. Remove the rear rotor bearing (9), rear end plate (11) and cylinder (12).

7. Position the rotor (15) vertically, pinion end up and grasp the bottom hub in copper covered vise jaws. Remove the rotor pinion retainer (22) with a screwdriver, being careful not to distort the retainer any more than necessary.

8. Remove the pinion (21) from the rotor hub.

9. Support the front end plate (16) as close to the rotor (15) as possible and press the rotor hub from the front rotor bearing (17), freeing the front end plate. Do not let the rotor fall.

10. Unscrew and remove the drive housing cap screws (34).

11. Remove the drive housing (45) from the gear case cover (31).

12. Lift the drive assembly (42) with all of its attached parts from the planet gear frame (24).

13. Using a pair of needle-nose pliers, remove the shift ring retainer (38) from the internal groove in the piston (36).

14. Lift the piston from the assembly, freeing the shift ring spacer (39) and the two halves of the shift ring (37).

15. Grasp the planet gear frame (24) and pull it along with the gear case cover (31) and all attached parts from the gear case (23).

DISASSEMBLY OF GEARS
(Refer to Fig. 13-16)

1. Using snap ring pliers, remove planet gear frame bearing retaining ring from the external groove in the planet gear frame bearing (29).

2. Lift the gear case cover assembly (31) from the planet gear frame bearing (29).

3. Using snap ring pliers, remove planet gear frame retaining ring (30) from the planet gear frame (24).

4. Using bearing pullers, remove planet gear frame bearing (29) from the planet gear frame.

5. Lift planet gear frame thrust ring (28) from the planet gear frame (24).

6. Press out planet gear shaft (27) and remove planet gear assembly (25) from planet gear frame (24).

7. Press the planet gear bearing (26) from the planet gear assembly (25) if new bearings are to be installed.

MOTOR ASSEMBLY
(Refer to Fig. 13-16)

1. Install the front end plate (16), with the side stamped "10BM-11" out, over the splined hub on the rotor (15).

2. Press the front rotor bearing (17) onto the rotor hub as far as possible without binding the end plate against the rotor face.

3. Slip the rotor pinion (21) onto the splined hub and install the rotor pinion retainer (22) on the hub so that

the concave face of the retainer is toward the pinion.

4. Hold the rotor vertically and grasp the rotor pinion with copper-covered vise jaws. Insert a vane (14) into each vane slot in the rotor.

5. Place the cylinder (12) over the rotor and onto the end plate so that the dowel hole and air ports are in the correct relative position as shown in Fig. 13-17.

6. Place the rear end plate (11), with the side stamped "10BM-12" up, over the rotor hub and against the cylinder.

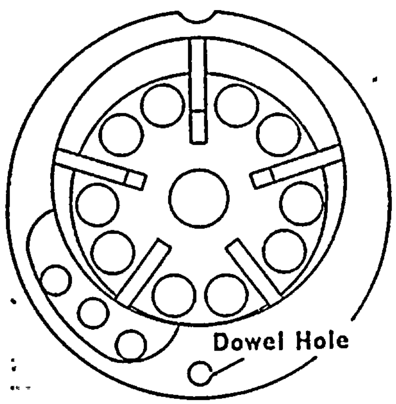


Fig. 13-17 — Dowel Hole And Air Port Alignment

7. Remove the assembly from the vise and push the rear rotor bearing (9), with shielded side first, onto the short hub of the rotor until it contacts the end plate. Install the rear rotor bearing retainer (10) in the groove in the short hub of the rotor.

8. Align the dowel holes in the cylinder (12) and end plates (11 and 16) and insert the cylinder dowel (13) until it is flush with the face of the front end plate (16).

9. Place the motor housing cover gasket (8) on the face of the rear end plate (11) so that the protruding end of the cylinder dowel passes through the small hole in the gasket, and the large hole is aligned with the proper air port in the end plate.

10. Align the air port in the motor housing cover (1) with that in the gasket, and place the cover on the motor assembly, being certain that the protruding end of the dowel enters the cover dowel holes.

11. Install the four motor housing cover cap screws (6) and tighten them finger-tight, then tighten each one a little at a time to a torque value of 20-25 ft-lbs.

ASSEMBLY OF PLANET GEARS (Refer to Fig. 13-16)

1. Press one planet gear bearing (26) into each planet gear assembly (25).
2. Install each planet gear assembly (25) into the planet gear frame (24) and then press a planet gear shaft (27) into each planet gear assembly.
3. Install planet gear frame thrust ring (28) in place on the collar of the planet gear frame. Then slide the planet gear frame bearing (29) over the small end of the planet gear frame and tap it down flush against the planet gear frame thrust ring.
4. Snap the planet gear frame retaining ring (30) into the groove in the planet gear frame to hold the planet gear bearing in place.
5. Install the gear case cover assembly (31) over the planet gear bearing and snap the planet gear frame bearing retaining ring in place in the external groove in the bearing.

ASSEMBLY OF PISTON, BENDIX STARTER DRIVE, AND PLANET GEAR FRAME

1. Align the bolt holes in the gear case cover (23) and the mating holes in the

motor housing (18) and install and tighten the bolts.

2. Install the planet gear assembly previously assembled into the gear case (23).

3. Insert the shift ring (37), shift ring spacer (39) and shift ring retainer (38) into the small end of the piston (36).

4. Insert the piston assembly (36) into the gear case cover assembly (31) making sure the piston seal (33) and piston ring (36A) are in place.

5. Install the Bendix starter drive (42), piston return spring (40) and return spring seat (41) over the gear frame shaft, then place the drive housing assembly (45) over the drive assembly and install and tighten the drive housing cap screws (34).

MOTOR INSTALLATION

1. Install each starting motor and drive assembly in position on the mounting bracket.

2. Install three bolts to secure each motor to the mounting bracket.

3. Connect air supply and exhaust lines.

UNATTACHED ACCESSORIES

The air line lubricator, strainer, air starting valve, solenoid valve, shutoff valve, and air relay valve are components of the engine air starting system. When components are not used in single and dual systems, the engine application is specified. The following descriptions are intended to be typical and not necessarily applicable to all engine installations.

AIR LINE STRAINER

DESCRIPTION

The air line strainer, Fig. 13-18, is a Y-shaped cast iron housing containing a cylindrical monel mesh screen. The strainer is located before the air valve in the system. One end of the screen fits into a recess in the diagonal wall of the strainer body and the other end is held in position by a bolted end cap. This strainer effectively removes impurities from the air being piped to the air starting system.

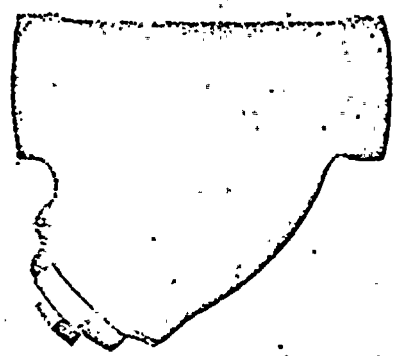


Fig. 13-18 — Air Strainer

MAINTENANCE

The only type of maintenance required on the strainer is to check the condition of the screen periodically and clean if required. The frequency of these inspections will be determined by the conditions under which the equipment has been operating.

AIR LINE LUBRICATOR (16-Cyl.)

DESCRIPTION

The air line lubricator, Fig. 13-19, located between the air starting valve and the starting motor, emits an oil-air mist into the starting system air to provide lubrication for the starting motor. The main

components of the lubricator are the oil bowl, needle valve, siphon tube, and venturi tube.

As air enters the lubricator, the oil bowl is pressurized by way of the reversible venturi tube. The air flow creates a reduced pressure area as it passes through the venturi section causing the oil in the bowl to go up the siphon tube into the chamber above the drip gland. At this point, the quantity of oil entering the air line is controlled by a needle valve. As the oil enters the air line it is diffused into a mist which is carried into the air starting motor. A sight glass below the needle valve gives visual indication of the flow rate of oil into the air line.

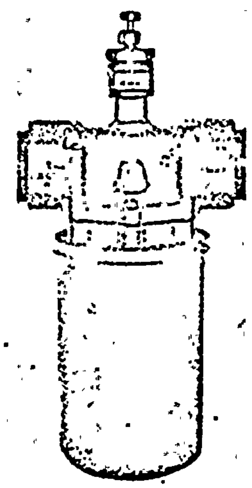


Fig. 13-19 — Air Line Lubricator

MAINTENANCE

The oil level in the bowl should be checked at intervals as specified in the Scheduled Maintenance Program. In addition to checking oil level, the needle valve should be checked to ensure that the flow rate is three drops per minute. This can be checked visually through the sight glass in the front of the lubricator.

If oil does not flow, remove top plug and drip gland. Clean parts and passages, using kerosene and blow out with compressed air. Replace any defective gaskets or packing. Reassemble, tightening drip gland firmly, but carefully.

Compounded oils containing graphites, soap, or fillers should not be used in the lubricator.

AIR STARTING VALVE (16-Cyl.)

DESCRIPTION

The air starting valve, Fig. 13-20, consists of an expansible synthetic rubber tube stretched over a double-ported hollow metal core enclosed in a metal body. A solid bulkhead divides the core into two separate compartments circumscribed by slotted ports which permit the air to flow through the open valve. A large encircling area between the encasing walls of the valve body and the outer surface of the core allows maximum expansion of the expansible tube. This area also serves as the pressure chamber to effect positive tight closure of the valve.

The starting valve is open or closed depending upon the position of the tube

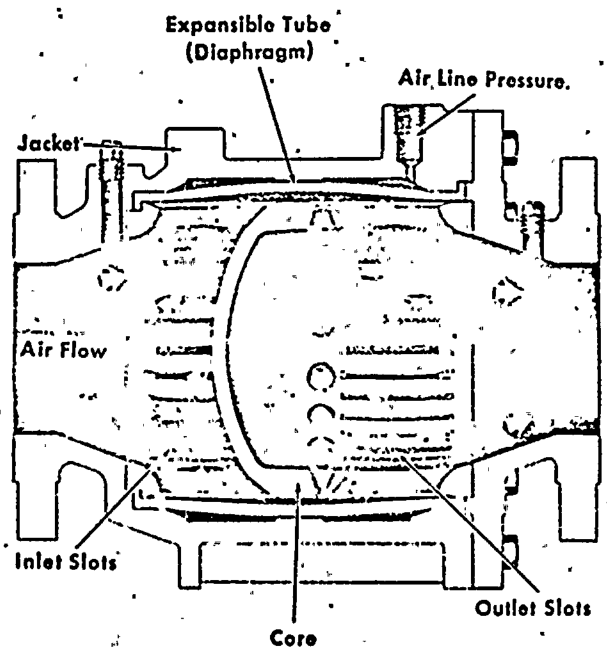


Fig. 13-20 — Air Starting Valve

on, or above, the slotted ports in the outlet end of the core. The position of the expansible tube depends mainly upon the relative magnitude of the differential pressures applied on the valve inlet, the valve outlet and in the jacket.

The tension of the tube over the core effects the operation also as this initial tension produces a set pressure which must be added to the pressure in the jacket. To open the valve, release the pressure from the jacket (by opening the air starting control valve) until the effective jacket pressure is less than the downstream line pressure. The tube will rise completely off the core so that the valve is opened completely, thus setting the starting motor in operation.

To close the valve, release the air starting control valve and allow the full inlet pressure to enter into the jacket. This makes the effective jacket pressure greater than the line pressure, thus forcing the tube against the core slots to close the valve.

MAINTENANCE

No maintenance is required other than keeping all connections securely tightened. After a long period of severe service, the expansible tube on the core might require renewal. This can quickly be accomplished by taking off the closure and removing the tube and core. A new tube is then installed over the core and inserted into the valve body.

SOLENOID VALVE (12 & 20-Cyl.)

DESCRIPTION

The solenoid valve, Fig. 13-21, used in the dual starting motor system, opens when current is applied to the solenoid, and returns to the normally closed position when the current is cut off. In the energized or open position, air is directed behind the pinion gear of the lower starting

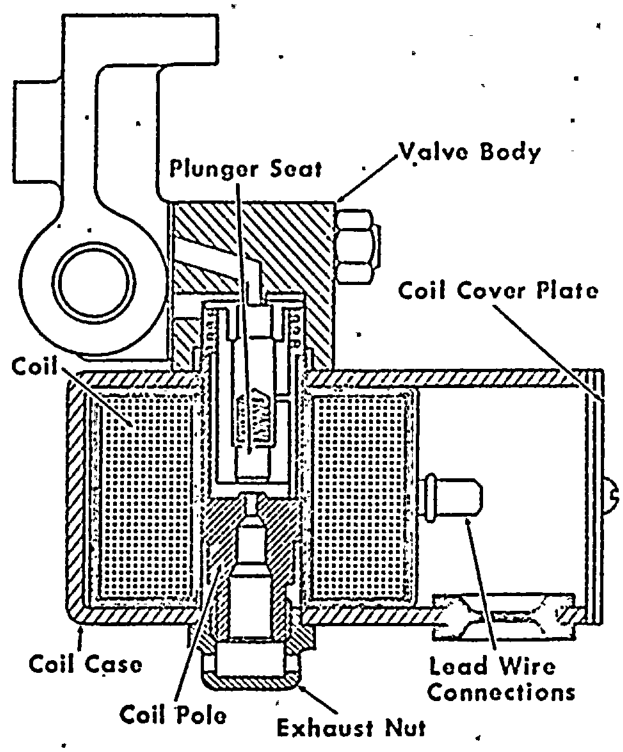


Fig. 13-21 — Solenoid Valve

motor. When the pinion gear is engaged with the ring gear, a port is opened in the motor allowing the air to go behind the pinion gear of the upper starting motor. With both pinion gears engaged, the air from the solenoid valve opens the air relay valve.

MAINTENANCE

Before performing any maintenance on the solenoid valve, make sure the electrical power and air pressure have been turned off.

CLEANING

Sluggish valve operation or excessive leakage will indicate that cleaning is required. The frequency of cleaning, however, will be determined by operating conditions. Clean the moving parts and air passages thoroughly, using a good commercial solvent.

COIL REPLACEMENT

Remove front cover plate from coil case and disconnect coil lead wires. Remove

the exhaust nut from the bottom of the coil case and slip the coil and coil case off the coil pole. Reassemble the components in the reverse order of disassembly, connect the coil leads, and replace the coil case cover plate.

SHUTOFF VALVE (12 & 20-Cyl.)

DESCRIPTION

A manually operated ball-type shutoff valve, Fig. 13-22, is used in the dual starting motor system. The valve closes off air to the starter motors, when maintenance work is being performed, to prevent inadvertent engine starting. The valve has a lock-type handle which provides an additional safety feature in preventing unintentional movement of the valve.

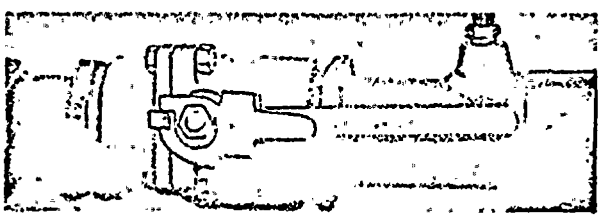


Fig. 13-22 — Shutoff Valve

MAINTENANCE

The wiping action of the ball dislodges any foreign material which may enter the valve, making the valve self-cleaning. In addition, the seat material contains a lubricant which provides the required lubrication for the ball. The only parts requiring replacement under normal operating conditions are the seats and the "O" rings.

AIR RELAY VALVE (12 & 20-Cyl.)

DESCRIPTION

When the pinion gear in both motors is engaged with the ring gear, air is released from the upper motor to the air

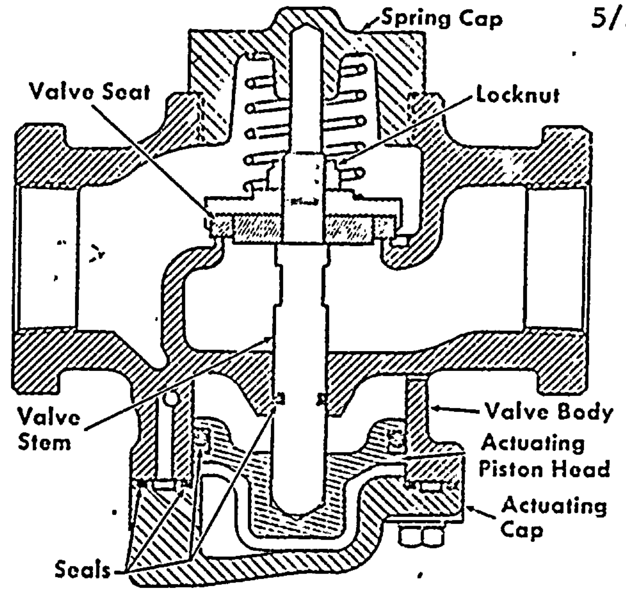


Fig. 13-23 — Air Relay Valve

relay valve. Air enters the air relay valve and forces the valve stem up unseating the valve seat, Fig. 13-23, and releasing the main starting air supply to the motors. When the starting control valve is released and the air solenoid valve closes off the control air supply to the motors, the supply of air to the air relay valve is shut off, which cuts off the main air supply to the motors.

MAINTENANCE

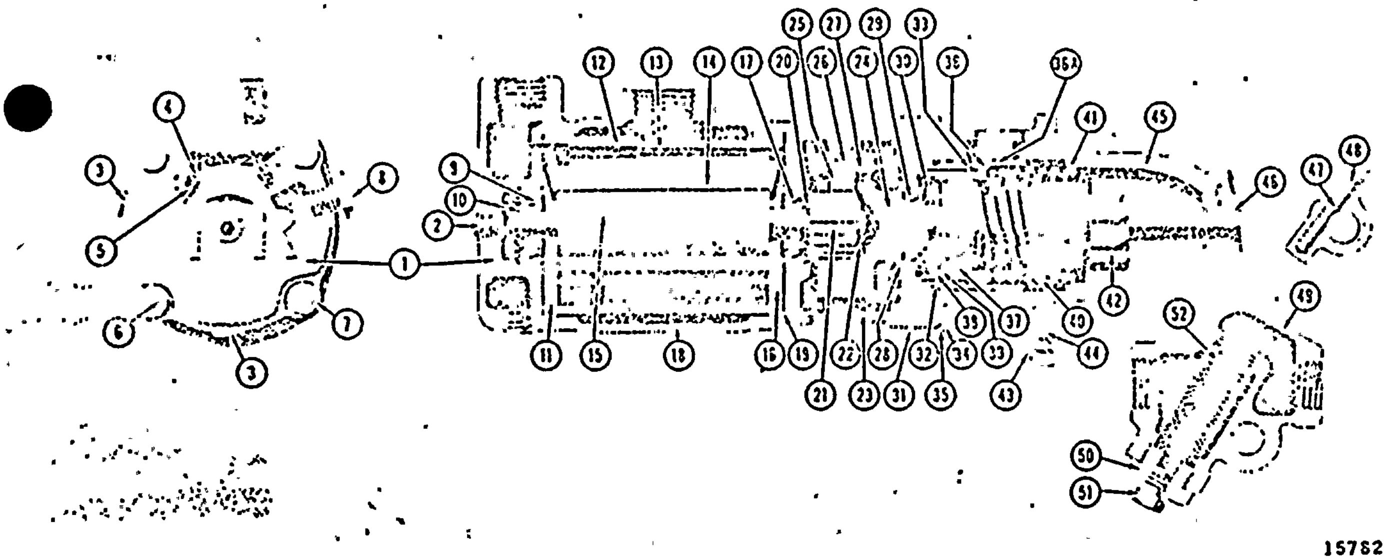
No periodic maintenance should be required, however, if at any time the valve seat becomes dirty and is not shutting off the main air supply properly, the seat can be removed and cleaned.

DISASSEMBLY

1. Unscrew the spring cap on top of the valve, Fig. 13-23, and remove the spring.

2. Unscrew the locknut holding the valve seat assembly to the valve stem and remove the valve seat assembly.

3. If the valve seals need replacement due to leakage, remove the bolts holding the actuating cap to the valve body, remove the actuating piston head and replace seals.



1. Motor Housing Cover Assembly
2. Housing Cover End Plug
3. Oil Drain Plug (2)
4. Oil Adjusting Screw (2)
5. Oiler Felt (2)
6. Motor Housing Cover Cap Screw (4)
7. Cover Cap Screw Lockwasher (4)
8. Oil Filler Plug
9. Rear Rotor Bearing
10. Rear Rotor Bearing Retainer
11. Rear End Plate
12. Cylinder
13. Cylinder Dowel
14. Vane (5)
15. Rotor
16. Front End Plate
17. Front Rotor Bearing
18. Motor Housing
19. Gear Case Gasket
20. Rotor Pinion Spacer
21. Rotor Pinion
22. Rotor Pinion Retainer
23. Gear Case
24. Planet Gear Frame
25. Planet Gear Assembly (3)
26. Planet Gear Bearing (3)
27. Planet Gear Shaft
28. Planet Gear Frame Thrust Ring
29. Planet Gear Frame Bearing
30. Planet Gear Frame Retaining Ring
31. Gear Case Cover Assembly
32. Gear Case Cover Seal
33. Piston Seal
34. Drive Housing Cap Screw (12)
35. Drive Housing Cap Screw Lockwasher
36. Piston Assembly
36A. Piston Ring
37. Shift Ring
38. Shift Ring Retainer
39. Shift Ring Spacer
40. Piston Return Spring
41. Return Spring Seat
42. Bendix Starter Drive
43. 3/8" Mounting Bolt Lockwasher (3)
44. 3/8" Mounting Bolt Bushing (3)
45. Drive Housing Assembly
46. Drive Housing Bushing
47. Bushing Oiler
48. Bushing Oiler Plug
49. Air Strainer Assembly
50. Air Strainer Cap
51. Air Strainer Plug
52. Air Strainer Screen

Fig. 13-16 – Air Starting Meter

by inadequate lubrication or the presence of rust, scale, dirt, excessive moisture, or other foreign matter in the air supply. New vanes can be easily and quickly installed by disassembling the motor as described in subsequent paragraphs.

LUBRICATION

Before putting a new air motor into operation, pour about two teaspoonfuls of engine oil into the air inlet so that it will be carried into the multivane motor with the live air. Before storage or lay up, the motor should be fully lubricated with a light oil containing a rust inhibitor.

Remove the oil filler plug, (8) Fig. 13-16, weekly, and fill the oil reservoir in the motor housing cover with SAE 20W motor oil for temperatures above 30° F. or 10W motor oil for lower temperatures. Using the same oil as above, remove the bushing oiler plug, (48) Fig. 3-16, from the drive housing and fill

MOTOR REMOVAL

1. Disconnect air supply and exhaust lines.
2. Remove three bolts securing the motor and drive assembly to the motor mounting bracket.
3. Remove starting motor and drive assembly.

MOTOR DISASSEMBLY
(Refer to Fig. 13-16)

1. Using a prick punch, mark adjacent spots on the motor housing cover (1), motor housing (18), gear case (23), gear case cover (31), and drive housing (45) so these members will be in the same relative position when the motor is assembled.
2. Unscrew and remove the motor housing cover cap screws (6), and pull the motor housing cover (1) from the motor housing (18).

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

ELECTRICAL MAINTENANCE INSTRUCTION 3

DIESEL GENERATORS

Description

This instruction covers the maintenance of the rotating machinery of the diesel generator auxiliaries and provides the procedure for the diesel redundant start test. Table EMI 3-1 is a listing of the scheduled maintenance itmes covered by this instruction.

Table EMI 3-1

Frequency	Maintenance Item
Monthly	Inspect the generator brushes for sparking during the performance of SI 4.9.A.1.a.
2 Months	Check the temperature of the generator bearing during the performance of SI 4.9.A.1.a.
2 Months	Perform the redundant start test.

*

Maintenance Items

The following paragraphs contain the specific maintenance items to be performed per Table EMI 3-1 and the general instructions for the generator bearing inspection and generator brush replacement.

*Revision

A. Generator Bearing

Requirement - Every two months, check the temperature of the generator bearing during the performance of SI 4.9.A.1.a.

Clearances - None required.

Measure the temperature of the generator bearing by applying a surface pyrometer to the outside of the bearing cover. The temperature measured should not exceed a 25°C rise above the room ambient temperature. If the temperature is greater than 25°C rise, immediately notify the ASE running the diesel and the electrical maintenance supervisor. Record both the bearing temperature and the room ambient temperature on the trouble report. Also, record the diesel running time on the trouble report for informational purpose. Upon receipt of the trouble report in the electrical maintenance office, the information will be transferred to data sheet EMI 3-A. A data sheet BF EMI 3-A will be kept for each diesel generator.

General Instructions-Bearing Inspection

Clearances - An EMI will be written at a later date to cover the diesel generator bearing inspection. It will contain the necessary clearances.

Inspect the generator bearing in accordance with the guidelines in the manufacturer's manual EMD MI 3327. There is only one bearing in the generator and it is located at the outboard end of the shaft. The bearing is a sealed grease lubricated, double row, spherical, self-aligning type and there should be no need for additional lubrication during the generator's life. Two conditions, a high bearing temperature or excessive noise in the outboard end of the generator, may warrant a bearing inspection in advance of the normal 9000 hour inspection.

Maintenance Items (Continued)

B. Generator Brushes

Requirement - Every month during the performance of SI 4.9.A.1.a., inspect the generator brushes for sparking.

Clearances - None required.

The generator brushes and slip rings are checked thoroughly during the diesel annual inspection and need only a visual check once a month. During the performance of SI 4.9.A.1.a., observe the generator brushes. If any sparking is noticed, immediately notify the ASE running the diesel and the electrical maintenance supervisor. Observe the length of each brush and if any brush appears to be approximately one-inch long, notify the electrical maintenace supervisor. Note on the trouble report whether any sparking was observed and wh whether the brushes are of acceptable length. Upon receipt of the trouble report in the electrical maintenance office, the information will be transferred to data sheet BF EMI 3-B. A data sheet BF EMI 3-B will be kept for each diesel generator.

General Instructions-Brush Changeout

Clearances - a. The clearances required for SI 4.9.A.1.d.
b. The exciter field breaker.

When any brush reaches a length of 1 inch $\pm$ 1/8 inch, change all four brushes on that generator. When installing new brushes, sand them to fit the curvature of the slip ring by placing a piece of sandpaper on the surface of the ring with the grit side against the brush. Then, with the brush held down by the pressure arm of the brush holder, move the sandpaper in the direction of rotation of the rings. Repeat the motion until the brush fits the curvature of the rings. Run the diesel per SI 4.9.A.1.a steps 3.5.a through 3.5.g (DO NOT FLASH THE FIELD) for one hour. Stop the diesel and inspect the brushes and repeat the diesel run as necessary until the brushes are seated on between 50% and 80% of them surface. Document the changeout of the brushes on the trouble report issued to accomplish the work.

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*Revision JBD

Maintenance Items (Continued)

*

F. Redundant Start Test

Requirement - Every two months perform the redundant start test on each diesel.

Clearances - None required.

This test shall be performed on each diesel every two months. DPSO support will be required to operate the oscillograph used to monitor relay pick up and drop out. The test will have to be coordinated with the shift engineer and will require support by one ASE and one AVO. Upon completion of the test, the data sheets and oscillograph traces will be submitted to the electrical maintenance section for review and filing. The oscillograph speed should be set for 2-inches/second. Record the performance of each step of the procedure by initials and data on data sheet BF EMI 3-F.

NOTE: This test is written for all eight diesels. Where there are any differences between the units 1 and 2 diesels and the unit 3 diesels a step will contain instructions for each set of diesels noted to indicate the applicable unit. The blanks in the procedure are for items that differ only by the letter designation of the diesel being tested. Before starting any cranking sequence, ensure that there is a minimum of 175 pounds of air in each bank.

*Revision

F.1.0 Test Number 1

F.1.1 Connect an oscillograph to monitor the following items:

a. Units 1 and 2: ASR ____ -1 coil.
Unit 3: ASR ____ -1 contacts 3-4 or 7-8 (Contact 3-4 to be used when monitoring start circuit 1 and contact 7-8 to be used when monitoring start circuit 2. A note will be placed at the beginning of each test to indicate the contact that should be used for that test.)

b. ZSR1 coil.

c. ZSR2 coil.

d. MSTV1 coil.

e. MSTV2 coil.

f. Governor booster pump 1 (GBP1).

g. Governor booster pump 2 (GBP2).

h. FPR coil.

NOTE: For Unit 3, ensure that ASR ____ -1 contact 7-8 is being monitored.

F.1.2 Place the "CB start 1" breaker in the OFF position.

F.1.3 Verify that the "CB start 2" breaker is in the ON position.

F.1.4 Place the "Preferred Start" selector switch (SCS) in position 1.

F.1.5 Manually hold the engine injector control lever in the OFF position (full out position.)

F.1.6 Start the oscillograph.

F.1.7 Units 1 and 2: Manually manipulate relay ASR ____ -1 to the energized position
Unit 3: At panel 3-9-23 turn the D/G ____ control switch to the START position.

F.1.8 Units 1 and 2: After the D/G cranking sequence is finished, manually manipulate relay R1 ____ to the energized position and stop the oscillograph.
Unit 3: After the D/G cranking sequence is finished, pull to stop D/G ____ control switch on panel 3-9-23 and stop the oscillograph.

F.1.9 Release the injector control lever.

F.1.10 Mark the oscillograph trace as "Trace #1."

Test Number 1 (Continued)

F.1.11 Reset all the alarms for D/G ____.

F.1.12 Verify the following acceptance criteria are met. Use the oscillograph's 0.1 second timing lines to verify times.

a. Start failure backup is 1 second, -10%, +25% (i.e. between 0.9 seconds and 1.25 seconds elapsed from ASR ____ -1 energized and MSTV2 energized the first time.)

b. Cranking time of first crank is 4 seconds, ± 10% (i.e. between 3.6 seconds and 4.4 seconds elapsed from MSTV2 energized the first time and MSTV2 deenergized the first time.)

c. First coastdown and second cranking time is 4.5 seconds ± 10% (i.e. between 4.05 seconds and 4.95 seconds elapsed from MSTV2 deenergized the first time and MSTV2 deenergized the second time.)

d. GBP2 is energized whenever MSTV2 is energized.

*e. FPR energized during the entire cranking sequence (i.e. FPR energized when MSTV2 energized the first time.)

NOTE: If any of the above criteria are not met, investigate to determine the cause, correct, and if necessary rerun the test. If the test is or is not repeated, explain why in the remarks section. If repeated document each step with another set of initials and dates on the data sheet.

F.2.0 Test Number 2

NOTE: For unit 3, ensure that ASR ____ -1 contact 3-4 is being monitored.

F.2.1 Place the "CB start 1" breaker in the ON position.

F.2.2 Place the "CB start 2" breaker in the OFF position.

F.2.3 Place the "Preferred start" selector switch (SCS) in position 2.

F.2.4 Manually hold the engine injector control lever in the OFF position (full out position.)

F.2.5 Start the oscillograph.

F.2.6 Units 1 and 2: Manually manipulate relay ASR ____ -1 to the energized position
Unit 3: At panel 3-9-23 turn the D/G ____ control switch to the start position.

F.2.7 Units 1 and 2: After the D/G cranking sequence is finished, manually manipulat relay R1 ____ to the energized position and stop the oscillograph.

*Revision

Test Number 2 (Continued)

F.2.7 (Continued)

Unit 3: After the D/G cranking sequence is finished, pull to STOP D/G ____ control switch on panel 3-9-23 and stop the oscillograph.

F.2.8 Release the injector control lever.

F.2.9 Mark the oscillograph trace as "Trace #2."

F.2.10 Reset all the alarms for D/G ____.

F.2.11 Verify the following acceptance criteria are met. Use the oscillograph's 0.1 second timing lines to verify times.

a. Start failure backup is 1 second, -10%, +25% (i.e. between 0.9 seconds and 1.25 seconds elapsed from ASR ____ -1 energized and MSTV1 energized the first time.)

b. Cranking time of first crank is 4 seconds ± 10% (i.e. between 3.6 seconds and 4.4 seconds elapsed from MSTV1 energized the first time and MSTV1 deenergized the first time.)

c. First coastdown and second cranking time is 4.5 seconds ± 10% (i.e. between 4.05 seconds and 4.95 seconds elapsed from MSTV1 deenergized the first time and MSTV1 deenergized the second time.)

d. GBP1 is energized whenever MSTV1 is energized.

*e. FPR energized during the entire cranking sequence (i.e. FPR energized when MSTV1 energized the first time.)

NOTE: If any of the above criteria are not met, investigate to determine the cause, correct, and if necessary rerun the test. If the test is or is not repeated, explain why in the remarks section. If repeated, document each step with another set of initials and dates on the data sheet.

*Revision

F.3.0 Test Number 3

NOTE: For unit 3, ensure that ASR ____ -1 contact 3-4 is being monitored.

F.3.1 Place the "CB start 2" breaker in the ON position.

F.3.2 Place the "Preferred start" selector switch (SCS) in position 1.

F.3.3 Close the following air line valves on both air banks:

a. Units 1 and 2:: 0-86-504.
   Unit 3: 3-86-554:

b. Units 1 and 2: 0-86-505.
   Unit 3: 3-86-555.

c. Units 1 and 2: 0-86-506.
   Unit 3: 3-86-556.

d. Units 1 and 2: 0-86-507.
   Unit 3: 3-86-557.

e. Units 1 and 2: 0-86-508.
   Unit 3: 3-86-558.

f. Units 1 and 2: 0-86-524.
   Unit 3: 3-86-574.

g. Units 1 and 2: 0-86-525.
   Unit 3: 3-86-575.

h. Units 1 and 2: 0-86-526.
   Unit 3: 3-86-576.

i. Units 1 and 2: 0-86-527.
   Unit 3: 3-86-577.

j. Units 1 and 2: 0-86-528.
   Unit 3: 3-86-578.

k. Units 1 and 2: 0-86-523.
   Unit 3: 3-86-573.

l. Units 1 and 2: 0-86-503.
   Unit 3: 3-86-553.

F.3.4 Manually hold the engine injector control lever in the OFF position (full out position.)

F.3.5 Start the oscillograph.

Test Number 3 (Continued)

F.3.6 Units 1 and 2: Manually manipulate relay ASR ____ -1 to the energized position.
Unit 3: At panel 3-9-23 turn the DG ____ control switch to the START position.

F.3.7 Units 1 and 2: After the D/G cranking sequence is finished, manually manipulate relay R1 ____ to the energized position and stop the oscillograph.
Unit 3: After the D/G cranking sequence is finished, pull to STOP D/G ____ control switch on panel 3-9-23 and stop the oscillograph.

F.3.8 Release the injector control lever.

F.3.9 Mark the oscillograph trace as "Trace #3."

F.3.10 Reset all the alarms for D/G ____.

F.3.11 Verify the following acceptance criteria are met. Use the oscillograph's 0.1 second timing lines to verify times.

a. MSTV1 is energized for 3 seconds ±10% (i.e. between 2.7 seconds and 3.3 seconds elapsed from MSTV1 energized the first time until MSTV1 deenergized the first time.)

b. Dead time after MSTV1 is deenergized the first time is 0.5 seconds, -20%, +40% (i.e. between 0.4 seconds and 0.7 seconds elapsed from MSTV1 deenergized the first time and both MSTV1 energized the second time and MSTV2 energized the first time.)

c. MSTV1 and MSTV2 are energized for 3 seconds, ±10% (i.e. between 2.7 seconds and 3.3 seconds elapsed from MSTV1 energized the second time and MSTV1 deenergized the second time, and MSTV2 energized the first time and MSTV2 deenergized the first time.)

d. Dead time after MSTV1 and MSTV2 deenergized is 0.5 seconds, -20%, +60% (i.e. between 0.4 seconds and 0.8 seconds elapsed from both MSTV1 deenergized the second time and MSTV2 deenergized the first time and MSTV2 energized the second time.)

e. MSTV2 is energized for 3 seconds ±10% (i.e. between 2.7 seconds and 3.3 seconds elapsed from MSTV2 energized the second time and MSTV2 deenergized the second time.)

f. GBP1 is energized whenever MSTV1 is energized.

g. GBP2 is energized whenever MSTV2 is energized.

*h. FPR energized during the entire cranking sequence (i.e. FPR energized when MSTV1 is energized the first time.)

*Revision

Test Number 3 (Continued)

NOTE: If any of the above criteria are not met, investigate to determine the cause, correct, and if necessary rerun the test. If the test is or is not repeated, explain why in the remarks section. If repeated, document each step with another set of initials and dates on the data sheet.

F.4.0 Test Number 4

NOTE: For unit 3, ensure that ASR ____ -1 contact 7-8 is being monitored.

F.4.1 Place the "preferred start" selector switch (SCS) in position 2.

F.4.2 Manually hold the engine injector lever in the OFF position (full out position.)

F.4.3 Start the oscillograph.

F.4.4 Units 1 and 2: Manually manipulate relay ASR ____ -1 to the energized position.
Unit 3: At panel 3-9-23 turn the D/G ____ control switch to the START position.

F.4.5 Units 1 and 2: After the D/G cranking sequence is finished, manually manipulate relay R1 ____ to the energized position and stop the oscillograph.
Unit 3: After the D/G cranking sequence is finished, pull to stop D/G ____ control switch on panel 3-9-23 and stop the oscillograph.

F.4.6 Release the injector control lever.

F.4.7 Mark the trace as "Trace #4."

F.4.8 Reset all the alarms for D/G ____.

F.4.9 Verify the following acceptance criteria are met. Use the oscillograph's 0.1 second timing lines to verify times.

a. MSTV2 is energized for 3 seconds ±10% (i.e. between 2.7 seconds and 3.3 seconds elapsed from MSTV2 energized the first time until MSTV2 deenergized the first time.)

b. Dead time after MSTV2 is deenergized the first time is 0.5 seconds, -20%, +40% (i.e. between 0.4 seconds and 0.7 seconds elapsed from MSTV2 deenergized the first time and both MSTV 2 energized the second time and MSTV1 energized the first time.)

Test Number 4 (Continued)

c. MSTV2 and MSTV1 are energized for 3 seconds, ±10% (i.e. between 2.7 seconds and 3.3 seconds elapsed from MSTV2 energized the second time and MSTV2 deenergized the second time, and MSTV1 energized the first time and MSTV1 deenergized the first time.)

d. Dead time after MSTV2 and MSTV1 deenergized is 0.5 seconds, -20%, +60% (i.e. between 0.4 seconds and 0.8 seconds elapsed from both MSTV2 deenergized the second time and MSTV1 deenergized the first time and MSTV1 energized the second time.)

e. MSTV1 is energized for 3 seconds ±10% (i.e. between 2.7 seconds and 3.3 seconds elapsed from MSTV1 energized the second time and MSTV1 deenergized the second time.)

f. GBP2 is energized whenever MSTV2 is energized.

g. GBP1 is energized whenever MSTV1 is energized.

*h. FPR energized during the entire cranking sequence (i.e. FPR energized when MSTV2 is energized the first time.)

NOTE: If any of the above criteria are not met, investigate to determine the cause, correct, and if necessary rerun the test. If the test repeated, document each step with another set of initials and dates on the data sheet.

F.5.0 Test Number 5

NOTE: For unit 3, ensure that ASR ____ -1 contact 7-8 is being monitored.

F.5.1 Open the following air line valves on both air banks:

a. Units 1 and 2: 0-86-504
Unit 3: 3-86-554

b. Units 1 and 2: 0-86-505
Unit 3: 3-86-555

c. Units 1 and 2: 0-86-506
Unit 3: 3-86-556

d. Units 1 and 2: 0-86-507
Unit 3: 3-86-557

e. Units 1 and 2: 0-86-508
Unit 3: 3-86-558

f. Units 1 and 2: 0-86-524
Unit 3: 3-86-574

*Revision [signature]

Test Number 5 (Continued)

F.5.1 (Continued)

g. Units 1 and 2: 0-86-525
Unit 3: 3-86-575

h. Units 1 and 2: 0-86-526
Unit 3: 3-86-576

i. Units 1 and 2: 0-86-527
Unit 3: 3-86-577

j. Units 1 and 2: 0-86-528
Unit 3: 3-86-578

k. Units 1 and 2: 0-86-523
Unit 3: 3-86-573

l. Units 1 and 2: 0-86-503
Unit 3: 3-86-553

F.5.2 Allow the air pressure in both start banks to build to at least 175 pounds.

F.5.3 Manually hold the engine injector lever in the OFF position (full out position.)

F.5.4 Start the oscillograph.

F.5.5 Units 1 and 2: Manually manipulate relay ASR ____ -1 to the energized position.
Unit 3: At panel 3-9-23 turn the D/G ____ control switch to the START position.

F.5.6 Units 1 and 2: After the D/G cranking sequence is finished, manually manipulate relay R1 ____ to the energized position and stop the oscillograph.
Unit 3: After the D/G cranking sequence is finished, pull to stop D/G ____ control switch on panel 3-9-23 and stop the oscillograph.

F.5.7 Release the injector control lever.

F.5.8 Mark the trace as "Trace #5."

F.5.9 Reset all the alarms for D/G ____.

Test Number 5 (Continued)

F.5.10 Verify the following acceptance criteria are met. Use the oscillograph's 0.1 second timing lines to verify times.

a. Cranking time of first crank is 4 seconds ±10% (i.e. between 3.6 seconds and 4.4 seconds elapsed from MSTV2 energized the first time and MSTV2 deenergized the first time.)

*b. First coastdown and second cranking time is 4.5 seconds ±10% (i.e. between 4.05 seconds and 4.95 seconds elapsed from MSTV2 deenergized the first time and both MSTV2 deenergized the second time and MSTV1 deenergized the first time.)

c. Second coastdown and third cranking time is 4.5 seconds ±10% (i.e. between 4.05 seconds and 4.95 seconds elapsed from both MSTV2 deenergized the second time and MSTV1 deenergized the first time and MSTV1 deenergized the second time.)

d. GBP2 is energized whenever MSTV2 is energized.

e. GBP1 is energized whenever MSTV1 is energized.

*f. FPR energized during the entire cranking sequence (i.e. FPR energized when MSTV2 energized the first time.)

NOTE: If any of the above criteria are not met, investigate to determine the cause, correct, and if necessary rerun the test. If the test is or is not repeated, explain why in the remarks section. If repeated, document each step with another set of initials and dates on the data sheet.

F.6.0 Test Number 6

NOTE: For unit 3, ensure that ASR ____ -1 contact 3-4 is being monitored.

F.6.1 Place the "Preferred start" selector switch (SCS) in position 1.

F.6.2 Manually hold the engine injector lever in the OFF position (full out position.)

F.6.3 Start the oscillograph.

F.6.4 Units 1 and 2: Manually manipulate relay ASR ____ -1 to the energized position.
Unit 3: At panel 3-9-23 turn the D/G ____ control switch to the START position.

F.6.5 After the second cranking attempt, release the injector control lever.

*Revision 11/92

Test Number 6 (Continued)

F.6.6 Verify the diesel started and record the following valves:

a. Engine speed.

b. Generator voltage.

F.6.7 Units 1 and 2: Manually manipulate relay R1 ____ to the energized position and stop the oscillograph.
Unit 3: Pull to stop D/G ____ control switch on panel 3-9-23 and stop the oscillograph.

F.6.8 Mark the trace as "Trace #6."

F.6.9 Reset all the alarms for D/G ____.

F.6.10 Verify the following acceptance criteria are met. Use the oscillograph

0.1 second timing lines to verify times.

a. Cranking time of first crank is 4 seconds ±10% (i.e. between 3.6 seconds and 4.4 seconds elapsed from MSTV1 energized the first time and MSTV1 deenergized the first time.)

*b. First coastdown and second cranking time is 4.5 seconds ±10% (i.e. between 4.05 seconds and 4.95 seconds elapsed from MSTV1 deenergized the first time and both MSTV1 deenergized the second time and MSTV2 deenergized the first time.)

c. Second coastdown and third cranking time is 4.5 seconds ±10% (i.e. between 4.05 seconds and 4.95 seconds elapsed from both MSTV1 deenergized the second time and MSTV2 deenergized the first time and MSTV2 deenergized the second time.)

d. GBP1 is energized whenever MSTV1 is energized.

e. GBP2 is energized whenever MSTV2 is energized.

*f. FPR is energized during the entire cranking sequence (i.e. FPR energized when MSTV1 energized the first time.)

g. The engine speed must be 905 rpm ± 5 rpm.

h. The generator voltage must be 4350 volts ± 50 volts.

NOTE: If any of the above criteria are not met, investigate to determine the cause, correct, and if necessary rerun the test. If the test is or is not repeated, explain why in the remarks section. If repeated, document each step with another set of initials and dates on the data sheet.

*Revision 11/4/92

Test Number 6 (Continued)

F.6.11 Remove the oscillograph used to monitor the following items:

a. Units 1 and 2: ASR ____ -1 coil
   Unit 3: ASR ____ -1 contacts 3-4 or 7-8

b. ZSR1 coil.

c. ZSR2 coil.

d. MSTV1 coil.

e. MSTV2 coil.

f. Governor booster pump 1 (GBP1).

g. Governor booster pump 2 (GBP2).

h. FPR coil.

F.6.12 Notify the shift engineer that testing on D/G ____ is complete and the diesel can be returned to standby readiness.

Data Sheet BF EMI 3-A

Generator Bearing Temperatures

Diesel Generator ________

Date	Trouble Report Number	Room Ambient Temp. (°C)	Gen. Bearing Temp. (°C)	Diesel Running Time (HRS)	Remarks

Data Sheet BF EMI 3-B

Generator Brush Condition

Diesel Generator ________

Date	Trouble Report Number	Brush Sparking Yes/No	Brush Length OK/Short	Remarks

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*Revision

Data Cover Sheet BF EMI 3-F

Redundant Start Test

Diesel Generator ________

This test was performed in accordance with the instructions of EMI 3.F, "Redundant Start Test" and meets all the acceptance criteria of the procedure.

Performed By: ____________________ Date ____________________
Electrician

This test has been reviewed for compliance with the acceptance criteria.

Reviewed By: ____________________ Date ____________________
Electrical Engineer

Approval of test results.

Approved By: ______________________________
Electrical Maintenance Supervisor/Date

Remarks: ______________________________

Data Sheet BF EMI 3-F

Redundant Start Test

Diesel Generator ________

NOTE: Each blank on the data sheet corresponds to the step in the procedure with the same step number. Initial and date each blank as its associated procedural step is completed.

		Initials/Date
F.1.0	Test number 1	NA
F.1.1	Oscillograph connections	NA
	a. ASR ____ -1 coil (U-1 & U-2) or contacts (U-3).	________
	b. ZSR1 coil.	________
	c. ZSR2 coil.	________
	d. MSTV1 coil.	________
	e. MSTV2 coil.	________
	f. GBP1.	________
	g. GBP2.	________
	h. FPR coil.	________
F.1.2	CB start 1 OFF.	________
F.1.3	CB start 2 ON.	________
F.1.4	SCS in position 1.	________
F.1.5	Injector lever out.	________
F.1.6	Oscillograph started.	________
F.1.7	Start cranking sequence.	________
F.1.8	Cranking sequence finished.	________
F.1.9	Injector lever released.	________
F.1.10	Trace marked.	________
F.1.11	Alarms reset.	________

Data Sheet BF EMI 3-F (Continued)

	Initials/Date
F.1.12 Acceptance criteria met.	NA
a. Start failure backup.	
b. First crank.	
c. First coastdown and second crank.	
d. GBP2.	
e. FPR.	

Remarks: ______________________________

F.2.0 Test number 2.	NA
F.2.1 CB start 1 ON.	
F.2.2 CB start 2 OFF.	
F.2.3 SCS in position 2.	
F.2.4 Injector lever out.	
F.2.5 Oscillograph started.	
F.2.6 Start cranking sequence.	
F.2.7 Cranking sequence finished.	
F.2.8 Injector lever released.	
F.2.9 Trace marked.	
F.2.10 Alarms reset.	

Data Sheet BF EMI 3-F (Continued)

Initials/Date

F.2.11 Acceptance criteria met. NA

a. Start failure backup. ____________

b. First crank. ____________

c. First coastdown and second crank. ____________

d. GBP1. ____________

e. FPR. ____________

Remarks: ____

____

____

____

Initials/Date

F.3.0 Test number 3. NA

F.3.1 CB start 2 ON. ____________

F.3.2 SCS in position 1. ____________

F.3.3 Air line valves closed. NA

a. 0-86-504 (U-1 & U-2) or 3-86-554 (U-3). ____________

b. 0-86-505 (U-1 & U-2) or 3-86-555 (U-3). ____________

c. 0-86-506 (U-1 & U-2) or 3-86-556 (U-3). ____________

d. 0-86-507 (U-1 & 2) or 3-86-557 (U-3). ____________

e. 0-86-508 (U-1 & 2) or 3-86-558 (U-3). ____________

f. 0-86-524 (U-1 & 2) or 3-86-574 (U-3). ____________

g. 0-86-525 (U-1 & 2) or 3-86-575 (U-3). ____________

h. 0-86-526 (U-1 & 2) or 3-86-576 (U-3). ____________

Data Sheet BF EMI 3-F (Continued)

F.3.3	(Continued)	Initials/Date
	i. 0-86-527 (U-1 & 2) or 3-86-577 (U-3).	
	j. 0-86-528 (U-1 & 2) or 3-86-578 (U-3).	
	k. 0-86-523 (U-1 & 2) or 3-86-573 (U-3).	
	l. 0-86-503 (U-1 & 2) or 3-86-553 (U-3).	
F.3.4	Injector lever out.	
F.3.5	Oscillograph started.	
F.3.6	Start cranking sequence.	
F.3.7	Cranking sequence finished	
F.3.8	Injector lever released.	
F.3.9	Trace marked.	
F.3.10	Alarms reset	
F.3.11	Acceptance criteria met.	NA
	a. MSTV1.	
	b. First dead time.	
	c. MSTV1 and MSTV2.	
	d. Second dead time.	
	e. MSTV2.	
	f. GBP1.	
	g. GBP2.	
	h. FPR.	

Remarks: ______________________________

Data Sheet BF EMI 3-F (Continued)

		Initials/Date
F.4.0	Test number 4	NA
F.4.1	SCS in position 2.	
F.4.2	Injector lever out.	
F.4.3	Oscillograph started.	
F.4.4	Start cranking sequence.	
F.4.5	Cranking sequence finished.	
F.4.6	Injector lever released.	
F.4.7	Trace marked.	
F.4.8	Alarms reset.	
F.4.9	Acceptance criteria met.	NA
	a. MSTV2.	
	b. First dead time.	
	c. MSTV2 and MSTV1.	
	d. Second dead time.	
	e. MSTV1.	
	f. GBP2.	
	g. GBP1.	
	h. FPR.	

Remarks: ______________________________

Re_ ______________________________

Data Sheet BF EMI 3-F (Continued)

		Initials/Date
F.5.0	Test Number 5.	NA
F.5.1	Air line valves open.	NA
	a. 0-86-504 (U-1 & 2) or 3-86-554 (U-3).	
	b. 0-86-505 (U-1 & 2) or 3-86-555 (U-3).	
	c. 0-86-506 (U-1 & 2) or 3-86-556 (U-3).	
	d. 0-86-507 (U-1 & 2) or 3-86-557 (U-3).	
	e. 0-86-508 (U-1 & 2) or 3-86-558 (U-3).	
	f. 0-86-524 (U-1 & 2) or 3-86-574 (U-3).	
	g. 0-86-525 (U-1 & 2) or 3-86-575 (U-3).	
	h. 0-86-526 (U-1 & 2) or 3-86-576 (U-3).	
	i. 0-86-527 U-1 & 2) or 3-86-577 (U-3).	
	j. 0-86-528 (U-1 & 2) or 3-86-578 (U-3).	
	k. 0-86-523 (U-1 & 2) or 3-86-573 (U-3).	
	l. 0-86-503 (U-1 & 2) or 3-86-553 (U-3).	
F.5.2	Air pressure at 175 pounds.	
F.5.3	Injector lever out.	
F.5.4	Oscillograph started.	
F.5.5	Start cranking sequence.	
F.5.6	Cranking sequence finished.	
F.5.7	Injector lever released.	
F.5.8	Trace marked.	
F.5.9	Alarms reset.	

Data Sheet BF EMI 3-F (Continued)

	Initials/Date
F.5.10 Acceptance criteria met.	____________
a. First cranking time.	____________
b. First coastdown and second crank.	____________
c. Second coastdown and third crank.	____________
d. GBP2.	____________
e. GBP1.	____________
f. FPR.	____________

Remarks: ____

____

____

____

F.6.0 Test Number 6.	NA
F.6.1 SCS in position 1.	____________
F.6.2 Injector lever out.	____________
F.6.3 Oscillograph started.	____________
F.6.4 Start cranking sequence.	____________
F.6.5 Injector lever released.	____________
F.6.6 Diesel started.	____________
a. Engine speed.	____________RPM
b. Generator voltage.	____________VOLTS

Data Sheet BF EMI 3-F (Continued)

		Initials/Date
F.6.7	Stop the diesel.	
F.6.8	Trace marked.	
F.6.9	Alarms reset.	
F.6.10	Acceptance criteria met.	NA
	a. First cranking time.	
	b. First coastdown and second crank.	
	c. Second coastdown and third crank.	
	d. GBP1.	
	e. GBP2.	
	f. FPR.	
	g. Speed.	
	h. Voltage.	
F.6.11	Remove oscillograph.	NA
	a. ASR ____ -1 coil (U-1 & 2) or contacts (U-3).	
	b. ZSR1 coil.	
	c. ZSR2 coil.	
	d. MSTV1 coil.	
	e. MSTV2 coil.	
	f. GBP1.	
	g. GBP2.	
	h. FPR Coil.	
F.6.12	Shift engineer notified.	

Remarks: ____

____

____

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

SURVEILLANCE INSTRUCTION 4.9.A.1.a

AUXILIARY ELECTRICAL EQUIPMENT

UNITS 1 AND 2 OR 3

Approved: H J Green
Plant Superintendent

Date: September 16, 1975

General Revision

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

DIESEL GENERATOR MONTHLY TEST

Description

This surveillance instruction is used to comply with requirements of technical specification 4.9.A.1.a. The following table lists the required surveillance items regarding this section:

Table 4.9.A.1.a - Surveillance Requirements

Frequency	Requirement
Monthly	Each diesel generator manually started.
	Each diesel generator loaded for at least 1 hour at 75% rated load or greater.
	Diesel generator starting air compressor checked for operation.
	Diesel fuel oil transfer pumps checked for operation.
	Diesel generator starting time logged.

The monthly diesel generator tests will provide information as to the condition of the diesel engines, the generators, and their associated equipment. Included in these tests are the operability of the starting air systems, the fuel oil systems, the diesel generator starting circuitry, and the diesel generator load control circuitry.

In order to check all starting situations, other surveillance tests may be incorporated into this test to provide starting signals to the diesel generators. These other surveillance tests are the Common Accident Signal Logic

<u>Description</u> (Continued)

System test (SI 4.9.A.3.a), the Start Bus 1A and 1B Undervoltage Start of the Diesel Generators (SI 4.9.A.4.a) and the 4-kV Shutdown Boards Undervoltage Start of the Diesel Generators (SI 4.9.A.4.b). By utilizing the start signals from these tests, excessive starts of the diesel generators will be avoided and all the surveillance requirements of table 4.9.A.1.a satisfied. All data entered on Data Sheet 4.9.A.1.a that is obtained from another surveillance test will be referenced as to surveillance instruction number and date that the data was taken.

SI 4.9.A.1.a
DIESEL GENERATOR MONTHLY TEST
D/G A

1. <u>Precautions</u>

   1.1 Do not perform this instruction during a condition calling for operation of the diesel generator.

   1.2 Personnel should use ear protection as applicable when running diesel generator.

2. <u>Prerequisites</u>

   2.1 Panel 9-23-7 and diesel information center manned.

   2.2 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (mechanical) or mechanical foreman as to time and date surveillance instruction is to be performed in order that MMI 6 may be performed.

   2.3 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (electrical) or electrical foreman as to time and date surveillance instruction is to be performed in order that applicable sections of EMI 3 may be performed.

3. <u>Procedure</u>

3.1 Annunciator Check

a. Engine Control Cabinet

1) Press annunciator test pushbutton and verify that bell rings and that full annunciator display panel is illuminated.

2) Press annunciator reset pushbutton and verify that bell is silenced and annunciator lights go out.

b. Diesel generator information center - panel 25-41, section A.

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

c. Panel 9-23-7, section A

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

3.2 Starting Air

a. Slowly open any one of the following drain valves until compressor No. 1 starts: 0-86-534-A, 535-A, 536-A, 537-A, 538-A. Close the valve.

b. Record pressure on "Starting air R.B." gauge on engine control cabinet.[1]

c. Record pressure on "Starting air R.B." gauge when compressor stops.[1]

[1] Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.2 Starting Air (Continued)

d. Slowly open any one of the following drain valves until compressor No. 2 starts: 0-86-516-A, 517-A, 518-A, 519-A, 520-A. Close the valve.

e. Record pressure on "Starting air L.B." gauge on engine control cabinet.(1)

f. Record pressure on "Starting air L.B." gauge when compressor stops.(1)

3.3 Fuel oil

a. Record amount of fuel in day tank.

3.4 Lube oil and cooling water

a. Verify that water is above 9 in. mark in sight glass on accessory rack.

b. Verify that lube oil is visible on crank case dipstick.

3.5 Diesel Start

a. Turn diesel generator logic breaker off (on 125-volt distribution panel).

b. Use governor control on engine control cabinet to move governor to its lowest setting. Verify setting of governor by visual observation of governor setting indicator.

c. Depress fuel prime pushbutton on engine control cabinet until fuel pressure reaches 30 psi.

d. Depress engine start pushbutton on engine control cabinet.

e. Verify diesel generator starts and levels out at 450 rpm.

f. Allow the engine to idle for 10 minutes.

3. <u>Procedure</u> (Continued)

3.5 Diesel Start (Continued)

g. Use governor control on engine control cabinet to raise the speed to 930 rpm.

h. Depress field flashing pushbutton on engine control cabinet.

i. Record generator voltage.

j. Record engine speed. (1).

k. Record cooling water level in sight glass.

l. Record lube oil level on crankcase dipstick (± inches, based on full mark).

m. Verify that panel 9-23-7 and diesel generator information center are manned.

n. Turn diesel generator logic breaker on.

o. Reset local alarms.

<u>NOTE</u>: Those RHRSW pumps not aligned for EECW service should be shutdown immediately following verification.

*p. Verify RHRSW pump A1 running annunciator at Pnl. 25-41.

*q. Verify RHRSW pump C1 running annunciator at Pnl 25-41.

*r. Verify RHRSW pump A1 running annunciator at Pnl. 9-23-7.

*s. Verify RHRSW pump C1 running annunciator at Pnl 9-23-7.

*t. Verify RHRSW pump D3 running annunciator at Pnl. 25-41.

*u. Verify RHRSW Pump B3 running annunciator at Pnl. 25-41.

*v. Verify RHRSW pump D3 running annunciator at Pnl. 9-23-7.

*w. Verify RHRSW pump B3 running annunciator at Pnl. 9-23-7.

x. Verify diesel generator A running annunciator at Pnl. 9-23-7.

y. Verify diesel generator A running annunciator at Pnl. 25-41.

z. Verify diesel generator A exhaust fan A running (visually).

3.6 Shutdown board A controls check.

a. Turn breaker 1818 control selector switch to EMERGENCY position.

b. Turn breaker 1818 synchronizing switch to ON position.

*Revision 9&D

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.6 Shutdown board A controls check (Continued)

c. Verify governor response by turning diesel generator A governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

d. Verify voltage regulator response by turning diesel generator A voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

e. Return breaker 1818 synchronizing switch to OFF position.

f. Return breaker 1818 control selector switch to NORMAL position.

3.7 Control room controls check

a. Turn breaker 1818 synchronizing switch located on panel 9-23-7 to ON position.

b. Verify governor response by turning diesel generator A governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

c. Verify voltage regulator response by turning diesel generator A voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease respectively on incoming voltmeter.

d. Return breaker 1818 synchronizing switch to OFF position.

3.8 Diesel Generator Loading

a. Verify diesel generator A operational mode switch is in PARALLEL WITH SYSTEM and associated mode light is on.

b. Turn breaker 1818 synchronizing switch to ON position.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Board A.

3. <u>Procedure</u> (Continued)

3.8 Diesel Generator Loading (Continued)

d. Close breaker 1818.

e. Increase load to 2500 KW and 1875 KVAR and maintain this l[illegible] for 1 hour.

3.9 Fuel and Lube Oil Check

a. Record the readings on the following gauges located on [illegible] engine control cabinet.

1) Fuel System 1 filter in

2) Fuel System 2 filter in

3) Lube oil engine

4) Lube oil filter in

b. Depress fuel transfer pushbutton no. 1 on engine control cabinet and verify fuel transfer pump 1 runs.

c. Depress fuel transfer pushbutton no. 2 on engine control cabinet and verify fuel transfer pump 2 runs.

3.10 Diesel generator shutdown

a. Unload diesel generator A.

b. Pull diesel generator A control switch to STOP position.

c. Verify breaker 1818 tripped.

d. Verify diesel generator speed dropped to approximately 450 rpm (engine will stop in approximately 11.5 minutes.)

e. Place breaker 1818 synchronizing switch in OFF position.

f. Reset all alarms.

3. <u>PROCEDURE</u> (Continued)

3.11 Diesel generator automatic start time

a. When diesel generator has stopped, station an operator in the diesel generator room with a stop watch. Begin timing when air start motors start to crank the engine and stop when engine speed levels.

b. Give the diesel generator an automatic start from panel 9-23 or from breaker 1818. Record starting time of diesel generator.

c. Record engine speed and generator voltage.(1)

d. Pull diesel generator A control switch to STOP position. (Engine will idle for 11.5 minutes and stop.)

e. When engine stops, reset all alarms on engine control cabinet, pnl 25-41, and pnl 9-23.

3.12 Return to Normal

a. Return all associated equipment to standby readiness (RHRSW pumps, exhaust fans).

b. Reset all alarms and recognition annunciations.

c. Turn preferred start selector switch to alternate position.

d. Verify that the diesel generator A system is in standby readiness per OI 82.

3.13 Verify by signature and date on Data Cover Sheet that the diesel generator A was tested in accordance with this instruction.

(1)Expected value and tolerance on data sheet.

DATA COVER SHEET SI 4.9.A.1.a

Diesel Generator Monthly Test

*D/G 1 & 2A

Performed By ______________________ Date ______________
Assistant Shift Engineer

Were criteria satisfied? _____ Yes _____ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)

_____ No (explain in remarks)

Verified by Shift Engineer ______________, ______________
Date

Reason for test:

_____ Maintenance complete on ______________

_____ Another system (__________________) inoperable

_____ Required by schedule

_____ Plant condition (explain) ______________________________

_____ Other (explain) ______________________________

Results reviewed ______________________________ Date ___________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________

Rescheduled

QA Staff ______________________ Date ______________

REMARKS ____

____

____

*Revision

SI-4.9.A.1.a
DATA SHEET

DIESEL GENERATOR MONTHLY TEST

*D/G 1 & 2A

NOTE: Step numbers correspond to numbers in the instruction.

Initials/Date

3.1 Annunciator check

a. Engine control cabinet

1) annunciator bell and light on ____________

2) annunciator bell and light off ____________

b. Panel 25-41

1) annunciator bell and light on ____________

2) annunciator bell and light off

c. Panel 9-23-7

1) annunciator bell and light on ____________

2) annunciator bell and light off ____________

3.2 Starting Air

a. Drain valve open-close ____________

b. R. B. Pressure Start (175 ± 8.75 lb.) ____________

c. R. B. Pressure Stop (200 ± 10 lb.) ____________

d. Drain valve open-close ____________

e. L. B. Pressure Start (175 ± 8.75 lb.) ____________

f. L. B. Pressure Stop (200 ± 10 lb.) ____________

3.3 Fuel Oil

a. Day tank fuel ____________gal.

3.4 Lube Oil and Cooling Water

a. Water > 9 in. ____________

b. Oil visible ____________

*Revision

Data Sheet SI 4.9.A.1.a (Continued)

3.5 Diesel Start	INITIALS/DATE	DATA
a. Logic breaker off		
b. Governor at low setting		
c. Fuel prime - 30 psi		
d. Start pushbutton		
e. D/G starts		
f. 10 minute idle		
g. Speed 930 rpm		
h. Field flash		
i. Voltage (1)		volts
j. Speed (905 ± 5 rpm)		rpm
k. Water level		in.
l. Oil level		in.
m. 9-23-7 and diesel information center manned		
n. Logic breaker on		
o. Alarms reset		
*p. RHRSW A1 pnl 25-41		
*q. RHRSW C1 pnl. 25-41		
*r. RHRSW A1 pnl 9-23-7		
*s. RHRSW C1 pnl 9-23-7		
*t. RHRSW D3 pnl 25-41		
*u. RHRSW B3 pnl 25-41		
*v. RHRSW D3 pnl 9-23-7		
*w. RHRSW B3 pnl 9-23-7		

(1) Tolerances for this step are listed since voltage reached from a manual start is dependent upon prior manipulation of the variable pot controlling voltage level. Ability to regulate voltage and synchronize will serve as acceptance criteria for voltage value.

*Revision JSD

Data Sheet SI 4.9.A.1.a (Continued)

Initials/Data

3.5 Diesel Start (Continued)

*x. D/G A pnl 9-23-7 ______

*y. D/G A pnl 25-41 ______

*z. Exhaust fan A on ______

3.6 Shutdown board A controls check

a. C. S. in EMERGENCY ______

b. Syn. sw. ON ______

c. Governor responds ______

d. Voltage regulator responds ______

e. Syn sw. OFF ______

f. C. S. in NORMAL ______

3.7 Control room controls check

a. Syn. sw. ON ______

b. Governor responds ______

c. Voltage regulator responds ______

d. Syn. sw. OFF ______

3.8 Diesel generator A loading

a. Mode sw, in PARALLEL WITH SYSTEM ______

b. Syn. sw. ON ______

c. In sync. with sd. bd. A ______

d. 1818 close ______

e. load - 2500 KW and 1875 KVAR ______

*Revision 11/72

Data Sheet SI 4.9.A.1.a (Continued)

		Initials/Data
3.9	Fuel and Lube Oil Check	
	a. 1) Fuel system 1	________
	2) Fuel system 2	________
	3) Lube oil engine	________
	4) Lube oil filter	________
	b. Pump 1 runs	________
	c. Pump 2 runs	________
3.10	Diesel generator A shutdown	
	a. Diesel generator unloaded	________
	b. C. S. in STOP	________
	c. 1818 tripped	________
	d. Speed at 450 rpm	________
	e. Syn. sw. OFF	________
	f. Alarms reset	________
3.11	Diesel generator automatic start	
	a. Operator at diesel	________
	b. Diesel generator start time	________ sec.
	c. Speed (905 ± 5 rpm)	________ rpm
	Voltage (4350 ± 50 volts)	________ volts
	d. Control sw. STOP	________
	e. Alarms reset	________

Data Sheet SI 4.9.A.1.a (Continued)

	Initials/Data
3.12 Return to Normal	
a. Assoc. equipment standby readiness	________
b. Alarms reset	________
c. Preferred start in alternate position	________
d. Diesel generator A standby readiness	________

REMARKS: ____

____

____

____

____

SI 4.9.A.1.a
DIESEL GENERATOR MONTHLY TEST
D/G B

1. Precautions

1.1 Do not perform this instruction during a condition calling for operation of the diesel generator.

1.2 Personnel should use ear protection as applicable when running the diesel generator.

2. Prerequisites

2.1 Panel 9-23-7 and diesel information center manned.

2.2 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (mechanical) or mechanical foreman as to time and date surveillance instruction is to be performed in order that MMI 6 may be performed.

2.3 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (electrical) or electrical foreman as to time and date surveillance instruction is to be performed in order that applicable sections of EMI 3 may be performed.

3. Procedure

3.1 Annunciator Check

a. Engine Control Cabinet

1) Press annunciator test pushbutton and verify that bell rings and that full annunciator display panel is illuminated.

2) Press annunciator reset pushbutton and verify that bell is silenced and annunciator lights go out.

3. Procedure (Continued)

3.1 Annunciator Check (Continued)

b. Diesel generator information center - panel 25-41, section B

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

c. Panel 9-23-7, section B

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

3.2 Starting Air

a. Slowly open any one of the following drain valves until compressor No. 1 starts: 0-86-534-B, 535-B, 536-B, 537-B, 538-B. Close the valve.

b. Record pressure on "Starting air R.B." gauge on engine control cabinet.(1)

c. Record pressure on "Starting air R.B." gauge when compressor stops.(1)

d. Slowly open any one of the following drain valves until compressor No. 2 starts: 0-86-516-B, 517-B, 518-B, 519-B, 520-B. Close the valve.

e. Record pressure on "Starting air L.B." gauge on engine control cabinet.(1)

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.2 Starting Air (Continued)

f. Record pressure on "Starting air L.B." gauge when compressor stops.(1)

3.3 Fuel oil

a. Record amount of fuel in day tank.

3.4 Lube oil and cooling water

a. Verify that water is above 9 in. mark in sight glass on accessory rack.

b. Verify that lube oil is visible on crank case dipstick.

3.5 Diesel Start

a. Turn diesel generator logic breaker off (on 125-volt distribution panel).

b. Use governor control on engine control cabinet to move governor to its lowest setting. Verify setting of governor by visual observation of governor setting indicator.

c. Depress fuel prime pushbutton on engine control cabinet until fuel pressure reaches 30 psi.

d. Depress engine start pushbutton on engine control cabinet.

e. Verify diesel generator starts and levels out at 450 rpm.

f. Allow the engine to idle for 10 minutes.

g. Use governor control on engine control cabinet to raise the speed to 930 rpm.

h. Depress field flashing pushbutton on engine control cabinet.

i. Record generator voltage.

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.5 Diesel Start (Continued)

j. Record engine speed. (1)

k. Record cooling water level in sight glass.

l. Record lube oil level on crankcase dipstick (± inches, based on full mark.)

m. Verify that panel 9-23-7 and diesel generator information center are manned.

n. Turn diesel generator logic breaker on.

o. Reset local alarms.

NOTE: Those RHRSW pumps not aligned for EECW service should be shutdown immediately following verification.

*p. Verify RHRSW pump B3 running annunciator at pnl 25-41.

*q. Verify RHRSW pump D3 running annunciator at pnl 25-41.

*r. Verify RHRSW pump B3 running annunciator at pnl 9-23-7.

*s. Verify RHRSW pump D3 running annunciator at pnl 9-23-7

*t. Verify RHRSW pump C1 running annunciator at pnl 25-41.

*u. Verify RHRSW pump A1 running annunciator at pnl 25-41.

*v. Verify RHRSW pump C1 running annunciator at pnl 9-23-7.

*w. Verify RHRSW pump A1 running annunciator at pnl 9-23-7.

x. Verify diesel generator B running annunciator at pnl 9-23-7.

y. Verify diesel generator B running annunciator at pnl 25-41.

z. Verify diesel generator B exhaust fan A running (visually).

3.6 Shutdown board B controls check

a. Turn breaker 1822 control selector switch to EMERGENCY position.

b. Turn breaker 1822 synchronizing switch to ON position.

c. Verify governor response by turning diesel generator B governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

(1) Expected value and tolerance on data sheet..

*Revision 9/5D

3. Procedure (Continued)

3.6 Shutdown board B controls check (Continued)

d. Verify voltage regulator response by turning diesel generator B voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

e. Return breaker 1822 synchronizing switch to OFF position.

f. Return breaker 1822 control selector switch to NORMAL position.

3.7 Control room controls check

a. Turn breaker 1822 synchronizing switch located on panel 9-23-7 to ON position.

b. Verify governor response by turning diesel generator B governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

c. Verify voltage regulator response by turning diesel generator B voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

d. Return breaker 1822 synchronizing switch to OFF position.

3.8 Diesel Generator Loading

a. Verify diesel generator B operational mode switch is in PARALLEL WITH SYSTEM and associated mode light is on.

b. Turn breaker 1822 synchronizing switch to ON position.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Board B.

d. Close breaker 1822.

e. Increase load to 2500 KW and 1875 KVAR and maintain this load for 1 hour.

3. <u>Procedure</u> (Continued)

3.9 Fuel and Lube Oil Check

a. Record the readings on the following gauges located on the engine control cabinet.

1) Fuel System 1 filter in

2) Fuel System 2 filter in

3) Lube oil engine

4) Lube oil filter in

b. Depress fuel transfer pushbutton no. 1 on engine control cabinet and verify fuel transfer pump 1 runs.

c. Depress fuel transfer pushbutton no. 2 on engine control cabinet and verify fuel transfer pump 2 runs.

3.10 Diesel generator shutdown

a. Unload diesel generator B.

b. Pull diesel generator B control switch to STOP position.

c. Verify breaker 1822 tripped.

d. Verify diesel generator speed dropped to approximately 450 rpm (engine will stop in approximately 11.5 minutes).

e. Place breaker 1822 synchronizing switch in OFF position.

f. Reset all alarms.

3.11 Diesel generator automatic start time

a. When diesel generator has stopped, station an operator in the diesel generator room with a stop watch. Begin timing when air start motors start to crank the engine and stop when engine speed levels.

3. PROCEDURE (continued)

3.11 Diesel generator automatic start time (Continued)

b. Give the diesel generator an automatic start from panel 9-23 or from breaker 1822. Record starting time of diesel generator.

c. Record engine speed and generator voltage.[1]

d. Pull diesel generator B control switch to STOP position. (Engine will idle for 11.5 minutes and stop.)

e. When engine stops, reset all alarms on engine control cabinet, panel 25-41 and panel 9-23.

3.12 Return to Normal

a. Return all associated equipment to standby readiness (RHRSW pumps, exhaust fans).

b. Reset all alarms and recognition ammunciations.

c. Turn preferred start selector switch to alternate position.

d. Verify that the diesel generator B system is in standby readiness per OI 82.

3.13 Verify by signature and data on Date Cover Sheet that the diesel generator B was tested in accordance with this instruction.

[1] Expected value and tolerance on data sheet.

DATA COVER SHEET SI 4.9.A.1.a

Diesel Generator Monthly Test

*D/G 1 & 2B

Performed By ______________________ Date ______________
Assistant Shift Engineer

Were criteria satisfied? ______ Yes ______ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? ______ Yes (explain in remarks)
______ No (explain in remarks)

Verified by Shift Engineer ______________, ______________
Date

Reason for test:

______ Maintenance complete on ______________

______ Another system (______________________) inoperable

______ Required by schedule

______ Plant condition (explain) ______________________

______ Other (explain) ______________________

Results reviewed ______________________ Date ______________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________

Rescheduled

QA Staff ______________________ Date ______________

REMARKS ____

*Revision JBD

SI 4.9.A.1.a
DATA SHEET

DIESEL GENERATOR MONTHLY TEST

*D/G 1 & 2B

NOTE: Step numbers correspond to numbers in the instruction.

	Initials/Data
3.1 Annunciator check	
a. Engine control cabinet	
1) annunciator bell and light on	______
2) annunciator bell and light off	______
b. Panel 25-41	
1) annunciator bell and light on	______
2) annunciator bell and light off	______
c. Panel 9-23-7	
1) annunciator bell and light on	______
2) annunciator bell and light off	______
3.2 Starting Air	
a. Drain valve open-close	______
b. R. B. Pressure Start (175 ± 8.75 lb.)	______
c. R. B. Pressure Stop (200 ± 10 lb.)	______
d. Drain valve open-close	______
e. L. B. Pressure Start (175 ± 8.75 lb.)	______
f. L. B. Pressure Stop (200 ± 10 lb.)	______
3.3 Fuel Oil	
a. Day tank fuel	______ gal.

*Revision [signature]

Data Sheet SI 4.9.A.1.a (Continued)

	INITIALS/DATE	DATA
3.4 Lube Oil and Cooling Water		
a. Water > 9 in.	________	
b. Oil visible	________	
3.5 Diesel Start		
a. Logic breaker off	________	
b. Governor at low setting	________	
c. Fuel prime - 30 psi	________	
d. Start pushbutton	________	
e. D/G starts	________	
f. 10 minute idle	________	
g. Speed 930 rpm	________	
h. Field flash	________	
i. Voltage (1)	________	volts ____
j. Speed (905 ± 5 rpm)	________	rpm ____
k. Water level	________	in. ____
l. Oil level	________	in. ____
m. 9-23-7 and diesel information center manned	________	
n. Logic breaker on	________	
o. Alarms reset	________	
*p. RHRSW B3 pnl 25-41	________	
*q. RHRSW D3 pnl 25-41	________	
*r. RHRSW B3 pnl 9-23-7	________	
*s. RHRSW D3 pnl 25-41	________	

(1) Tolerances for this step are not listed since voltage reached from a manual start is dependent upon prior manipulation of the variable pot controlling voltage level. Ability to regulate voltage and synchronize will serve as acceptance criteria for voltage value.

*Revision JBD

Data Sheet SI 4.9.A.1.a (Continued)

	INITIALS/DATE
3.5 Diesel Start (Continued)	
*t. RHRSW C1 pnl 25-41	______
*u. RHRSW A1 pnl 25-41	______
*v. RHRSW C1 pnl 9-23-7	______
*w. RHRSW A1 pnl 9-23-7	______
x. D/G B pnl 9-23-7	______
y. D/G B pnl 25-41	______
z. Exhaust fan A on	______
3.6 Shutdown board B controls check	
a. C. S. in EMERGENCY	______
b. Syn. sw. ON	______
c. Governor responds	______
d. Voltage regulator responds	______
e. Syn sw. OFF	______
f. C. S. in NORMAL	______
3.7 Control room controls check	
a. Syn. sw. ON	______
b. Governor responds	______
c. Voltage regulator responds	______
d. Syn. sw. OFF	______
*3.8 Diesel generator B loading	
*a. Mode sw. in PARALLEL WITH SYSTEM	______
*b. Syn. sw. ON	______
*c. In sync. with sd. bd. B	______

*Revision JBW

Data Sheet SI 4.9.A.1.a (Continued)

Initials/Data

3.8 Diesel generator B loading (Continued)

d. 1822 close ________

e. Load - 2500 KW and 1875 KVAR ________

3.9 Fuel and Lube Oil Check

a. 1) Fuel system 1 ________

2) Fuel system 2 ________

3) Lube oil engine ________

4) Lube oil filter ________

b. Pump 1 runs ________

c. Pump 2 runs ________

3.10 Diesel generator B shutdown ________

a. Diesel generator unloaded ________

b. C. S. in STOP ________

c. 1822 tripped ________

d. Speed at 450 rpm ________

e. Syn. sw. OFF ________

f. Alarms reset ________

3.11 Diesel generator automatic start time

a. Operator at diesel ________

b. Diesel generator start time ________

c. Speed (905 ± 5 rpm) ________

Voltage (4350 ± 50 volts) ________

d. Control sw. STOP ________

e. Alarms reset ________

Data Sheet SI 4.9.A.1.a (Continued)

Initials/Data

3.12 Return to Normal

a. Assoc. equipment standby readiness ____________

b. Alarms reset ____________

c. Preferred start in alternate position ____________

d. Diesel generator B standby readiness ____________

REMARKS: ____

SI 4.9.A.1.a
DIESEL GENERATOR MONTHLY TEST
D/G C

1. Precautions

1.1 Do not perform this instruction during a condition calling for operation of the diesel generator.

1.2 Personnel should use ear protection as applicable when running the diesel generator.

2. Prerequisites

2.1 Panel 9-23-8 and diesel information center manned.

2.2 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (mechanical) or mechanical foreman as to time and date surveillance instruction is to be performed in order that MMI 6 may be performed.

2.3 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (electrical) or electrical foreman as to time and date surveillance instruction is to be performed in order that applicable sections of EMI 3 may be performed.

3. Procedure

3.1 Annunciator Check

a. Engine Control Cabinet

1) Press annunciator test pushbutton and verify that bell rings and that full annunciator display panel is illuminated.

2) Press annunciator reset pushbutton and verify that bell is silenced and annunciator lights go out.

3. Procedure (Continued)

3.1 Annunciator Check (Continued)

b. Diesel generator information center - panel 25-41, section C

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Press annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

c. Panel 9-23-8, section C

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

3.2 Starting Air

a. Slowly open any one of the following drain valves until compressor No. 1 starts: 0-86-534-C, 535-C, 536-C, 537-C, 538-C. Close the valve.

b. Record pressure on "Starting air R.B." gauge on engine control cabinet.(1)

c. Record pressure on "Starting air R.B." gauge on engine control cabinet.(1)

d. Slowly open any one of the following drain valves until compressor No. 2 starts: 0-86-516-C, 517-C, 518-C, 519-C, 520-C. Close the valve.

e. Record pressure on "Starting air L.B." gauge on engine control cabinet.(1)

f. Record pressure on "Starting air L.B." gauge when compressor stops.(1)

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.3 Fuel oil

a. Record amount of fuel in day tank.

3.4 Lube oil and cooling water

a. Verify that water is above 9 in. mark in sight glass on accessory rack.

b. Verify that lube oil is visible on crankcase dipstick.

3.5 Diesel Start

a. Turn diesel generator logic breaker off (on 125-volt distribution panel).

b. Use governor control on engine control cabinet to move governor to its lowest setting. Verify setting of governor by visual observation of governor setting indicator.

c. Depress fuel prime pushbutton on engine control cabinet until fuel pressure reaches 30 psi.

d. Depress engine start pushbutton on engine control cabinet.

e. Verify diesel generator starts and levels out at 450 rpm.

f. Allow the engine to idle for 10 minutes.

g. Use governor control on engine control cabinet to raise the speed to 930 rpm.

h. Depress field flashing pushbutton on engine control cabinet.

i. Record generator voltage.

j. Record engine speed.(1)

k. Record cooling water level in sight glass.

l. Record lube oil level on crankcase dipstick (± inches, based on full mark.)

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.5 Diesel Start (Continued)

m. Verify that panel 9-23-8 and diesel generator information center are manned.

n. Turn diesel generator logic breaker on.

o. Reset local alarms.

NOTE: Those RHRSW pumps not aligned for EECW service should be shutdown immediately following annunciator verification.

*p. Verify RHRSW pump B3 running annunciator at pnl 25-41.

*q. Verify RHRSW pump D3 running annunciator at pnl 25-41.

*r. Verify RHRSW pump B3 running annunciator at pnl 9-23-8.

*s. Verify RHRSW pump D3 running annunciator at pnl 9-23-8.

*t. Verify RHRSW pump C1 running annunciator at pnl 25-41.

*u. Verify RHRSW pump A1 running annunciator at pnl 25-41.

*v. Verify RHRSW pump C1 running annunciator at pnl 9-23-8.

*w. Verify RHRSW pump A1 running annunciator at pnl 9-23-8.

x. Verify diesel generator C running annunciator at pnl 9-23-8.

y. Verify diesel generator C running annunciator at pnl 25-41.

z. Verify diesel generator C exhaust fan A running (visually).

3.6 Shutdown board C controls check

a. Turn breaker 1812 control selector switch to EMERGENCY position.

b. Turn breaker 1812 synchronizing switch to ON position.

c. Verify governor response by turning diesel generator C governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

d. Verify voltage regulator response by turning diesel generator C voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

e. Return breaker 1812 synchronizing switch to OFF position.

f. Return breaker 1812 control selector switch to NORMAL position.

*Revision JBD

3. <u>Procedure</u> (Continued)

3.7 Control room controls check

a. Turn breaker 1812 synchronizing switch located on panel 9-23-8 to ON position.

b. Verify governor response by turning diesel generator C governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

c. Verify voltage regulator response by turning diesel generator C voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

d. Return breaker 1812 synchronizing switch to OFF position.

3.8 Diesel Generator Loading

a. Verify diesel generator C operational mode switch is in PARALLEL WITH SYSTEM and associated mode light is on.

b. Turn breaker 1812 synchronizing switch to ON position.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Board C.

d. Close breaker 1812.

e. Increase load to 2500 KW and 1875 KVAR and maintain this load for 1 hour.

3.9 Fuel and Lube Oil Check

a. Record the readings on the following gauges located on the engine control cabinet.

1) Fuel System 1 filter in

2) Fuel System 2 filter in

3) Lube oil engine

4) Lube oil filter in

3. <u>Procedure</u> (Continued)

3.9 Fuel and Lube Oil Check (Continued)

b. Depress fuel transfer pushbutton no. 1 on engine control cabinet and verify fuel transfer pump 1 runs.

c. Depress fuel transfer pushbutton no. 2 on engine control cabinet and verify fuel transfer pump 2 runs.

3.10 Diesel generator shutdown and return to normal

a. Unload diesel generator C.

b. Pull diesel generator C control switch to STOP position.

c. Verify breaker 1812 tripped.

d. Verify diesel generator speed dropped to approximately 450 rpm (engine will stop in approximately 11.5 minutes.

e. Place breaker 1812 synchronizing switch in OFF position.

f. Reset all alarms.

3.11 Diesel generator automatic start time

a. When diesel generator has stopped, station an operator in the diesel generator room with a stop watch. Begin timing when air start motors start to crank the engine and stop when engine speed levels.

b. Give the diesel generator an automatic start from panel 9-23 or from breaker 1812. Record starting time of diesel generator.

c. Record engine speed and generator voltage.(1)

d. Pull diesel generator C control switch to STOP position. (Engine will idle for 11.5 minutes and stop.

e. When engine stops, reset all alarms on engine control cabinet, pnl 25-41, and pnl 9-23.

(1)Expected value and tolerance on data sheet.

3. <u>Procedure</u> (Continued)

3.12 Return to Normal

a. Return all associated equipment to standby readiness (RHRSW pumps, exhaust fans).

b. Reset all alarms and recognition annunciations.

c. Turn preferred start selector switch to alternate position.

d. Verify that the diesel generator C system is in standby readiness per OI 82.

3.13 Verify by signature and date on Data Cover Sheet that the diesel generator C was tested in accordance with this instruction.

DATA COVER SHEET SI 4.9.A.1.a

Diesel Generator Monthly Test

*D/G 1 & 2C

Performed By ______________________ Date ______________
Assistant Shift Engineer

Were criteria satisfied? _____ Yes _____ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ______________, ______________
Date

Reason for test:

_____ Maintenance complete on ______________

_____ Another system (______________________) inoperable

_____ Required by schedule

_____ Plant condition (explain) ______________________________

_____ Other (explain) ______________________________

Results reviewed ______________________________ Date ______________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________

Rescheduled

QA Staff ______________________ Date ______________

REMARKS ____

____

____

*Revision 9.b.d

SI 4.9.A.1.a
DATA SHEET

DIESEL GENERATOR MONTHLY TEST

*D/G 1 & 2C

NOTE: Step numbers correspond to numbers in the instruction.

		Initials/Data
3.1	Annunciator check	
	a. Engine control cabinet	
	1) annunciator bell and light on	______
	2) annunciator bell and light off	______
	b. Panel 25-41	
	1) annunciator bell and light on	______
	2) annunciator bell and light off	______
	c. Panel 9-23-8	
	1) annunciator bell and light on	______
	2) annunciator bell and light off	______
3.2	Starting Air	
	a. Drain valve open-close	______
	b. R. B. Pressure Start (175 ± 8.75 lb.)	______
	c. R. B. Pressure Stop (200 ± 10 lb.)	______
	d. Drain valve open-close	______
	e. L. B. Pressure Start (175 ± 8.75 lb.)	______
	f. L. B. Pressure Stop (200 ± 10 lb.)	______
3.3	Fuel Oil	
	a. Day tank fuel	______

*Revision

Data Sheet SI 4.9.A.1.a (Continued)

	Initials/Data
3.4 Lube oil and Cooling Water	
a. Water > 9 in.	______
b. Oil visible	______
3.5 Diesel Start	
a. Logic breaker off	______
b. Governor at low setting	______
c. Fuel prime - 30 psi	______
d. Start pushbutton	______
e. D/G Starts	______
f. 10 minute idle	______
g. Speed 930 rpm	______
h. Field flash	______
i. Voltage (1)	______ volts
j. Speed (905 ± 5 rpm)	______ rpm
k. Water level	______ in.
l. Oil level	______ in.
m. 9-23-8 and diesel information center manned	______
n. Logic breaker on	______
o. Alarms reset	______

(1) Tolerances for this step are not listed since voltage reached from a manual start is dependent upon prior manipulation of the variable pot controlling voltage level. Ability to regulate voltage and synchronize will serve as acceptance criteria for voltage value.

Data Sheet SI 4.9.A.1.a (Continued)

		Initials/Date
3.5	Diesel Start (Continued)	
*p.	RHRSW B3 pnl 25-41	________
*q.	RHRSW D3 pnl 25-41	________
*r.	RHRSW B3 pnl 9-23-8	________
*s.	RHRSW D3 pnl 9-23-8	________
*t.	RHRSW C1 pnl 25-41	________
*u.	RHRSW A1 pnl 25-41	________
*v.	RHRSW C1 pnl 9-23-8	________
*w.	RHRSW A1 pnl 9-23-8	________
x.	D/G C pnl 9-23-8	________
y.	D/G C pnl 25-41	________
z.	Exhaust fan A on	________
3.6	Shutdown board C controls check	
a.	C. S. in EMERGENCY	________
b.	Syn. sw. ON	________
c.	Governor responds	________
d.	Voltage regulator responds	________
e.	Syn. sw. OFF	________
f.	C. S. in NORMAL	________
3.7	Control room controls check	
a.	Syn. sw. ON	________
b.	Governor responds	________
c.	Voltage regulator responds	________
d.	Syn. sw. OFF	________
3.8	Diesel generator C loading	
a.	Mode sw. in PARALLEL WITH SYSTEM	________
b.	Syn. sw. ON	________
c.	In sync. with sd. bd. C	________

*Revision 9&D

Data Sheet SI 4.9.A.1.a (Continued)

		Initials/Data
3.8 Diesel generator C loading (Continued)		
d. 1812 close	______	
e. Load - 2500 KW and 1875 KVAR	______	
3.9 Fuel and Lube Oil Check		
a. 1) Fuel system 1	______	
2) Fuel system 2	______	
3) Lube oil engine	______	
4) Lube oil filter	______	
b. Pump 1 runs	______	
c. Pump 2 runs	______	
3.10 Diesel generator C shutdown		
a. Diesel generator unloaded	______	
b. C. S. in STOP	______	
c. 1812 tripped	______	
d. Speed at 450 rpm	______	
e. Syn. sw. OFF	______	
f. Alarms reset	______	
3.11 Diesel generator automatic start time		
a. Operator at diesel	______	
b. Diesel generator start time	______	sec.
c. Speed (905 ± 5 rpm)	______	rpm
Voltage (4350 ± 50 volts)	______	volts
d. Control sw. STOP	______	
e. Alarms reset	______	

Data Sheet SI 4.9.A.1.a (Continued)

Initials/Data

3.12 Return to Normal

a. Assoc. equipment standby readiness ____________

b. Alarms reset ____________

c. Preferred start in alternate position ____________

d. Diesel generator C standby readiness ____________

REMARKS: ____

SI 4.9.A.1.a
DIESEL GENERATOR MONTHLY TEST
D/G D

1. Precautions

1.1 Do not perform this instruction during a condition calling for operation of the diesel generator.

1.2 Personnel should use ear protection as applicable when running the diesel generator.

2. Prerequisites

2.1 Panel 9-23-8 and diesel information center manned.

2.2 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (mechanical) or mechanical foreman as to time and date surveillance instruction is to be performed in order that MMI 6 may be performed.

2.3 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (electrical) or electrical foreman as to time and date surveillance instruction is to be performed so that applicable sections of EMI 3 may be performed.

3. Procedure

3.1 Annunciator Check

a. Engine Control Cabinet

1) Press annunciator test pushbutton and verify that bell rings and that full annunciator display panel is illuminated.

2) Press annunciator reset pushbutton and verify that bell is silenced and annunciator lights go out.

3. <u>Procedure</u> (Continued)

3.1 Annunciator Check (Continued)

b. Diesel generator information center - panel 25-41, section D

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

c. Panel 9-23-8, section D

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

3.2 Starting Air

a. Slowly open any one of the following drain valves until compressor No. 1 starts: 0-86-534-D, 535-D, 536-D, 537-D, 538-D. Close the valve.

b. Record pressure on "Starting air R.B." gauge on engine control cabinet.(1)

c. Record pressure on "Starting air R.B." gauge when compressor stops.(1)

d. Slowly open any one of the following drain valves until compressor No. 2 starts: 0-86-516-D, 517-D, 518-D, 519-D, 520-D. Close the valve.

e. Record pressure on "Starting air L.B." gauge on engine control cabinet.(1)

f. Record pressure on "Starting air L.B." gauge when compressor stops.(1)

(1)Expected value and tolerance on data sheet

3. Procedure (Continued)

3.3 Fuel oil

a. Record amount of fuel in day tank.

3.4 Lube oil and cooling water

a. Verify that water is above 9 in. mark in sight glass on accessory rack.

b. Verify that lube oil is visible on crank case dipstick.

3.5 Diesel Start

a. Turn diesel generator logic breaker off (on 125-volt distribution panel).

b. Use governor control on engine control cabinet to move governor to its lowest setting. Verify setting of governor by visual observation of governor setting indicator.

c. Depress fuel prime pushbutton on engine control cabinet until fuel pressure reaches 30 psi.

d. Depress engine start pushbutton on engine control cabinet.

e. Verify diesel generator starts and levels out at 450 rpm.

f. Allow the engine to idle for 10 minutes.

g. Use governor control on engine control cabinet to raise the speed to 930 rpm.

h. Depress field flashing pushbutton on engine control cabinet.

i. Record generator voltage.

j. Record engine speed.[1]

k. Record cooling water level in sight glass.

[1] Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.5 Diesel Start (Continued)

l. Record lube oil level on crankcase dipstick (± inches, based on full mark.)

m. Verify that panel 9-23-8 and diesel generator information center are manned.

n. Turn diesel generator logic breaker on.

o. Reset local alarms.

NOTE: Those RHRSW pumps not aligned for EECW service should be shutdown immediately following annunciator verification.

*p. Verify RHRSW pump A1 running annunciator at pnl 25-41.

*q. Verify RHRSW pump C1 running annunciator at pnl 25-41.

*r. Verify RHRSW pump A1 running annunciator at pnl 9-23-8.

*s. Verify RHRSW pump C1 running annunciator at pnl 9-23-8.

*t. Verify RHRSW pump D3 running annunciator at pnl 25-41.

*u. Verify RHRSW pump B3 running annunciator at pnl 25-41.

*v. Verify RHRSW pump D3 running annunciator at pnl 9-23-8.

*w. Verify RHRSW pump B3 running annunciator at pnl 9-23-8.

x. Verify diesel generator D running annunciator at pnl 9-23-8.

y. Verify diesel generator D running annunciator at pnl 25-41.

z. Verify diesel generator D exhaust fan A running (visually).

3.6 Shutdown board D controls check

a. Turn breaker 1816 control selector switch to EMERGENCY position.

b. Turn breaker 1816 synchronizing switch to ON position.

c. Verify governor response by turning diesel generator D governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

d. Verify voltage regulator response by turning diesel generator D voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

*Revision JBD

3. <u>Procedure</u> (Continued)

3.6 Shutdown board D controls check (Continued)

e. Return breaker 1816 synchronizing switch to OFF position.

f. Return breaker 1816 control selector switch to NORMAL position.

3.7 Control room controls check

a. Turn breaker 1816 synchronizing switch located on panel 9-23-8 to ON position.

b. Verify governor response by turning diesel generator D governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

c. Verify voltage regulator response by turning diesel generator D voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

d. Return breaker 1816 synchronizing switch to OFF position.

3.8 Diesel generator loading

a. Verify diesel generator D operational mode switch in PARALLEL WITH SYSTEM and associated mode light is on.

b. Turn breaker 1816 synchronizing switch to ON position.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Board D.

d. Close breaker 1816.

e. Increase load to 2500 KW and 1875 KVAR and maintain this load for 1 hour.

3. <u>Procedure</u> (Continued)

3.9 Fuel and Lube Oil Check

a. Record the readings on the following gauges located on the engine control cabinet.

1) Fuel System 1 filter in

2) Fuel System 2 filter in

3) Lube oil engine

4) Lube oil filter in

b. Depress fuel transfer pushbutton no. 1 on engine control cabinet and verify fuel transfer pump 1 runs.

c. Depress fuel transfer pushbutton no. 2 on engine control cabinet and verify fuel transfer pump 2 runs.

3.10 Diesel generator shutdown

a. Unload diesel generator D.

b. Pull diesel generator D control switch to STOP position.

c. Verify breaker 1816 tripped.

d. Verify diesel generator speed dropped to approximately 450 rpm (engine will stop in approximately 11.5 minutes.).

e. Place breaker 1816 synchronizing switch in OFF position.

f. Reset all alarms.

3.11 Diesel generator automatic start time

a. When diesel generator has stopped, station an operator in the diesel generator room with a stop watch. Begin timing when air start motors start to crank the engine and stop when engine speed levels.

3. <u>Procedure</u> (Continued)

3.11 Diesel generator automatic start time (Continued)

b. Give the diesel generator an automatic start from panel 9-23 or from breaker 1816. Record starting time of diesel generator.(1)

c. Record engine speed and generator voltage.

d. Pull diesel generator D control switch to STOP position. (Engine will idle for 11.5 minutes and stop).

e. When engine stops, reset all alarms on engine control cabinet, panel 25-41, and panel 9-23.

3.12 Return to Normal

a. Return all associated equipment to standby readiness (RHRSW pumps, exhaust fans).

b. Reset all alarms and recognition annunciations.

c. Turn preferred start selector switch to alternate position.

d. Verify that the diesel generator D system is in standby readiness per OI 82.

3.13 Verify by signature and date on Data Cover Sheet that the diesel generator D was tested in accordance with this instruction.

(1) Expected value and tolerance on data sheet.

DATA COVER SHEET SI 4.9.A.1.a

Diesel Generator Monthly Test

*D/G 1 & 2D

Performed By ______________________ Date ______________
Assistant Shift Engineer

Were criteria satisfied? ______ Yes ______ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? ______ Yes (explain in remarks)
______ No (explain in remarks)

Verified by Shift Engineer ______________, ______________
Date

Reason for test:

______ Maintenance complete on ______________

______ Another system (______________________) inoperable

______ Required by schedule

______ Plant condition (explain) ______________________________

______ Other (explain) ______________________________

Results reviewed ______________________________ Date ______________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________

Rescheduled

QA Staff ______________________ Date ______________

REMARKS ____

____

____

*Revision 9/82

SI 4.9.A.1.a
DATA SHEET

DIESEL GENERATOR MONTHLY TEST

*D/G 1 & 2D

NOTE: Step numbers correspond to numbers in the instruction.

	Initials/Date
3.1 Annunciator check	
a. Engine control cabinet	
1) annunciator bell and light on	______
2) annunciator bell and light off	______
b. Panel 25-41	
1) annunciator bell and light on	______
2) annunciator bell and light off	______
c. Panel 9-23-8	
1) annunciator bell and light on	______
2) annunciator bell and light off	______
3.2 Starting Air	
a. Drain valve open-close	______
b. R. B. Pressure Start (175 ± 8.75 lb.)	______
c. R. B. Pressure Stop (200 ± 10 lb.)	______
d. Drain valve open-close	______
e. L. B. Pressure Start (175 ± 8.75 lb.)	______
f. L. B. Pressure Stop (200 ± 10 lb.)	______
3.3 Fuel Oil	
a. Day tank fuel	______ gal.

*Revision

Data Sheet SI 4.9.A.1.a (Continued)

		INITIALS/DATE	
3.4	Lube Oil and Cooling Water		
	a. Water > 9 in.	______	
	b. Oil visible	______	
3.5	Diesel Start		
	a. Logic breaker off	______	
	b. Governor at low setting	______	
	c. Fuel prime - 30 psi	______	
	d. Start pushbutton	______	
	e. D/G Starts	______	
	f. 10 minute idle	______	
	g. Speed 930 rpm	______	
	h. Field flash	______	
	i. Voltage (1)	______	volts
	j. Speed (905 ± 5 rpm)	______	rpm
	k. Water level	______	in.
	l. Oil level	______	in.
	m. 9-23-8 and diesel information center manned	______	
	n. Logic breaker on	______	
	o. Alarms reset	______	
	*p. RHRSW A1 pnl 25-41	______	
	*q. RHRSW C1 pnl 25-41	______	

(1) Tolerances for this step are not listed since voltage reached from a manual start is dependent upon prior manipulation of the variable pot controlling voltage level. Ability to regulate voltage and synchronize will serve as acceptance criteria for voltage value.

*Revision JBD

Data Sheet SI 4.9.A.1.a (Continued)

INITIALS/DATE

3.5 Diesel Start (Continued)

*r. RHRSW A1 pnl 9-23-8 ______

*s. RHRSW C1 pnl 9-23-8 ______

*t. RHRSW D3 pnl 25-41 ______

*u. RHRSW B3 pnl 25-41 ______

*v. RHRSW D3 pnl 9-23-8 ______

*w. RHRSW B3 pnl 9-23-8 ______

x. D/G D pnl 9-23-8 ______

y. D/G D pnl 25-41 ______

z. Exhaust fan A on ______

3.6 Shutdown board D controls check

a. C. S. in EMERGENCY ______

b. Syn. sw. ON ______

c. Governor responds ______

d. Voltage regulator responds ______

e. Syn. sw. OFF ______

f. C. S. in NORMAL ______

3.7 Control room controls check

a. Syn. sw. ON ______

b. Governor responds ______

c. Voltage regulator responds ______

d. Syn. sw. OFF ______

3.8 Diesel generator D loading ______

a. Mode sw. in PARALLEL WITH SYSTEM ______

b. Syn. sw. ON ______

c. In sync. with sd. bd. D ______

*Revision

Data Sheet SI 4.9.A.1.a (Continued)

	Initials/Data
3.8 Diesel generator D loading (Continued)	
d. 1816 close	______
e. Load - 2500 KW and 1875 KVAR	______
3.9 Fuel and Lube Oil Check	
a. 1) Fuel system 1	______
2) Fuel system 2	______
3) Lube oil engine	______
4) Lube oil filter	______
b. Pump 1 runs	______
c. Pump 2 runs	______
3.10 Diesel generator D shutdown	
a. Diesel generator unloaded	______
b. C. S. in STOP	______
c. 1816 tripped	______
d. Speed at 450 rpm	______
e. Syn. sw. OFF	______
f. Alarms reset	______
3.11 Diesel generator automatic start time	
a. Operator at diesel	______
b. Diesel generator start time	______ sec.
c. Speed (905 $\pm$ 5 rpm)	______ rpm
Voltage (4350 $\pm$ 50 volts)	______ volts
d. Control sw. STOP	______
e. Alarms reset	______

Data Sheet SI 4.9.A.1.a (Continued)

Initials/Data

3.12 Return to Normal

a. Assoc. equipment standby readiness ______

b. Alarms reset ______

c. Preferred start in alternate position ______

d. Diesel generator D standby readiness ______

REMARKS: ______

SI 4.9.A.1.a
DIESEL GENERATOR MONTHLY TEST
D/G 3A

1. Precautions

   1.1 Do not perform this instruction during a condition calling for operation of the diesel generator.

   1.2 Personnel should use ear protection as applicable when running the diesel generator.

2. Prerequisites

   2.1 Panel 3-9-23 and shutdown board room 3EA manned.

   2.2 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (mechanical) or mechanical foreman as to time and date surveillance instruction is to be performed in order that MMI 6 may be performed.

   2.3 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (electrical) or electrical foreman as to time and date surveillance instruction is to be performed in order that applicable sections of EMI 3 may be performed.

3. Procedure

   3.1 Annunciator Check

      a. Engine Control Cabinet

         1) Press annunciator test pushbutton and verify that bell rings and that full annunciator display panel is illuminated.

         2) Press annunciator reset pushbutton and verify that bell is silenced and annunciator lights go out.

3. <u>Procedure</u> (Continued)

3.1 Annunciator Check (Continued)

b. Shutdown Board room 3EA

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

c. Panel 3-9-23

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

3.2 Starting Air

a. Slowly open any one of the following drain valves until compressor No. 1 starts: 0-86-584-3A, 585-3A, -586-3A, -587-3A, 588-3A. Close the valve.

b. Record pressure on "Starting air R.B." gauge on engine control cabinet.(1)

c. Record pressure on "Starting air R.B." gauge when compressor stops.(1)

d. Slowly open any one of the following drain valves until compressor No. 2 starts: 0-86-566-3A, -567-3A, -568-3A, 569-3A, -570-3A. Close the valve.

e. Record pressure on "Starting air L.B." gauge on engine control cabinet.(1)

f. Record pressure on "Starting air L.B." gauge when compressor stops.(1)

(1)Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.3 Fuel oil

a. Record amount of fuel in day tank.

3.4 Lube oil and cooling water

a. Verify that water is above 9 in. mark in sight glass on accessory rack.

b. Verify that lube oil is visible on crankcase dipstick.

3.5 Diesel Start

a. Turn diesel generator logic breaker off (on 125-volt distribution panel).

b. Use governor control on engine control cabinet to move governor to its lowest setting. Verify setting of governor by visual observation of governor setting indicator.

c. Depress fuel prime pushbutton on engine control cabinet until fuel pressure reaches 30 psi.

d. Depress engine start pushbutton on engine control cabinet.

e. Verify diesel generator starts and levels out at 450 rpm.

f. Allow the engine to idle for 10 minutes.

g. Use governor control on engine control cabinet to raise the speed to 930 rpm.

h. Depress field flashing pushbutton on engine control cabinet.

i. Record generator voltage.

j. Record engine speed.(1)

k. Record cooling water level in sight glass.

l. Record lube oil level on crankcase dipstick (± inches, based on full mark).

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.5 Diesel Start (Continued)

m. Verify that panel 3-9-23 and shutdown board room 3EA are manned.

n. Turn diesel generator logic breaker on.

o. Reset local alarms.

*p. Verify RHRSW pump A3 running annunciator at Pnl. 3-9-23.

*q. Verify RHRSW pump C3 running annunciator at Pnl. 3-9-23.

*r. Verify RHRSW pump B1 running annunciator at Pnl. 3-9-23.

*s. Verify RHRSW pump D1 running annunciator at Pnl. 3-9-23.

t. Verify diesel generator 3A running annunciator at Pnl. 3-9-23.

u. Verify diesel generator 3A running annunciator at shutdown board room 3EA.

v. Verify diesel generator 3A exhaust fan A running (visually).

3.6 Shutdown board 3EA controls check

a. Turn breaker 1838 control selector switch and CS43-3A to EMERGENCY position.

b. Turn breaker 1838 synchronizing switch to ON position.

c. Verify governor response by turning diesel generator 3A governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

d. Verify voltage regulator response by turning diesel generator 3A voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

e. Return breaker 1838 synchronizing switch to OFF position.

f. Return breaker 1838 control selector switch and CS43-3A to NORMAL position.

*Revision JBD

3. <u>Procedure</u> (Continued)

3.7 Control room controls check

a. Turn breaker 1838 synchronizing switch located on panel 3-9-23 to ON position.

b. Verify governor response by turning diesel generator 3A governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

c. Verify voltage regulator response by turning diesel generator 3A voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

d. Return breaker 1838 synchronizing switch to OFF position.

3.8 Diesel Generator Loading

a. Verify diesel generator 3A operational mode switch is in PARALLEL WITH SYSTEM and associated mode light is on.

b. Turn breaker 1838 synchronizing switch to ON position.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Board 3EA.

d. Close breaker 1838.

e. Increase load to 2500 KW and 1875 KVAR and maintain this load for 1 hour.

3.9 Fuel and Lube Oil Check

a. Record the readings on the following gauges located on the engine control cabinet.

1) Fuel System 1 filter in

2) Fuel System 2 filter in

3) Lube oil engine

4) Lube oil filter in

3. Procedure (Continued)

3.9 Fuel and Lube Oil Check (Continued)

b. Depress fuel transfer pushbutton no. 1 on engine control cabinet and verify fuel transfer pump 1 runs.

c. Depress fuel transfer pushbutton no. 2 on engine control cabinet and verify fuel transfer pump 2 runs.

3.10 Diesel generator shutdown

a. Unload diesel generator 3A.

b. Pull diesel generator 3A control switch to STOP position.

c. Verify breaker 1838 tripped.

d. Verify diesel generator speed dropped to approximately 450 rpm (engine will stop in approximately 11.5 minutes).

e. Place breaker 1838 synchronizing switch in OFF position.

f. Reset all alarms.

3.11 Diesel generator automatic start time

a. When diesel generator has stopped, station an operator in the diesel generator room with a stop watch. Begin timing when air start motors start to crank the engine and stop when engine speed levels.

b. Give the diesel generator an automatic start from panel 3-9-23 or from breaker 1838. Record starting time of diesel generator.

c. Record engine speed and generator voltage.(1)

d. Pull diesel generator 3A control switch to STOP position. (Engine will idle for 11.5 minutes and stop.)

e. When engine stops, reset all alarms on engine control cabinet, pnl. 3-9-23 and shutdown board room 3EA.

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.12 Return to Normal

a. Return all associated equipment to standby readiness (RHRSW pumps, exhaust fans).

b. Reset all alarms and recognition annunciations.

c. Turn preferred start selector switch to alternate position.

d. Verify that the diesel generator 3A system is in standby readiness per OI 82.

3.13 Verify by signature and date on Data Cover Sheet that the diesel generator 3A was tested in accordance with this instruction.

DATA COVER SHEET SI 4.9.A.1.a

Diesel Generator Monthly Test

D/G 3A

Performed By ______________________ Date ______________
Assistant Shift Engineer

Were criteria satisfied? ______ Yes ______ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? ______ Yes (explain in remarks)
______ No (explain in remarks)

Verified by Shift Engineer ______________, ______________
Date

Reason for test:

______ Maintenance complete on ______________.

______ Another system (______________) inoperable

______ Required by schedule

______ Plant condition (explain) ______________________

______ Other (explain) ______________________

Results reviewed ______________________ Date ______________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________

Rescheduled

QA Staff ______________________ Date ______________

REMARKS ____

____

____

SI 4.9.A.1.a
DATA SHEET

Diesel Generator Monthly Test
D/G 3A

<u>NOTE</u>: Step numbers correspond to numbers in the instruction.

	Initials/Data
3.1 Annunciator check	
a. Engine control cabinet	
1) annunciator bell and light on	______
2) annunciator bell and light off	______
b. Shutdown Board Room 3EA	
1) annunciator bell and light on	______
2) annunciator bell and light off	______
c. Panel 3-9-23	
1) annunciator bell and light on	______
2) annunciator bell and light off	______
3.2 Starting Air	
a. Drain valve open-close	______
b. R. B. Pressure Start (175 ± 5 lb.)	______
c. R. B. Pressure Stop (200 ± 5 lb.)	______
d. Drain valve open-close	______
e. L. B. Pressure Start (175 ± 5 lb.)	______
f. L. B. Pressure Stop (200 ± 5 lb.)	______
3.3 Fuel Oil	
a. Day tank fuel	______ gal.

Data Sheet SI 4.9.A.1.a (Continued)

		INITIALS/DATE		DAT
3.4	Lube Oil and Cooling Water			
	a. Water > 9 in.	____________		
	b. Oil visible	____________		
3.5	Diesel Start			
	a. Logic breaker off	____________		
	b. Governor at low setting	____________		
	c. Fuel prime - 30 psi	____________		
	d. Start pushbutton	____________		
	e. D/G starts	____________		
	f. 10 minute idle	____________		
	g. Speed 930 rpm	____________		
	h. Field flash	____________		
	i. Voltage(1)	____________	volts	____
	j. Speed (905 ±5 rpm)	____________	rpm	____
	k. Water level	____________	in.	____
	l. Oil level	____________	in.	____
	m. 3-9-23 and shutdown board room 3EA	____________		
	n. Logic breaker on	____________		
	o. Alarms reset	____________		
	*p. RHRSW A3 pnl 3-9-23	____________		
	*q. RHRSW C3 pnl 3-9-23	____________		
	*r. RHRSW B1 pnl 3-9-23	____________		
	*s. RHRSW D1 pnl 3-9-23	____________		

(1) Tolerances for this step are not listed since voltage reached from a manual start is dependent upon prior manipulation of the variable pot controlling voltage level. Ability to regulate voltage and synchronize will serve as acceptance criteria for voltage value.

*Revision 20

Data Sheet SI 4.9.A.1.a (Continued)

	Initials/Data
3.5 Diesel Start (Continued)	
t. D/G 3A pnl 3-9-23	
u. D/G 3A pnl shutdown board room 3EA	
v. Exhaust fan A on	
3.6 Shutdown board 3EA controls check	
a. C.S.'s in EMERGENCY	
b. Syn. sw. ON	
c. Governor responds	
d. Voltage regulator responds	
e. Syn. sw. OFF	
f. C.S.'s in NORMAL	
3.7 Control room controls check	
a. Syn. sw. ON	
b. Governor responds	
c. Voltage regulator responds	
d. Syn. sw. OFF	
3.8 Diesel generator 3A loading	
a. Mode sw. in PARALLEL WITH SYSTEM	
b. Syn. sw. ON	
c. In sync. with sd. bd. 3EA	
d. 1838 close	
e. Load - 2500 KW and 1875 KVAR	

Data Sheet SI 4.9.A.1.a (Continued)

Initials/Data

3.9 Fuel and Lube Oil Check

a. 1) Fuel system 1 ____________

2) Fuel system 2 ____________

3) Lube oil engine ____________

4) Lube oil filter ____________

b. Pump 1 runs ____________

c. Pump 2 runs ____________

3.10 Diesel generator 3A shutdown

a. Diesel generator unloaded ____________

b. C.S. in STOP ____________

c. 1838 tripped ____________

d. Speed at 450 rpm ____________

e. Syn. sw. OFF ____________

f. Alarms reset ____________

3.11 Diesel generator automatic start

a. Operator at diesel ____________

b. Diesel generator start time ____________ sec.

c. Speed (905 $\pm$5 rpm) ____________ rpm

Voltage (4350 $\pm$ 50 volts) ____________ volts

d. Control sw. STOP ____________

e. Alarms reset ____________

Data Sheet SI 4.9.A.1.a (Continued)

Initials/Data

3.12 Return to Normal

a. Assoc. equipment standby readiness ____________

b. Alarms reset ____________

c. Preferred start in alternate position ____________

d. Diesel generator 3A standby readiness ____________

REMARKS: ____

____

____

____

____

SI 4.9.A.1.a
DIESEL GENERATOR MONTHLY TEST
D/G 3B

1. Precautions

1.1 Do not perform this instruction during a condition calling for operation of the diesel generator.

1.2 Personnel should use ear protection as applicable when running the diesel generator.

2. Prerequisites

2.1 Panel 3-9-23 and shutdown board room 3EB manned.

2.2 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (mechanical) or mechanical foreman as to time and date surveillance instruction is to be performed in order that MMI 6 may be performed.

2.3 Prior to performing SI 4.9.A.1.a notify the maintenance supervisor (electrical) or electrical foreman as to time and date surveillance instruction is to be performed in order that applicable sections of EMI 3 may be performed.

3. Procedure

3.1 Annunciator Check

a. Engine Control Cabinet

1) Press annunciator test pushbutton and verify that bell rings and that full annunciator display panel is illuminated.

2) Press annunciator reset pushbutton and verify that bell is silenced and annunciator lights go out.

3. Procedure (Continued)

3.1 Annunciator Check (Continued)

b. Shutdown board room 3EB

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

c. Panel 3-9-23

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

3.2 Starting Air

a. Slowly open any one of the following drain valves until compressor No. 1 starts: 0-86-584-3B, -585-3B, -586-3B, -587-3B, -588-3B. Close the valve.

b. Record pressure on "Starting air R.B." gauge on engine control cabinet.(1)

c. Record pressure on "Starting air R.B." gauge when compressor stops.(1)

d. Slowly open any one of the following drain valves until compressor No. 2 starts: 0-86-566-3B, -567-3B, -568-3B, -569-3B, -570-3B. Close the valve.

e. Record pressure on "Starting air L.B." gauge on engine control cabinet.(1)

f. Record pressure on "Starting air L.B." gauge when compressor stops.(1)

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.3 Fuel Oil

a. Record amount of fuel in day tank.

3.4 Lube oil and cooling water

a. Verify that water is above 9 in. mark in sight glass on accessory rack.

b. Verify that lube oil is visible on crankcase dipstick.

3.5 Diesel Start

a. Turn diesel generator logic breaker off (on 125-volt distribution panel).

b. Use governor control on engine control cabinet to move governor to its lowest setting. Verify setting of governor by visual observation of governor setting indicator.

c. Depress fuel prime pushbutton on engine control cabinet until fuel pressure reaches 30 psi.

d. Depress engine start pushbutton on engine control cabinet.

e. Verify diesel generator starts and levels out at 450 rpm.

f. Allow the engine to idle for 10 minutes.

g. Use governor control on engine control cabinet to raise the speed to 930 rpm.

h. Depress field flashing pushbutton on engine control cabinet.

i. Record generator voltage.

j. Record engine speed.(1)

k. Record cooling water level in sight glass.

l. Record lube oil level on crankcase dipstick (± inches, based on full mark).

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.5 Diesel Start (Continued)

m. Verify that panel 3-9-23 and shutdown board room 3EB.

n. Turn diesel generator logic breaker on.

o. Reset local alarms.

*p. Verify RHRSW pump A3 running annunciator at Pnl 3-9-23.

*q. Verify RHRSW pump C3 running annunciator at Pnl 3-9-23.

*r. Verify RHRSW pump B1 running annunciator at Pnl 3-9-23.

*s. Verify RHRSW pump D1 running annunciator at Pnl 3-9-23.

t. Verify diesel generator 3B running annunciator at Pnl 3-9-23.

u. Verify diesel generator 3B running annunciator at shutdown board room 3EB.

v. Verify diesel generator 3B exhaust fan A running (visually).

3.6 Shutdown board 3EB controls check

a. Turn breaker 1842 control selector switch and C.S. 43-3B to EMERGENCY position.

b. Turn breaker 1842 synchronizing switch to ON position.

c. Verify governor response by turning diesel generator 3B governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

d. Verify voltage regulator response by turning diesel generator 3B voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

e. Return breaker 1842 synchronizing switch to OFF position.

f. Return breaker 1842 control selector switch and C.S. 43-3B to NORMAL position.

*Revision JBD

3. Procedure (Continued)

3.7 Control room controls check

a. Turn breaker 1842 synchronizing switch located on panel 3-9-23 to ON position.

b. Verify governor response by turning diesel generator 3B governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

c. Verify voltage regulator response by turning diesel generator 3B voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

d. Return breaker 1842 synchronizing switch to OFF position.

3.8 Diesel Generator Loading

a. Verify diesel generator 3B operational mode switch is in PARALLEL WITH SYSTEM and associated mode light is on.

b. Turn breaker 1842 synchronizing switch to ON position.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Board 3EB.

d. Close breaker 1842.

e. Increase load to 2500 KW and 1875 KVAR and maintain this load for 1 hour.

3.9 Fuel and Lube Oil Check

a. Record the readings on the following gauges located on the engine control cabinet.

1) Fuel system 1 filter in

2) Fuel system 2 filter in

3) Lube oil engine

4) Lube oil filter in

3. <u>Procedure</u> (Continued)

3.9 Fuel and Lube Oil Check (Continued)

b. Depress fuel transfer pushbutton no. 1 on engine control cabinet and verify fuel transfer pump 1 runs.

c. Depress fuel transfer pushbutton no. 2 on engine control cabinet and verify fuel transfer pump 2 runs.

3.10 Diesel generator shutdown

a. Unload diesel generator 3EB.

b. Pull diesel generator 3EB control switch to STOP position.

c. Verify breaker 1842 tripped.

d. Verify diesel generator speed dropped to approximately 450 rpm (engine will stop in approximately 11.5 minutes).

e. Place breaker 1842 synchronizing switch in OFF position.

f. Reset all alarms.

3.11 Diesel generator automatic start time

a. When diesel generator has stopped, station an operator in the diesel generator room with a stop watch. Begin timing when air start motors start to crank the engine and stop when engine speed levels.

b. Give the diesel generator an automatic start from panel 3-9-23 or from breaker 1842. Record starting time of diesel generator.

c. Record engine speed and generator voltage.(1)

d. Pull diesel generator 3B control switch to STOP position. (Engine will idle for 11.5 minutes and stop).

e. When engine stops, reset all alarms on engine control cabinet, pnl 3-9-23, and shutdown board room 3EB.

(1)Expected value and tolerance on data sheet.

3. <u>Procedure</u> (Continued)

3.12 Return to Normal

a. Return all associated equipment to standby readiness (RHRSW pumps, exhaust fans).

b. Reset all alarms and recognition annunciations.

c. Turn preferred start selector switch to alternate position.

d. Verify that the diesel generator 3B system is in standby readiness per OI 82.

3.13 Verify by signature and date on Data Cover Sheet that the diesel generator 3B was tested in accordance with this instruction.

DATA COVER SHEET SI 4.9.A.1.a

Diesel Generator Monthly Test

D/G 3B

Performed By ______________________ Date ______________
Assistant Shift Engineer

Were criteria satisfied? ______ Yes ______ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? ______ Yes (explain in remarks)
______ No (explain in remarks)

Verified by Shift Engineer ______________, ______________
Date

Reason for test:

______ Maintenance complete on ______________.

______ Another system (__________________) inoperable

______ Required by schedule

______ Plant condition (explain) ______________________

______ Other (explain) ______________________

Results reviewed ______________________ Date ______________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________

Rescheduled

QA Staff ______________________ Date ______________

REMARKS ____

____

____

SI 4.9.A.1.a
DATA SHEET

Diesel Generator Monthly Test
D/G 3B

NOTE: Step numbers correspond to numbers in the instruction.

Initials/Data

3.1 Annunciator check

a. Engine control cabinet

1) annunciator bell and light on ______________

2) annunciator bell and light off ______________

b. Shutdown board room 3EB

1) annunciator bell and light on ______________

2) annunciator bell and light off ______________

c. Panel 3-9-23

1) annunciator bell and light on ______________

2) annunciator bell and light off ______________

3.2 Starting Air

a. Drain valve open-close ______________

b. R. B. Pressure Start (175 ± 5 lb.) ______________

c. R. B. Pressure Stop (200 ± 5 lb.) ______________

d. Drain valve open-close ______________

e. L. B. Pressure Start (175 ± 5 lb.) ______________

f. L. B. Pressure Stop (200 ± 5 lb.) ______________

3.3 Fuel Oil

a. Day tank fuel ______________ gal.

Data Sheet SI 4.9.A.1.a (Continued)

	INITIALS/DATE	DATA
3.4 Lube Oil and Cooling Water		
a. Water > 9 in.	______	
b. Oil visible	______	
3.5 Diesel Start		
a. Logic breaker off	______	
b. Governor at low setting	______	
c. Fuel prime - 30 psi	______	
d. Start pushbutton	______	
e. D/G starts	______	
f. 10 minute idle	______	
g. Speed 930 rpm	______	
h. Field flash	______	
i. Voltage(1)	______	volts ______
j. Speed (905 ±5 rpm)	______	rpm ______
k. Water level	______	in. ______
l. Oil level	______	in. ______
m. 3-9-23 and shutdown board room 3EB	______	
n. Logic breaker on	______	
o. Alarms reset	______	
*p. RHRSW A3 pnl 3-9-23	______	
*q. RHRSW C3 pnl 3-9-23	______	

(1) Tolerances for this step are not listed since voltage reached from a manual start is dependent upon prior manipulation of the variable pot controlling voltage level. Ability to regulate voltage and synchronize will serve as acceptance criteria for voltage value.

*Revision

Data Sheet SI 4.9.A.1.a (Continued)

INITIALS/DATE

3.5 Diesel Start (Continued)

*r. RHRSW B1 pnl 3-9-23 ____________

*s. RHRSW D1 pnl 3-9-23 ____________

t. D/G 3B pnl 3-9-23 ____________

u. D/G 3B shutdown board room 3EB ____________

v. Exhaust fan A on ____________

3.6 Shutdown board 3EB controls check

a. C. S. in EMERGENCY ____________

b. Syn. sw. ON ____________

c. Governor responds ____________

d. Voltage regulator responds ____________

e. Syn. sw. OFF ____________

f. C. S. in NORMAL ____________

3.7 Control room controls check

a. Syn. sw. ON ____________

b. Governor responds ____________

c. Voltage regulator responds ____________

d. Syn. sw. OFF ____________

3.8 Diesel generator 3B loading

a. Mode sw. in PARALLEL WITH SYSTEM ____________

b. Syn. sw. ON ____________

c. In sync. with sd. bd. 3EB ____________

*Revision JBD

Data Sheet SI 4.9.A.1.a (Continued)

		Initials/Data
3.8	Diesel generator 3B loading (Continued)	
	d. 1842 close	______
	e. Load - 2500 KW and 1875 KVAR	______
3.9	Fuel and Lube Oil Check	
	a. 1) Fuel system 1	______
	2) Fuel system 2	______
	3) Lube oil engine	______
	4) Lube oil filter	______
	b. Pump 1 runs	______
	c. Pump 2 runs	______
3.10	Diesel generator 3B shutdown	
	a. Diesel generator unloaded	______
	b. C. S. in STOP	______
	c. 1842 tripped	______
	d. Speed at 450 rpm	______
	e. Syn. sw. OFF	______
	f. Alarms reset	______
3.11	Diesel generator automatic start	
	a. Operator at diesel	______
	b. Diesel generator start time	______ sec.
	c. Speed (905 $\pm$ 5 rpm)	______ rpm
	Voltage (4350 $\pm$ 50 volts)	______ volts

Data Sheet SI 4.9.A.1.a (Continued)

	Initials/Data
3.11 Diesel generator automatic start (Continued)	
d. Control sw. STOP	
e. Alarms reset	
3.12 Return to Normal	
a. Assoc. equipment standby readiness	
b. Alarms reset	
c. Preferred start in alternate position	
d. Diesel generator 3B standby readiness	

REMARKS:

SI 4.9.A.1.a
DIESEL GENERATOR MONTHLY TEST
D/G 3C

1. Precautions

1.1 Do not perform this instruction during a condition calling for operation of the diesel generator.

1.2 Personnel should use ear protection as applicable when running the diesel generator.

2. Prerequisites

2.1 Panel 3-9-23 and shutdown board room 3EC.

2.2 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (mechanical) or mechanical foreman as to time and date surveillance instruction is to be performed in order that MMI 6 may be performed.

2.3 Prior to performing SI 4.9.A.1.a notify the maintenance supervisor (electrical) or electrical foreman as to time and date surveillance instruction is to be performed in order that applicable sections of EMI 3 may be performed.

3. Procedure

3.1 Annunciator Check

a. Engine Control Cabinet

1) Press annunciator test pushbutton and verify that bell rings and that full annunciator display panel is illuminated.

2) Press annunciator reset pushbutton and verify that bell is silenced and annunciator lights go out.

3. Procedure (Continued)

3.1 Annunciator Check

b. Shutdown board room 3EC.

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

c. Panel 3-9-23

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

3.2 Starting Air

_____ a. Slowly open any one of the following drain valves until compressor No. 1 starts: 0-86-584-3C, -585-3C, -586-3C, -587-3C, -588-3C. Close the valve.

_____ b. Record pressure on "Starting air R.B." gauge on engine control cabinet.(1)

_____ c. Record pressure on "Starting air R.B." gauge when compressor stops.(1)

_____ d. Slowly open any one of the following drain valves until compressor No. 2 starts: 0-86-566-3C, -567-3C, -568-3C, -569-3C, -570-3C. Close the valve.

e. Record pressure on "Starting air L.B." gauge on engine control cabinet.(1)

f. Record pressure on "Starting air L.B." gauge when compressor stops.(1)

(1) Expected value and tolerance on data sheet.

3. <u>Procedure</u> (Continued)

3.3 Fuel oil

a. Record amount of fuel in day tank.

3.4 Lube oil and cooling water

a. Verify that water is above 9 in. mark in sight glass on accessory rack.

b. Verify that lube oil is visible on crankcase dipstick.

3.5 Diesel Start

a. Turn diesel generator logic breaker off (on 125-volt distribution panel).

b. Use governor control on engine control cabinet to move governor to its lowest setting. Verify setting of governor by visual observation of governor setting indicator.

c. Depress fuel prime pushbutton on engine control cabinet until fuel pressure reaches 30 psi.

d. Depress engine start pushbutton on engine control cabinet.

e. Verify diesel generator starts and levels out at 450 rpm.

f. Allow the engine to idle for 10 minutes.

g. Use governor control on engine control cabinet to raise the speed to 930 rpm.

h. Depress field flashing pushbutton on engine control cabinet.

i. Record generator voltage.

j. Record engine speed.[1]

k. Record cooling water level in sight glass.

[1] Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.5 Diesel Start (Continued)

l. Record lube oil level on crankcase dipstick (± inches, based on full mark).

m. Verify that panel 3-9-23 and shutdown board room 3EC are manned.

n. Turn diesel generator logic breaker on.

o. Reset local alarms.

*p. Verify RHRSW pump A3 running annunciator at Pnl 3-9-23.

*q. Verify RHRSW pump C3 running annunciator at Pnl 3-9-23.

*r. Verify RHRSW pump B1 running annunciator at Pnl 3-9-23.

*s. Verify RHRSW pump D1 running annunciator at Pnl 3-9-23.

t. Verify diesel generator 3C running annunciator at Pnl 3-9-23.

u. Verify diesel generator 3C running annunciator at shutdown board room 3EC.

v. Verify diesel generator 3C exhaust fan A running (visually).

3.6 Shutdown board 3EC controls check

a. Turn breaker 1832 control selector switch and C.S. 43-3C to EMERGENCY position.

b. Turn breaker 1832 synchronizing switch to ON position.

c. Verify governor response by turning diesel generator 3C governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

d. Verify voltage regulator response by turning diesel generator 3C voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

*Revision JBD

3. Procedure (Continued)

3.6 Shutdown board 3EC controls check (Continued)

e. Return breaker 1832 synchronizing switch to OFF position.

f. Return breaker 1832 control selector switch and C.S. 43-3C to NORMAL position.

3.7 Control room controls check

a. Turn breaker 1832 synchronizing switch located on panel 3-9-23 to ON position.

b. Verify governor response by turning diesel generator 3C governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

c. Verify voltage regulator response by turning diesel generator 3C voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

d. Return breaker 1832 synchronizing switch to OFF position.

3.8 Diesel Generator Loading

a. Verify diesel generator 3C operational mode switch is in PARALLEL WITH SYSTEM and associated mode light is on.

b. Turn breaker 1832 synchronizing switch to ON position.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Board 3EC.

d. Close breaker 1832.

e. Increase load to 2500 KW and 1875 KVAR and maintain this load for 1 hour.

3. <u>Procedure</u> (Continued)

3.9 Fuel and Lube Oil Check

a. Record the readings on the following gauges located on the engine control cabinet.

1) Fuel system 1 filter in

2) Fuel system 2 filter in

3) Lube oil engine

4) Lube oil filter in

b. Depress fuel transfer pushbutton no. 1 on engine control cabinet and verify fuel transfer pump 1 runs.

c. Depress fuel transfer pushbutton no. 2 on engine control cabinet and verify fuel transfer pump 2 runs.

3.10 Diesel generator shutdown

a. Unload diesel generator 3C.

b. Pull diesel generator 3C control switch to STOP position.

c. Verify breaker 1832 tripped.

d. Verify diesel generator speed dropped to approximately 450 rpm (engine will stop in approximately 11.5 minutes).

e. Place breaker 1832 synchronizing switch in OFF position.

f. Reset all alarms.

3.11 Diesel generator automatic start time

a. When diesel generator has stopped, station an operator in the diesel generator room with a stop watch. Begin timing when air start motors start to crank the engine and stop when engine speed levels.

b. Give the diesel generator an automatic start from panel 3-9-23 or from breaker 1832. Record starting time of diesel generator.

3. Procedure (Continued)

3.11 Diesel generator automatic start time (Continued)

c. Record engine speed and generator voltage.(1)

d. Pull diesel generator 3C control switch to STOP position. (Engine will idle for 11.5 minutes and stop.)

e. When engine stops, reset all alarms on engine control cabinet, pnl 3-9-23, and shutdown board room 3EC.

3.12 Return to Normal

a. Return all associated equipment to standby readiness (RHRSW pumps, exhaust fans).

b. Reset all alarms and recognition annunciations.

c. Turn preferred start selector switch to alternate position.

d. Verify that the diesel generator 3C system is in standby readiness per OI 82.

3.13 Verify by signature and date on Data Cover Sheet that the diesel generator 3C was tested in accordance with this instruction.

(1) Expected value and tolerance on data sheet.

DATA COVER SHEET SI 4.9.A.1.a

Diesel Generator Monthly Test

D/G . 3C

Performed By ______________________________ Date ______________
Assistant Shift Engineer

Were criteria satisfied? _____ Yes _____ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ______________, ______________
Date

Reason for test:

_____ Maintenance complete on ______________

_____ Another system (______________) inoperable

_____ Required by schedule

_____ Plant condition (explain) ______________________________

_____ Other (explain) ______________________________

Results reviewed ______________________________ Date ______________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________________ Date ______________

Rescheduled

QA Staff ______________________________ Date ______________

REMARKS ____

____

____

SI 4.9.A.1.a
DATA SHEET

Diesel Generator Monthly Test
D/G 3C

NOTE: Step numbers correspond to numbers in the instruction.

Initials/Data

3.1 Annunciator check

a. Engine control cabinet

1) annunciator bell and light on ____________

2) annunciator bell and light off ____________

b. Shutdown board room 3EC

1) annunciator bell and light on ____________

2) annunciator bell and light off ____________

c. Panel 3-9-23

1) annunciator bell and light on ____________

2) annunciator bell and light off ____________

3.2 Starting Air

a. Drain valve open-close ____________

b. R.B. Pressure Start (175 ± 5 lb.) ____________

c. R.B. Pressure Stop (200 ± 5 lb.) ____________

d. Drain valve open-close ____________

e. L.B. Pressure Start (175 ± 5 lb.) ____________

f. L.B. Pressure Stop (200 ± 5 lb.) ____________

3.3 Fuel Oil

a. Day tank fuel ____________

Data Sheet SI 4.9.A.1.a (Continued)

		INITIALS/DATE	DATA
3.4	Lube Oil and Cooling Water		
	a. Water > 9 in.	________	
	b. Oil visible	________	
3.5	Diesel Start		
	a. Logic breaker off	________	
	b. Governor at low setting	________	
	c. Fuel prime - 30 psi	________	
	d. Start pushbutton	________	
	e. D/G starts	________	
	f. 10 minute idle	________	
	g. Speed 930 rpm	________	
	h. Field flash	________	
	i. Voltage(1)	________	volts ____
	j. Speed (905 ± 5 rpm)	________	rpm ____
3.2	k. Water level	________	in. ____
	l. Oil level	________	in. ____
	m. 3-9-23 and shutdown board room 3EC manned	________	
	n. Logic breaker on	________	
	o. Alarms reset	________	
	*p. RHRSW A3 pnl 3-9-23	________	
	*q. RHRSW C3 pnl 3-9-23	________	

(1) Tolerances for this step are not listed since voltage reached from a manual start is dependent upon prior manipulation of the variable pot controlling voltage level. Ability to regulate voltage and synchronize will serve as acceptance criteria for voltage value.

*Revision

Data Sheet SI 4.9.A.1.a (Continued)

INITIALS/DATE

3.5 Diesel Start (Continued)

*r. RHRSW B1 pnl 3-9-23 ____________

*s. RHRSW D1 pnl 3-9-23 ____________

t. D/G 3C pnl 3-9-23 ____________

u. D/G 3C shutdown board room 3EC ____________

v. Exhaust fan A on ____________

3.6 Shutdown board 3EC controls check

a. C. S. in EMERGENCY ____________

b. Syn. sw. ON ____________

c. Governor responds ____________

d. Voltage regulator responds ____________

e. Syn. sw. OFF ____________

f. C. S. in NORMAL ____________

3.7 Control room controls check

a. Syn. sw. ON ____________

b. Governor responds ____________

c. Voltage regulator responds ____________

d. Syn. sw. OFF ____________

3.8 Diesel generator 3C loading

a. Mode sw. in PARALLEL WITH SYSTEM ____________

b. Syn. sw. ON ____________

c. In sync. with sd. bd. A ____________

*Revision

Data Sheet SI 4.9.A.1.a (Continued)

		Initials/Data
3.8	Diesel generator 3C loading (Continued)	
	d. 1832 close	________
	e. Load - 2500 KW and 1875 KVAR	________
3.9	Fuel and Lube Oil Check	
	a. 1) Fuel system 1	________
	2) Fuel system 2	________
	3) Lube oil engine	________
	4) Lube oil filter	________
	b. Pump 1 runs	________
	c. Pump 2 runs	________
3.10	Diesel generator 3C shutdown	
	a. Diesel generator unloaded	________
	b. C. S. in STOP	________
	c. 1832 tripped	________
	d. Speed at 450 rpm	________
	e. Syn. sw. OFF	________
	f. Alarms reset	________
3.11	Diesel generator automatic start	
	a. Operator at diesel	________
	b. Diesel generator start time	________ sec.
	c. Speed (905 $\pm$ 5 rpm)	________ rpm
	Voltage (4350 $\pm$ 50 volts)	________ volts

Data Sheet SI 4.9.A.1.a (Continued)

	Initials/Data
3.11 Diesel generator automatic start (Continued)	
d. Control sw. STOP	____________
e. Alarms reset	____________
3.12 Return to Normal	
a. Assoc. equipment standby readiness	____________
b. Alarms reset	____________
c. Preferred start in alternate position	____________
d. Diesel generator 3C standby readiness	____________

REMARKS: ____

____

____

____

____

SI 4.9.A.1.a
DIESEL GENERATOR MONTHLY TEST
D/G 3D

1. Precautions

    1.1 Do not perform this instruction during a condition calling for operation of the diesel generator.

    1.2 Personnel should use ear protection as applicable when running the diesel generator.

2. Prerequisites

    2.1 Panel 3-9-23 and shutdown board room 3ED.

    2.2 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (mechanical) or mechanical foreman as to time and date surveillance instruction is to be performed in order that MMI 6 may be performed.

    2.3 Prior to performing SI 4.9.A.1.a, notify the maintenance supervisor (electrical) or electrical foreman as to time and date surveillance instruction is to be performed in order that applicable sections of EMI 3 may be performed.

3. Procedure

    3.1 Annunciator Check

        a. Engine Control Cabinet

            1) Press annunciator test pushbutton and verify that bell rings and that full annunciator display panel is illuminated.

            2) Press annunciator reset pushbutton and verify that bell is silenced and annunciator lights go out.

3. Procedure (Continued)

3.1 Annunciator Check (Continued)

b. Shutdown board room 3ED

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

c. Panel 3-9-23

1) Turn annunciator switch to test and verify that buzzer sounds and that full annunciator display panel is illuminated.

2) Turn annunciator switch to reset and verify that buzzer is silenced and annunciator lights go out.

3.2 Starting Air

a. Slowly open any one of the following drain valves until compressor No. 1 starts: 0-8-584-3D, -585-3D, -586-3D, -587-3D, -588-3D. Close the valve.

b. Record pressure on "Starting air R.B." gauge on engine control cabinet.(1)

c. Record pressure on "Starting air R.B." gauge when compressor stops.(1)

d. Slowly open any one of the following drain valves until compressor No. 2 starts: 0-86-566-3D, -567-3D, -568-3D, -569-3D, -570-3D. Close the valve.

e. Record pressure on "Starting air L.B." gauge on engine control cabinet.(1)

f. Record pressure on "Starting air L.B." gauge when compressor stops.(1)

(1)Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.3 Fuel oil

a. Record amount of fuel in day tank.

3.4 Lube oil and cooling water

a. Verify that water is above 9 in. mark in sight glass on accessory rack.

b. Verify that lube oil is visible on crankcase dipstick.

3.5 Diesel Start

a. Turn diesel generator logic breaker off (on 125-volt distribution panel).

b. Use governor control on engine control cabinet to move governor to its lowest setting. Verify setting of governor by visual observation of governor setting indicator.

c. Depress fuel prime pushbutton on engine control cabinet until fuel pressure reaches 30 psi.

d. Depress engine start pushbutton on engine control cabinet.

e. Verify diesel generator starts and levels out at 450 rpm.

f. Allow the engine to idle for 10 minutes.

g. Use governor control on engine control cabinet to raise the speed to 930 rpm.

h. Depress field flashing pushbutton on engine control cabinet.

i. Record generator voltage.

j. Record engine speed.(1)

k. Record cooling water level in sight glass.

l. Record lube oil level on crankcase dipstick (± inches, based on full mark).

(1) Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.5 Diesel Start (Continued)

m. Verify that panel 3-9-23 and shutdown board room 3ED are manned.

n. Turn diesel generator logic breaker on.

o. Reset local alarms.

*p. Verify RHRSW pump A3 running annunciator at Pnl. 3-9-23.

*q. Verify RHRSW pump C3 running annunciator at Pnl. 3-9-23.

*r. Verify RHRSW pump B1 running annunciator at Pnl. 3-9-23.

*s. Verify RHRSW pump D1 running annunciator at Pnl. 3-9-23.

t. Verify diesel generator 3D running annunciator at Pnl. 3-9-23.

u. Verify diesel generator 3D running annunciator at shutdown board room 3ED.

v. Verify diesel generator 3D exhaust fan A running (visually).

3.6 Shutdown board 3ED controls check

a. Turn breaker 1836 control selector switch and C.S. 43-3D to NORMAL position.

b. Turn breaker 1836 synchronizing switch to ON position.

c. Verify governor response by turning diesel generator 3D governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

d. Verify voltage regulator response by turning diesel generator 3D voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

e. Return breaker 1836 synchronizing switch to OFF position.

f. Return breaker 1836 control selector switch and C.S. 43-3D to NORMAL position.

*Revision JBD

3. <u>Procedure</u> (Continued)

3.7 Control room controls check

a. Turn breaker 1836 synchronizing switch located on panel 3-9-23 to ON position.

b. Verify governor response by turning diesel generator 3D governor control switch to RAISE and LOWER positions and verify frequency increase and decrease, respectively, on incoming frequency meter.

c. Verify voltage regulator response by turning diesel generator 3D voltage regulator switch to RAISE and LOWER positions and verify voltage increase and decrease, respectively, on incoming voltmeter.

d. Return breaker 1836 synchronizing switch to OFF position.

3.8 Diesel Generator Loading

a. Verify diesel generator 3D operational mode switch is in PARALLEL WITH SYSTEM and associated mode light is on.

b. Turn breaker 1836 synchronizing switch to ON position.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Board 3ED.

d. Close breaker 1836.

e. Increase load to 2500 KW and 1875 KVAR and maintain this load for 1 hour.

3.9 Fuel and Lube Oil Check

a. Record the readings on the following gauges located on the engine control cabinet.

1) Fuel System 1 filter in

2) Fuel System 2 filter in

3) Lube oil engine

4) Lube oil filter in

3. Procedure (Continued)

3.9 Fuel and Lube Oil Check (Continued)

b. Depress fuel transfer pushbutton no. 1 on engine control cabinet and verify fuel transfer pump 1 runs.

c. Depress fuel transfer pushbutton no. 2 on engine control cabinet and verify fuel transfer pump 2 runs.

3.10 Diesel generator shutdown

a. Unload diesel generator 3D.

b. Pull diesel generator 3D control switch to STOP position.

c. Verify breaker 1836 tripped.

d. Verify diesel generator speed dropped to approximately 450 rpm (engine will stop in approximately 11.5 minutes.)

e. Place breaker 1836 synchronizing switch in OFF position.

f. Reset all alarms.

3.11 Diesel generator automatic start time

a. When diesel generator has stopped, station an operator in the diesel generator room with a stop watch. Begin timing when air start motors start to crank the engine and stop when engine speed levels.

b. Give the diesel generator an automatic start from panel 9-23 or from breaker 1836. Record starting time of diesel generator.

c. Record engine speed and generator voltage.[1]

d. Pull diesel generator 3D control switch to STOP position. (Engine will idle for 11.5 minutes and stop.)

e. When engine stops, reset all alarms on engine control cabinet.

[1]Expected value and tolerance on data sheet.

3. Procedure (Continued)

3.12 Return to Normal

a. Return all associated equipment to standby readiness (RHRSW pumps, exhaust fans).

b. Reset all alarms and recognition annunciations.

c. Turn preferred start selector switch to alternate position.

d. Verify that the diesel generator 3D system is in standby readiness per OI 82.

3.13 Verify by signature and date on Data Cover Sheet that the diesel generator 3D was tested in accordance with this instruction.

DATA COVER SHEET SI 4.9.A.1.a

Diesel Generator Monthly Test

D/G 3D

Performed By ______________________________ Date ________________
Assistant Shift Engineer

Were criteria satisfied? _____ Yes _____ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ______________, ________________
Date

Reason for test:

_____ Maintenance complete on ________________

_____ Another system (________________) inoperable

_____ Required by schedule

_____ Plant condition (explain) ________________________________

_____ Other (explain) ________________________________

Results reviewed ______________________________ Date ____________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________________ Date ____________

Rescheduled

QA Staff ______________________________ Date ____________

REMARKS ____

____

____

SI 4.9.A.1.a
DATA SHEET

Diesel Generator Monthly Test
D/G 3D

NOTE: Step numbers correspond to numbers in the instruction.

Initials/Data

3.1 Annunciator check

a. Engine control cabinet

1) annunciator bell and light on ________

2) annunciator bell and light off ________

b. Shutdown board room 3ED

1) annunciator bell and light on ________

2) annunciator bell and light off ________

c. Panel 3-9-23

1) annunciator bell and light on ________

2) annunciator bell and light off ________

3.2 Starting Air

a. Drain valve open-close ________

b. R.B. Pressure Start (175 ± 5 lb.) ________

c. R.B. Pressure Stop (200 ± 5 lb.) ________

d. Drain valve open-close ________

e. L.B. Pressure Start (175 ± 5 lb.) ________

f. L.B. Pressure Stop (200 ± 5 lb.) ________

3.3 Fuel Oil

a. Day tank fuel ________ gal.

Data Sheet SI 4.9.A.1.a (Continued)

	INITIALS/DATE		DATA
3.4 Lube Oil and Cooling Water			
a. Water >9 in.			
b. Oil visible			
3.5 Diesel Start			
a. Logic breaker off			
b. Governor at low setting			
c. Fuel prime - 30 psi			
d. Start pushbutton			
e. D/G starts			
f. 10 minute idle			
g. Speed 930 rpm			
h. Field flash			
i. Voltage(1)		volts	
j. Speed (905 ± 5 rpm)		rpm	
k. Water level		in.	
l. Oil level		in.	
m. 3-9-23 and shutdown board room 3ED.			
n. Logic breaker on			
o. Alarms reset			
*p. RHRSW A3 pnl 3-9-23			
*q. RHRSW C3 pnl 3-9-23			

(1) Tolerances for this step are not listed since voltage reached from a manual start is dependent upon prior manipulation of the variable pot controlling voltage level. Ability to regulate voltage and synchronize will serve as acceptance criteria for voltage value.

*Revision

Data Sheet SI 4.9.A.1.a (Continued)

INITIALS/DATE

3.5 Diesel Start (Continued)

*r. RHRSW B1 pnl 3-9-23 ________

*s. RHRSW D1 pnl 3-9-23 ________

t. D/G 3D pnl 3-9-23 ________

u. D/G 3D pnl shutdown board room 3ED ________

v. Exhaust fan A on ________

3.6 Shutdown board 3ED controls check

a. C.S. in EMERGENCY ________

b. Syn. sw. ON ________

c. Governor responds ________

d. Voltage regulator responds ________

e. Syn. sw. OFF ________

f. C. S. in NORMAL ________

3.7 Control room controls check

a. Syn. sw. ON ________

b. Governor responds ________

c. Voltage regulator responds ________

d. Syn. sw. OFF ________

3.8 Diesel generator 3D loading

a. Mode sw. in PARALLEL WITH SYSTEM ________

b. Syn. sw. ON ________

c. In sync. with sd. bd. 3ED ________

*Revision JBD

Data Sheet SI 4.9.A.1.a (Continued)

		Initials/Data
3.8	Diesel generator 3D loading (Continued)	
	d. 1836 close	________
	e. load - 2500 KW and 1875 KVAR	________
3.9	Fuel and Lube Oil Check	
	a. 1) Fuel system 1	________
	2) Fuel system 2	________
	3) Lube oil engine	________
	4) Lube oil filter	________
	b. Pump 1 runs	________
	c. Pump 2 runs	________
3.10	Diesel generator 3D shutdown	
	a. Diesel generator unloaded	________
	b. C. S. in STOP	________
	c. 1836 tripped	________
	d. Speed at 450 rpm	________
	e. Syn. sw. OFF	________
	f. Alarms reset	________
3.11	Diesel generator automatic start	
	a. Operator at diesel	________
	b. Diesel generator start time	________ sec.
	c. Speed (905 $\pm$ 5 rpm)	________ rpm
	Voltage (4350 $\pm$ 50 volts)	________ volts
	d. Control sw. STOP	________
	e. Alarms reset	________

Data Sheet SI 4.9.A.1.a (Continued)

	Initials/Data
3.12 Return to Normal	
a. Assoc. equipment standby readiness	________
b. Alarms reset	________
c. Preferred start in alternate position	________
d. Diesel generator 3D standby readiness	________

REMARKS: ____

____

____

____

____

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

SURVEILLANCE INSTRUCTION 4.9.A.1.b

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST

UNITS 1 AND 2 OR 3

Approved: H J Green
Plant Superintendent

Date: April 6, 1976
General Revision

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST

SI 4.9.A.1.b

Description

This surveillance instruction is used to comply with the requirements of technical specification 4.9.A.1.b. The following table lists the required surveillance items regarding this section:

Table SI 4.9.A.1.b - Surveillance Requirements

Frequency	Requirement
Once/operating cycle$^{(1)}$	Demonstrate the emergency diesel generators will start and accept emergency load within the specified time sequence.

This test provides verification that each diesel generator will start and accept its assigned emergency load when called upon by a simultaneous loss of shutdown power and an accident signal. In addition to this verification, data will be taken to check the stability of each diesel generator under severe load transients. From test to test comparisons can be made to detect any significant changes in each diesel generator's characteristics under these conditions. Since this test concerns the operation of the diesel generators and not of the ECCS equipment, this test for units 1 and 2 will be conducted using only unit 1 equipment as the loads.

The test is written to test each diesel generator individually without hindering or altering the other diesel generators' ability to function.

SI 4.9.A.1.b

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G A

1. Prerequisites

1.1 The unit 1 reactor vessel pressure shall not be greater than atmospheric.

1.2 The unit 1 core spray system shall be lined up for standby readiness as specified by Operating Instruction No. 75.

1.3 The unit 1 RHR system shall be lined up for standby readiness as specified by Operating Instruction No. 74.

*1.4 RHRSW pump A1 shall be operable.

1.5 Receive permission from the unit 1 assistant shift engineer to perform this test.

2. Precautions

2.1 This test will render loop I of the unit 1 core spray system inoperable. Do not conduct any test on loop II simultaneously. The requirements to test other systems or loops when one system is found to be inoperable will be waived when the system is made inoperable for testing.

2.2 This test will render loop I of the unit 1 RHR system inoperable. Do not conduct any test on loop II simultaneously.

2.3 Coordinate this test with the unit 2 operator and request that no surveillance testing be performed on the unit 2 core spray and RHR systems during this test.

*Revision JBD

3. Procedure

3.1 Core Spray Alignment - Unit 1

a. Vent the CSSI discharge piping through valves 75-584A and 75-585A until a steady stream of water is observed to flow out of the vent line into the open funnel.

b. Verify FCV-75-25 is closed by observing position indicating lights on panel 9-3.

c. Remove control power from FCV-75-25 by tripping breaker in compartment 14B on 480V Reactor MOV Bd 1A.

d. Verify FCV-75-23 is closed by observing position indicating lights on panel 9-3.

e. Verify test switch 14A-S15A (panel 9-32) is in the NORMAL position.

f. Plug core spray system test fixture into jack 14A-J1A (panel 9-32).

<u>CAUTION</u>: Assure the test fixture switch is in the OFF position.

g. Place switch 14A-S11A (panel 9-32) in TEST position and verify relay 14A-K29A (panel 9-32) drops out.

h. Block contact 1-2 on relay 14A-K25A (panel 9-32) open with an insulated boot per Standard Practice BFA25.

i. Block contact 5-6 on relay 14A-K25A (panel 9-32) open with an insulated boot per Standard Practice BFA25.

j. Place a jumper between contact terminals 7 and 8 on relay 14A-K10A (panel 9-32) per BFA25. There are two wires on terminal 7 and one wire on terminal 8.

k. Remove CS pump 1C breaker (4-kV Sd Bd B, panel 6).

3. Procedure (Continued)

3.2 RHR Alignment - Unit 1

a. Venting of the RHR system shall have been accomplished no longer than 30 days prior to the implementation of this test. This can be verified by checking the last running date of SI 4.5.B.1.a, SI 4.5.B.1.b, or SI 4.5.B.1.d. If venting has not been accomplished, vent the RHRs at the following locations:

Solenoid Valve	Valve Location
FSV-74-142	A heat exchanger
FSV-74-143	C heat exchanger
FSV-74-139	Sys. I drywell spray line
FSV-74-140	Sys. I LPCI injection line
FSV-74-144	B heat exchanger
FSV-74-145	D heat exchanger
FSV-74-147	Units 1 and 2 return cross connect line
FSV-74-141	Sys. II LPCI injection line
FSV-74-138	Reactor head spray line

b. Verify FCV-74-61 is closed by observing position indicating lights on panel 9-3.

c. Remove power from FCV-74-61 by tripping breaker 7B on 480V Reactor MOV Bd 1A.

d. Verify FCV-74-60 is closed by observing position indicating lights on panel 9-3.

e. Verify FCV-74-53 is closed by observing position indicating lights on panel 9-3.

f. Verify FCV-74-58 is closed by observing position indicating lights on panel 9-3.

3. Procedure (Continued)

3.2 RHR Alignment - Unit 1 (Continued)

g. Verify FCV-74-78 is closed by observing position indicating lights on panel 9-3.

h. Verify switch 10A-S48A (panel 9-32) is in the NORMAL position.

i. Verify FCV 74-46 is closed by observing the indicating lights on panel 9-3. Close the valve if it is open.

j. Verify that relay 10A-K72A (panel 9-32) is deenergized.

k. Block contact 5-6 on relay NVA-A-1 (panel 25-45A) open with an insulated boot in accordance with Standard Practice BFA25.

l. Verify relay 10A-K105A (panel 9-32) is deenergized)

m. Place a jumper between contact terminals 3 and 4 on relay 10A-K9A (panel 9-32) in accordance with BFA25. There is one wire on terminal 3 and two wires on terminal 4.

NOTE: When RHR 1A pump breaker closes, it cannot be tripped locally.

3.3 Shutdown Board A Alignment

a. Transfer 480V Shutdown Bd 11A feed from TS1A to TS1E.

b. Transfer 480V Diesel Auxiliary Board A to its emergency source (TDE).

c. Caution unit 1 operator not to use fire pump A during this test.

d. Caution units 1 and 2 operators not to use CRD pump 1B during this test.

e. Caution unit 1 operator not to use RCW pump 1D during this test.

f. Trip 43SA (panel 9-23) to manual.

g. Block contact 9-10 on relay DGVA-A-3 (panel 25-45A) open with an insulated boot in accordance with BFA25.

h. Block contact 11-12 on relay DGVA-A-3 (panel 25-45A) open with an insulated boot in accordance with BFA25.

3. Procedure (Continued)

3.3 Shutdown Board A Alignment (Continued)

i. Block contact 1-2 on relay DGVA-A-4 (panel 25-45A) open with an insulated boot in accordance with BFA25.

j. Block contact 3-4 on relay DGVA-A-4 (panel 25-45A) open with an insulated boot in accordance with BFA25.

k. Connect oscillograph cahnnels to monitor the following:

(1) 1614 trip circuit

(2) 1818 close circuit

(3) RHR pump 1A close circuit

(4) CS pump 1A close circuit

*(5) RHRSW pump A1 close circuit

(6) 4-kV Shutdown Board A bus voltage

(7) D/G A current

3.4 Test Performance

NOTE: Because the sequence of events in this test is critical, a communication link should be established between 4-kV shutdown board A and panel 9-3, unit 1, prior to test initiation.

NOTE: As soon as core spray pump 1A and RHR pump 1A start, open their test loop valves from panel 9-3 - FCV-75-22 and FCV-74-57 and FCV-74-59 respectively. Continue until rated flows are established. (7000 to 10000 gpm for RHR and 3000 to 3125 gpm for core spray)

a. With the oscillograph running, trip breaker 1614. (Leave the oscillograph on for 45 seconds.)

b. Verify that the following breakers closed:

(1) 1818

(2) RHR pump 1A

(3) CS pump 1A

*(4) RHRSW pump A1

*Revison JBD

3. <u>Procedure</u> (Continued)

3.4 Test Performance (Continued)

c. Verify that diesel generator A voltage and current are stable.

d. Record the following D/G A data from metering on panel 9-23:

(1) KW

(2) KVAR

(3) VOLTS

(4) AMPS

(5) FREQUENCY

e. Mark oscillogram as trace no. 1-1 and attach to the data sheet.

3.5 Diesel Generator A Shutdown

a. Turn breaker 1614 synchronizing switch to ON position.

b. Place diesel generator A operational mode switch in PARALLEL WITH SYSTEM and verify associated mode light is on.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Bus 1.

d. Close breaker 1614.

e. Unload diesel generator.

f. Trip breaker 1818.

g. Pull diesel generator A control switch to STOP position.

h. Verify diesel generator speed drops to idle (450 rpm).

i. Place 1614 synchronizing switch in OFF position.

j. When diesel generator stops, verify diesel generator system A is in standby readiness per OI 82.

3. <u>Procedure</u> (Continued)

3.6 Core Spray Shutdown And Return To Normal - Unit 1

a. Remove jumper between contact terminals 7 and 8 on relay 14A-K10A (panel 9-32) in accordance with Standard Practice BFA25. There should be two wires left on terminal 7 and one on terminal 8.

b. Remove core spray system test fixture from jack 14A-J1A (panel 9-32).

c. Remove boot from contact 1-2 on relay 14A-K25A (panel 9-32) in accordance with Standard Practice BFA25.

d. Remove boot from contact 5-6 on relay 14A-K25A (panel 9-32) in accordance with Standard Practice BFA25.

e. Return switch 14A-S11A (panel 9-32) to NORMAL position.

f. Close FCV-75-22. Verify FCV-75-9 opens as flow decreases.

g. Trip CS pump 1A.

h. Restore power to FCV-75-25 and verify position indicating light is on.

i. Reset all core spray annunciation.

3.7 RHR Shutdown And Return To Normal - Unit 1

a. Remove jumper between contact terminals 3 and 4 on relay 10A-K9A (panel 9-32) in accordance with Standard Practice BFA25. There should be one wire left on terminal 3 and two wires on terminal 4.

b. Remove boot from contact 5-6 on relay NVA-A-1 (panel 25-45A) in accordance with BFA25.

c. Verify relay 10A-K105A (panel 9-32) is energized.

d. Close FCV-74-59 and FCV-74-57. Verify that FCV-74-7 opens as flow decreases.

e. Trip RHR pump 1A.

3. Procedure (Continued)

3.7 RHR Shutdown And Return To Normal - Unit 1 (Continued)

f. Restore power to FCV-74-61 and verify position indicating light is on.

g. Return FCV-74-46 to the position required by the shift engineer. indicate the position on the data sheet.

h. Reset all RHR annunciation.

3.8 Shutdown Board A Return To Normal

a. Reset 43SA (panel 9-23) to auto.

b. Inform unit 1 operator that RCW pump 1D is now ready for operation.

c. Inform unit 1 and unit 2 operators that CRD pump 1B is now ready for operation.

d. Inform unit 1 operator that fire pump A is now ready for operation.

e. Return 480V Shutdown Board 1A feed to TS1A.

f. Return CS pump 1C breaker to operate position.

g. Remove boot from contact 9-10 on relay DGVA-A-3 in accordance with BFA25.

h. Remove boot from contact 11-12 on relay DGVA-A-3 in accordance with BFA25.

i. Remove boot from contact 1-2 on relay DGVA-A-4 in accordance with BFA25.

j. Remove boot from contact 3-4 on relay DGVA-A-4 in accordance with BFA25.

k. Remove oscillograph inputs.

l. Return the EECW system to standby readiness per OI 67.

m. Return 480V Diesel Auxiliary Board A to its normal feed (TDA).

3. Procedure (Continued)

3.9 Test Completion

a. The unit 1 core spray system, the unit 1 RHR system, and Diesel Generator A are now normal and in standby readiness.

b. Verify by signature and date on data cover sheet that Diesel Generator A was tested in accordance with this instruction.

3.10 Acceptance Criteria

a. Diesel generator A reaches rated speed and voltage, and breaker 1818 closes within 11.5 seconds after 1614 trips.

b. RHR pump 1A starts within 1 second of 1818 closure.

c. CS pump 1A starts 7 ± 1 second after 1818 closure.

*d. RHRSW pump A1 starts 14 ± 1 second after 1818 closure.

e. All three pumps successfully accelerate on diesel generator power.

f. Diesel generator A is stable following the test.

*Revision JSD

SI 4.9.A.1.b

DATA COVER SHEET

Diesel Generator Emergency Load Acceptance Test

D/G A

Performed By ______________________ Date ______________________
Electrician

Were criteria satisfied? ______ Yes ______ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer __________________, ____________
Date

Reason for test:

______ Required by schedule

______ Other (explain) ______________________________

Results reviewed ______________________ Date ______________________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________________

Rescheduled

QA Staff ______________________ Date ______________________

Remarks ____
____
____
____

SI 4.9.A.1.b
DATA SHEET

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G A

NOTE: Step numbers correspond to numbers in the instruction.

Step		Initials/Data
3.1	Core Spray Alignment - Unit 1	
	a. CSSI vented	________
	b. FCV-75-25 closed	________
	c. FCV-75-25 power removed	________
	d. FCV-75-23 closed	________
	e. 14A-S15A NORMAL	________
	f. 14A-J1A fixture in	________
	g. 14A-S11A TEST/14A-K29A out	________
	h. 14A-K25A (1-2) booted	________
	2nd person verification	________
	i. 14A-K25A (5-6) booted	________
	2nd person verification	________
	j. 14A-K10A (7-8) jumpered	________
	2nd person verification	________
	k. CS 1C removed	________
3.2	RHR Alignment - Unit 1	
	a. RHR vented	________
	b. FCV-74-61 closed	________
	c. FCV-74-61 power removed	________
	d. FCV-74-60 closed	________
	e. FCV-74-53 closed	________

Data Sheet SI 4.9.A.1.b (Continued)

Step			Initials/Data
3.2	RHR Alignment - Unit 1 (Continued)		
	f.	FCV-74-58 closed	____________
	g.	FCV-74-78 closed	____________
	h.	10A-S48A NORMAL	____________
	i.	FCV-74-46 closed	____________
	j.	10A-K72A deenergized	____________
	k.	NVA-A-1 (5-6) booted	____________
		2nd person verification	____________
	l.	10A-K105A deenergized	____________
	m.	10A-K9A (3-4) jumpered	____________
		2nd person verification	____________
3.3	Shutdown Bd A Alignment		
	a.	480V Sd Bd 1A transferred	____________
	b.	480V Diesel Aux. Bd. A transferred	____________
	c.	Fire pump A caution	____________
	d.	CRD pump 1B caution	____________
	e.	RCW pump 1D caution	____________
	f.	43SA tripped	____________
	g.	DGVA-A-3 (9-10) booted	____________
		2nd person verification	____________
	h.	DGVA-A-3 (11-12) booted	____________
		2nd person verification	____________
	i.	DGVA-A-4 (1-2) booted	____________
		2nd person verifiecation	____________

Data Sheet SI 4.9.A.1.b (Continued)

Step	INITIALS/DATE
3.3 Shutdown Bd A Alignment (Continued)	
j. DGVA-A-4 (3-4) booted	________
2nd person verification	________
k. Oscillograph connections	
(1) 1614 trip ckt	________
(2) 1818 cl. ckt	
(3) RHR 1A cl. ckt	________
(4) CS 1A cl. ckt	________
*(5) RHRSW A1 cl ckt	________
(6) 4-kV Sd Bd A volt	________
(7) D/G A current	________
3.4 Test Performance	
a. 1614 trip	________
b. Breaker closure	________
(1) 1818	________
(2) RHR 1A	________
(3) CS 1A	________
*(4) RHRSW A1	________
c. Diesel gen. A stable	________
d. D/G A data	________
(1) KW	________
(2) KVAR	________
(3) Volts	________
(4) Amps	________
(5) Frequency	________

*Revision 9/5/D

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.4	Test Performance (Continued)	
	e. Trace no. 1-1 attached	________
3.5	D/G A Shutdown	
	a. 1614 sync. sw. ON	________
	b. Mode sw. PARALLEL WITH SYSTEM	________
	c. D/G A in sync.	________
	d. 1614 closed	________
	e. D/G A unloaded	________
	f. 1818 trip	________
	g. Control sw. STOP	________
	h. D/G idle	________
	i. 1614 sync. sw. OFF	________
	j. D/G A standby readiness	________
3.6	Core Spray Shutdown and Return to Normal - Unit 1	
	a. 14A-K10A (7-8) jumper removed	________
	2nd person verification	________
	b. 14A-J1A fixture removed	________
	2nd person verification	________
	c. 14A-K25A (1-2) boot removed	________
	2nd person verification	________
	d. 14A-K25A (5-6) boot removed	________
	2nd person verification	________
	e. 14A-S11A NORMAL	________
	2nd person verification	________

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.6	Core Spray Shutdown and Return to Normal - Unit 1 (Continued)	
	f. FCV-75-22 closed/FCV-75-9 open	
	g. CS 1A trip	
	h. FCV-75-25 power restored	
	i. Annunciation reset	
3.7	RHR Unit 1 Shutdown and Return to Normal	
	a. 10A-K9A (3-4) jumper removed	
	2nd person verification	
	b. NVA-A-1 (5-6) boot removed	
	2nd person verification	
	c. 10A-K105A energized	
	d. FCV-74-59 and -57 close/-7 open	
	e. RHR 1A trip	
	f. FCV-74-61 power restored	
	g. FCV-74-46 as left position	
	* h. Annunciation reset	
3.8	Shutdown Board A Return to Normal	
	a. 43SA reset	
	b. RCW 1D returned	
	c. CRD 1B returned	
	d. Fire pump A returned	
	e. 480V Sd Bd 1A returned	
	f. CS 1C returned	

*Revision JBD

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.8	Shutdown Board A Return to Normal (Continued)	
	g. DGVA-A-3 (9-10) boot removed	____
	2nd person verified	____
	h. DGVA-A-3 (11-12) boot removed	____
	2nd person verified	____
	i. DGVA-A-4 (1-2) boot removed	____
	2nd person verified	____
	j. DGVA-A-4 (3-4) boot removed	____
	2nd person verified	____
	k. Oscillograph inputs removed	____
	l. EECW system in standby readiness	____
	m. 480V Diesel Aux Bd. A returned to Normal	____

SI 4.9.A.1.b
Diesel Generator Emergency Load Acceptance Test
D/G B

1. Prerequisites

1.1 The unit 1 reactor vessel pressure shall not be greater than atmospheric.

1.2 The unit 1 core spray system shall be lined up for standby readiness as specified by Operating Instruction No. 75.

1.3 The unit 1 RHR system shall be lined up for standby readiness as specified by Operating Instruction No. 74.

*1.4 RHRSW pump C1 shall be operable.

1.5 Receive permission from the unit 1 assistant shift engineer to perform this test.

2. Precautions

2.1 This test will render loop I of the unit 1 core spray system inoperable. Do not conduct any test on loop II simultaneously. The requirements to test other systems or loops when one system is found to be inoperable will be waived when the system is made inoperable for testing.

2.2 This test will render loop I of the unit 1 RHR system inoperable. Do not conduct any test on loop II simultaneously.

2.3 Coordinate this test with the unit 2 operator and request that no surveillance testing be performed on the unit 2 core spray and RHR systems during this test.

3. Procedure

3.1 Core Spray Alignment - Unit 1

a. Vent the CSSI discharge piping through valves 75-584A and 75-585A until a steady stream of water is observed to flow out of the vent line into the open funnel.

*Revision 9/5/1

3. Procedure (Continued)

3.1 Core Spray Alignment - Unit 1 (Continued)

b. Verify FCV-75-25 is closed by observing position indicating lights on panel 9-3.

c. Remove control power from FCV-75-25 by tripping breaker in compartment 14B on 480V Reactor MOV Bd. 1A.

d. Verify FCV-75-23 is closed by observing position indicating lights on panel 9-3.

e. Verify test switch 14A-S15A (panel 9-32) is in the NORMAL position.

f. Plug core spray test fixture into jack 14A-J1A (panel 9-32).

CAUTION: Assure the test fixture switch is in the OFF position.

g. Place switch 14A-S13A (panel 9-32) in the TEST position and verify relay 14A-K31A drops out.

h. Block contact 1-2 on relay 14A-K26A (panel 9-32) open with an insulated boot per Standard Practice BFA25.

i. Block contact 5-6 on relay 14A-K26A (panel 9-32) open with an insulated boot per Standard Practice BFA25.

j. Place a jumper between contact terminals 3 and 4 on relay 14A-K10A (panel 9-32) per Standard Practice BFA25. There are two wires on terminal 3 and one wire on terminal 4.

k. Place CS pump 1A breaker (4-kV Sd Bd A, panel 16) in the test position.

3.2 RHR Alignment - Unit 1

a. Verify FCV-74-61 is closed by observing position indicating lights on panel 9-3.

b. Remove power from FCV-74-61 by tripping breaker 7B on 480V Reactor MOV Bd 1A.

3. <u>Procedure</u> (Continued)

3.2 RHR Alignment - Unit 1 (Continued)

c. Verify FCV-74-60 is closed by observing position indicating lights on panel 9-3.

d. Verify FCV-74-53 is closed by observing position indicating lights on panel 9-3.

e. Verify FCV-74-58 is closed by observing position indicating lights on panel 9-3.

f. Verify FCV-74-78 is closed by observing position indicating lights on panel 9-3.

g. Verify FCV-74-46 is closed by observing indicating lights on panel 9-3. Close the valve if it is open.

h. Verify switch 10A-S48A (panel 9-32) is in the NORMAL position.

i. Verify that relay 10A-K76A (panel 9-32) is deenergized.

j. Block contact 5-6 on relay NVA-B-1 (panel 25-45B) open with an insulated boot in accordance with Standard Practice BFA25.

k. Verify relay 10A-K105C (panel 9-32) is deenergized.

l. Place a jumper between contact terminals 9 and 10 on relay 10A-K9A (panel 9-32) in accordance with BFA25. There is one wire on terminal 9 and one wire on terminal 10.

<u>NOTE</u>: When RHR 1C pump breaker closes, it cannot be tripped locally.

3.3 Shutdown Board B Alignment

a. Verify that neither 480V Diesel Aux Bd. A or B is feeding from TDE.

b. Verify that neither 480V Shutdown Bd 1A or 1B is feeding from TS1E.

c. Transfer 480V Shutdown Bd 2A feed from TS2A to TS2E.

d. Caution unit 1 operator not to use fire pump B during the test.

e. Trip 43SB (panel 9-23) to manual.

3. Procedure (Continued)

3.3 Shutdown Board B Alignment (Continued)

f. Block contact 9-10 on relay DGVA-B-3 open with an insulated boot in accordance with Standard Practice BFA25.

g. Block contact 11-12 on relay DGVA-B-3 open with an insulated boot in accordance with Standard Practice BFA25.

h. Block contact 1-2 on relay DGVA-B-4 open with an insulated boot in accordance with Standard Practice BFA25.

i. Block contact 3-4 on relay DGVA-B-4 open with an insulated boot in accordance with Standard Practice BFA25.

j. Connect oscillograph channels to monitor the following:

(1) 1616 trip circuit

(2) 1822 close circuit

(3) RHR pump 1C close circuit

(4) CS pump 1C close circuit

*(5) RHRSW pump C1 close circuit

(6) 4-kV Shutdown Board B bus voltage

(7) D/G B current

3.4 Test Performance

NOTE: Because the sequence of events in this test is critical, a communication link should be established between 4-kV Shutdown Board B and panel 9-3, unit 1, prior to test initiation.

NOTE: As soon as core spray pump 1C and RHR pump 1C start, open their test loop valves from panel 9-3 - FCV-75-22 and FCV-74-57 and FCV-74-59, respectively. Continue until rated flows are established. (7000 to 10000 gpm for RHR and 3000 to 3125 gpm for core spray)

a. With the oscillograph running, trip breaker 1616. (Leave the oscillograph on for 45 seconds.)

*Revision JBD

3. Procedure (Continued)

3.4 Test Performance (Continued)

b. Verify that the following breakers closed:

(1) 1822

(2) RHR pump 1C

(3) CS pump 1C

*(4) RHRSW pump C1

c. Verify that diesel generator B voltage and current are stable.

d. Record the following D/G B data from metering on panel 9-23:

(1) KW

(2) KVAR

(3) Volts

(4) Amps

(5) Frequency

e. Mark oscillogram as trace no. 1-2 and attach to the data sheet.

3.5 Diesel Generator B Shutdown

a. Turn breaker 1616 synchronizing switch to ON position.

b. Place diesel generator B operational mode switch in PARALLEL WITH SYSTEM and verify associated mode light is on.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Bus 1.

d. Close breaker 1616.

e. Unload diesel generator.

f. Trip breaker 1822.

g. Pull diesel generator B control switch to STOP position.

h. Verify diesel generator speed drops to idle (450 rpm).

*Revision 28D

3. Procedure (Continued)

3.5 Diesel Generator B Shutdown (Continued)

i. Place 1616 synchronizing switch in OFF position.

j. When diesel generator stops verify diesel generator system B is in standby readiness per OI 82.

3.6 Core Spray Shutdown And Return To Normal - Unit 1

a. Remove jumper between contact terminals 3 and 4 on relay 14A-K10A (panel 9-32) in accordance with Standard Practice BFA25. There should be two wires left on terminal 3 and 1 wire on terminal 4.

b. Remove core spray system test fixture from jack 14A-J1A (panel 9-32).

c. Remove boot from contact 1-2 on relay 14A-K26A (panel 9-32) in accordance with BFA25.

d. Remove boot from contact 5-6 on relay 14A-K26A (panel 9-32) in accordance with BFA25.

e. Return switch 14A-S13A (panel 9-32) to the NORMAL position.

f. Close FCV-75-22. Verify FCV-75-9 opens as flow decreases.

g. Trip CS pump 1C.

h. Restore power to FCV-75-25 and verify position indicating light is on.

i. Reset all core spray annunciation.

3.7 RHR Shutdown And Return To Normal - Unit 1

a. Remove jumper between contact terminals 9 and 10 on relay 10A-K9A (panel 9-32) in accordance with Standard Practice BFA25. There should be one wire left on terminal 9 and one wire on terminal 10.

b. Remove boot from contact 5-6 on relay NVA-B-1 (panel 25-45B) in accordance with BFA25.

3. <u>Procedure</u> (Continued)

3.7 RHR Shutdown And Return To Normal - Unit 1 (Continued)

c. Verify relay 10A-K105C (panel 9-32) is energized.

d. Close FCV-74-59 and FCV-74-57. Verify that FCV-74-7 opens as flow decreases.

e. Trip RHR pump 1C.

f. Restore power to FCV-74-61 and verify position indicating lights is on.

g. Return FCV-74-46 to the position required by the shift engineer. Indicate the position on the data sheet.

h. Reset all RHR annunciation.

3.8 Shutdown Board B Return To Normal

a. Reset 43SB (panel 9-23) to auto.

b. Inform unit 1 operator that fire pump B is ready for operation.

c. Return 480V Shutdown Bd. 2A feed to TS2A.

d. Return CS pump 1A breaker to operate position.

e. Remove boot from contact 9-10 on relay DGVA-B-3 in accordance with BFA25.

f. Remove boot from contact 11-12 on relay DGVA-B-3 in accordance with BFA25.

g. Remove boot from contact 1-2 on relay DGVA-B-4 in accordance with BFA25.

h. Remove boot from contact 3-4 on relay DGVA-B-4 in accordance with BFA25.

i. Remove oscillograph inputs.

j. Return EECW system to standby readiness per OI 67.

3. <u>Procedure</u> (Continued)

3.9 Test Completion

a. The unit 1 core spray system, the unit 1 RHR system, and Diesel Generator B are now normal and in standby readiness.

b. Verify by signature and date on Data Cover Sheet that Diesel Generator B was tested in accordance with this instruction.

3.10 Acceptance Criteria

a. Diesel generator B reaches rated speed and voltage, and breaker 1822 closes within 11.5 seconds after 1616 trips.

b. RHR pump 1C starts within 1 second of 1822 closure.

c. CS pump 1C starts 7 ± 1 second after 1822 closure.

*d. RHRSW pump C1 starts 14 ± 1 second after 1822 closure.

e. All three pumps successfully accelerate on diesel generator power.

f. Diesel generator B is stable following the test.

*Revision JBD

SI 4.9.A.1.b

DATA COVER SHEET

Diesel Generator Emergency Load Acceptance Test

D/G B

Performed By ______________________ Date ______________________
Electrician

Were criteria satisfied? ______ Yes ______ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ________________, __________
Date

Reason for test:

______ Required by schedule

______ Other (explain) ______________________________

Results reviewed ______________________ Date ______________________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________________

Rescheduled

QA Staff ______________________ Date ______________________

Remarks ____

____

____

____

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.2	RHR Alignment - Unit 1 (Continued)	
	f. FCV-74-78 closed	_______
	g. FCV-74-46 closed	_______
	h. 10A-S48A NORMAL	_______
	i. 10A-K76A deenergized	_______
	j. NVA-B-1 (5-6) booted	_______
	2nd person verification	_______
	k. 10A-K105C deenergized	_______
	l. 10A-K9A (9-10) jumpered	_______
	2nd person verification	_______
3.3	Shutdown Bd. B Alignment	
	a. 480V Diesel Aux. Bd. A and B feeds verified	_______
	b. 480V Sd. Bds. 1A and 1B feeds verified	_______
	c. 480V Sd. Bd. 2A transferred	_______
	d. Fire pump B caution	_______
	e. 43SB tripped	_______
	f. DGVA-B-3 (9-10) booted	_______
	2nd person verification	_______
	g. DGVA-B-3 (11-12) booted	_______
	2nd person verification	_______
	h. DGVA-B-4 (1-2) booted	_______
	2nd person verification	_______
	i. DGVA-B-4 (3-4) booted	_______
	2nd person verification	_______

SI 4.9.A.1.b
DATA SHEET

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G B

NOTE: Step numbers correspond to numbers in the instruction.

Step		Initials/Data
3.1	Core Spray Alignment - Unit 1	
	a. CSSI vented	________
	b. FCV-75-25 closed	________
	c. FCV-75-25 power removed	________
	d. FCV-75-23 closed	________
	e. 14A-S15A NORMAL	________
	f. 14A-J1A fixture in	________
	g. 14A-S13A TEST/14A-K31A out	________
	h. 14A-K26A (1-2) booted	________
	2nd person verification	________
	i. 14A-K26A (5-6) booted	________
	2nd person verification	________
	j. 14A-K10A (3-4) jumpered	________
	2nd person verification	________
	k. CS 1A removed	________
3.2	RHR Alignment - Unit 1	
	a. FCV-74-61 closed	________
	b. FCV-74-61 power removed	________
	c. FCV-74-60 power closed	________
	d. FCV-74-53 closed	________
	e. FCV-74-58 closed	________

Data Sheet SI 4.9.A.1.b (Continued)

Step	INITIALS/DATE
3.3 Shutdown Bd. B Alignment (Continued)	
j. Oscillograph connections	
(1) 1616 trip ckt.	____
(2) 1822 cl. ckt.	____
(3) RHR 1C cl. ckt.	____
(4) CS 1C cl. ckt.	____
*(5) RHRSW C1 cl. ckt.	____
(6) 4-kV Sd. Bd. B volt	____
(7) D/G B current	____
3.4 Test Performance	
a. 1616 trip	____
b. Breaker closure	
(1) 1822	____
(2) RHR 1C	____
(3) CS 1C	____
*(4) RHRSW C1	____
c. Diesel gen. B stable	____
d. D/G B data	
(1) KW	____
(2) KVAR	____
(3) Volts	____
(4) Amps	____
(5) Frequency	____
e. Trace no. 1-2 attached	____

*Revision JSD

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.5	D/G A Shutdown	
	a. 1616 sync. sw. ON	______
	b. Mode sw. PARALLEL WITH SYSTEM	______
	c. D/G B in sync.	______
	d. 1616 closed	______
	e. D/G B unloaded	______
	f. 1822 trip	______
	g. Control sw. STOP	______
	h. D/G idle	______
	i. 1616 sync. sw. OFF	______
	j. D/G B standby readiness	______
3.6	Core Spray Shutdown and Return to Normal - Unit 1	
	a. 14A-K10A (3-4) jumper removed	______
	2nd person verification	______
	b. 14A-J1A fixture removed	______
	2nd person verification	______
	c. 14A-K26A (1-2) boot removed	______
	2nd person verification	______
	d. 14A-K26A (5-6) boot removed	______
	2nd person verification	______
	e. 14A-S13A NORMAL	______
	2nd person verification	______
	f. FCV-75-22 closed/FCV-75-9 open	______
	g. CS 1C trip	______

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.6	Core Spray Shutdown and Return to Normal - Unit 1 (Continued)	
	h. FCV-75-25 power restored	________
	i. Annunciation reset	________
3.7	RHR Shutdown and Return to Normal - Unit 1	
	a. 10A-K9A (9-10) jumper removed	________
	2nd person verification	________
	b. NVA-B-1 (5-6) boot removed	________
	2nd person verification	________
	c. 10A-K105C energized	________
	d. FCV-75-59 and -57 close/-7 open	________
	e. RHR 1C trip	________
	f. FCV-74-61 power restored	________
	g. FCV-74-46 as left position	________
	h. Annunciation reset	________
3.8	Shutdown Board B Return to Normal	
	a. 43SB reset	________
	b. Fire pump B returned	________
		________
	c. 480V Sd. Bd. 2A returned	________
	d. CS 1A returned	________
	e. DGVA-B-3 (9-10) boot removed	________
	2nd person verification	________

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.8	Shutdown Board B Return to Normal (Continued)	
	f. DGVA-B-4 (11-12) boot removed	______
	2nd person verification	______
	g. DGVA-B-4 (1-2) boot removed	______
	2nd person verification	______
	h. DGVA-B-4 (3-4) boot removed	______
	2nd person verification	______
	i. Oscillograph inputs removed	______
	j. EECW system in standby readiness	______

3.8.

SI 4.9.A.1.b
Diesel Generator Emergency Load Acceptance Test
D/G C

1. Prerequisites

1.1 The unit 1 reactor vessel pressure shall not be greater than atmospheric.

1.2 The unit 1 core spray system shall be lined up for standby readiness as specified by Operating Instruction No. 75.

1.3 The unit 1 RHR system shall be lined up for standby readiness as specified by Operating Instruction No. 74.

*1.4 RHRSW pump B3 shall be operable.

1.5 Receive permission from the unit 1 assistant shift engineer to perform this test.

2. Precautions

2.1 This test will render loop II of the unit 1 core spray system inoperable. Do not conduct any test on loop I simultaneously. The requirements to test other systems or loops when one system is found to be inoperable will be waived when the system is made inoperable for testing.

2.2 This test will render loop II of the unit 1 RHR system inoperable. Do not conduct any test on loop I simultaneously.

2.3 Coordinate this test with the unit 2 operator and request that no surveillance testing be performed on the unit 2 core spray and RHR systems during this test.

3. Procedure

3.1 Core Spray Alignment - Unit 1

a. Vent the CSSII discharge piping through valves 75-584B and 75-585B until a steady stream of water is observed to flow out of the vent line into the open funnel.

*Revision JSD

3. Procedure (Continued)

3.1 Core Spray Alignment - Unit 1 (Continued)

b. Verify FCV-75-53 is closed by observing position indicating lights on pnl. 9-3.

c. Remove control power from FCV-75-53 by tripping breaker in compartment 7E on 480V Reactor MOV Bd. 1B.

d. Verify FCV-75-51 is closed by observing position indicating lights on pnl. 9-3.

e. Verify test switch 14A-S15B (pnl. 9-33) is in the NORMAL position.

f. Plug core spray system test fixture into jack 14A-J1B (pnl. 9-33).

g. Place switch 14A-S11B (pnl. 9-33) in the TEST position and verify relay 14A-K29B (pnl. 9-33) drops out.

h. Block contact 1-2 on relay 14A-K25B (pnl. 9-33) open with an insulated boot per Standard Practice BFA25.

i. Block contact 5-6 on relay 14A-K25B (pnl. 9-33) open with an insulated boot per Standard Practice BFA 25.

j. Place a jumper between contact terminals 7 and 8 on relay 14A-K10B (pnl.-9-33) per Standard Practice BFA25. There are 2 wires on terminal 7 and one wire on terminal 8.

k. Remove CS pump 1D breaker (4KV Sd Bd D, pnl. 7) from the operate position.

3.2 RHR Alignment - Unit 1

a. Verify FCV-74-75 is closed by observing position indicating lights on pnl. 9-3.

b. Remove power from FCV-74-75 by tripping breaker 10E on 480V Reactor MOV Bd. 1B.

c. Verify FCV-74-74 is closed by observing position indicating lights on pnl. 9-3.

3. Procedure (Continued)

3.2 RHR Alignment - Unit 1 (Continued)

d. Verify FCV-74-67 is closed by observing position indicating lights on pnl. 9-3.

e. Verify FCV-74-72 is closed by observing position indicating lights on pnl. 9-3.

f. Verify FCV-74-78 is closed by observing position indicating lights on pnl. 9-3.

g. Verify FCV-74-46 is closed by observing the indicating lights on pnl. 9-3. Close the valve if it is open.

h. Verify FCV-78-61 is closed by observing the indicating lights on pnl. 9-4.

i. Verify switch 10A-S48B (pnl. 9-33) is in the NORMAL position.

j. Verify that relay 10A-K72B (pnl 9-33) is deenergized.

k. Block contact 5-6 on relay NVA-C-1 (pnl. 25-45C) open with an insulated boot in accordance with Standard Practice BFA25.

l. Verify that relay 10A-K105B (pnl. 9-33) is deenergized.

m. Verify that relay 10A-K74B (pnl. 9-33) is deenergized.

n. Place a jumper between contact terminals 3 and 4 on relay 10A-K9B (pnl. 9-33) in accordance with BFA25. There is one wire on terminal 3 and two wires on terminal 4.

NOTE: When RHR 1B pump breaker closes, it cannot be tripped locally.

3.3 Shutdown Board C Alignment

a. Transfer 480V Shutdown Bd. 1B feed from TS1B to TS1E.

b. Verify that neither 480V Shutdown Bd. 2A nor 2B is feeding from TS2E.

c. Caution unit 1 operator not to use fire pump C during this test.

3. Procedure (Continued)

3.3 Shutdown Board C Alignment (Continued)

d. Trip 43SC (pnl. 9-23) to manual.

e. Block contact 9-10 on relay DGVA-C-3 open with an insulated boot in accordance with Standard Practice BFA25.

f. Block contact 11-12 on relay DGVA-C-3 open with an insulated boot in accordance with Standard Practice BFA25.

g. Block contact 1-2 on relay DGVA-C-4 open with an insulated boot in accordance with Standard Practice BFA25.

h. Block contact 3-4 on relay DGVA-C-4 open with an insulated boot in accordance with Standard Practice BFA25.

i. Connect oscillograph channels to monitor the following:

(1) 1718 trip circuit

(2) 1812 close circuit

(3) RHR pump 1B close circuit

(4) CS pump 1B close circuit

*(5) RHRSW pump B3 close circuit

(6) 4-KV Shutdown Board C bus voltage

(7) D/G C current

3.4 Test Performance

NOTE: Because the sequence of events in this test is critical, a communication link should be established between 4-KV Shutdown Board C and panel 9-3, unit 1, prior to test initiation.

NOTE: As soon as core spray pump 1B and RHR pump 1B start, open their test loop valves from pnl. 9-3 - FCV-75-50, and FCV-74-71 and FCV-74-73, respectively. Continue until rated flows are established. (7000 to 10000 gpm for RHR and 3000 to 3125 gpm for core spray.)

*Revision JBD

3. Procedure (Continued)

3.4 Test Performance (Continued)

a. With the oscillograph running, trip breaker 1718. (Leave the oscillograph on for 45 seconds.)

b. Verify that the following breakers closed:

(1) 1812

(2) RHR pump 1B

(3) CS pump 1B

*(4) RHRSW pump B3

c. Verify that diesel generator C voltage and current are stable.

d. Record the following D/G C data from metering on pnl. 9-23.

(1) KW

(2) KVAR

(3) Volts

(4) Amps

(5) Frequency

e. Mark oscillogram as trace no. 1-3 and attach to the data sheet.

3.5 Diesel Generator C Shutdown

a. Turn breaker 1718 synchronizing switch to ON position.

b. Place diesel generator C operational mode switch in PARALLEL WITH SYSTEM and verify associated mode light is on.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Bus 2.

d. Close breaker 1718.

e. Unload diesel generator.

f. Trip breaker 1812.

*Revision JBD

3. <u>Procedure</u> (Continued)

3.5 Diesel Generator C Shutdown (Continued)

g. Pull diesel generator C control switch to STOP position.

h. Verify diesel generator speed drops to idle (450 rpm).

i. Place 1718 synchronizing switch in OFF position.

j. When diesel generator stops verify diesel generator system C is in standby readiness per OI 82.

3.6 Core Spray Shutdown And Return To Normal - Unit 1

a. Remove jumper between contact terminals 7 and 8 on relay 14A-K10B (pnl. 9-33) in accordance with BFA25. There should be 2 wires left on terminal 7 and one wire on terminal 8.

b. Remove core spray system test fixture from jack 14A-J1B (pnl. 9-33)

c. Remove boot from contact 1-2 on relay 14A-K25B (pnl. 9-33) in accordance with BFA25.

d. Remove boot from contact 5-6 on relay 14A-K25B (pnl. 9-33) in accordance with BFA25.

e. Return switch 14A-S11B (pnl. 9-33) to NORMAL position.

f. Close FCV-75-50. Verify FCV-75-37 opens as flow decreases.

g. Trip CS pump 1B.

h. Restore power to FCV-75-53 and verify position indicating light is on.

i. Reset all core spray annunciation.

3.7 RHR Shutdown And Return To Normal - Unit 1

a. Remove jumper between contact terminals 3 and 4 on relay 10A-K9B (pnl. 9-33) in accordance with Standard Practice BFA25. There should be one wire left on terminal 3 and two wires on terminal 4.

3. Procedure (Continued)

3.7 RHR Shutdown And Return To Normal - Unit 1 (Continued)

b. Remove boot from contact 5-6 on relay NVA-C-1 (pnl. 25-45C) in accordance with BFA25.

c. Verify relay 10A-K105B (pnl. 9-33) is energized.

d. Close FCV-74-71 and FCV-74-73. Verify that FCV-74-30 opens as flow decreases.

e. Trip RHR pump 1B.

f. Restore power to FCV-74-75 and verify position indicating light is on.

g. Return FCV-74-46 to the position required by the shift engineer. Indicate the position on the data sheet.

h. Reset all RHR annunciation.

3.8 Shutdown Board C Return To Normal

a. Reset 43SC (pnl. 9-23) to auto.

b. Inform unit 1 operator that fire pump C is now ready for operation.

c. Return 480V Shutdown Bd. 1B feed to TS1B.

d. Return CS pump 1D breaker to operate position.

e. Remove boot from contact 9-10 on relay DGVA-C-3 in accordance with BFA25.

f. Remove boot from contact 11-12 on relay DGVA-C-3 in accordance with BFA25.

g. Remove boot from contact 1-2 on relay DGVA-C-4 in accordance with BFA25.

h. Remove boot from contact 3-4 on relay DGVA-C-4 in accordance with BFA25.

i. Remove oscillograph inputs.

j. Return the EECW System to standby readiness per OI 67.

3. Procedure (Continued)

3.9 Test Completion

a. The unit 1 core spray system, the unit 1 RHR system, and Diesel Generator C are now normal and in standby readiness.

b. Verify by signature and date on Data Cover Sheet that Diesel Generator C was tested in accordance with this instruction.

3.10 Acceptance Criteria

a. Diesel generator C reaches rated speed and voltage, and breaker 1812 closes within 11.5 seconds after 1718 trips.

b. RHR pump 1B starts within 1 second of 1812 closure.

c. CS pump 1B starts 7 ± 1 second after 1812 closure.

*d. RHRSW pump B3 starts 14 ± 1 second after 1812 closure.

e. All three pumps successfully accelerate on diesel generator power.

f. Diesel generator C is stable following the test.

*Revision JBD

SI 4.9.A.1.b

DATA COVER SHEET

Diesel Generator Emergency Load Acceptance Test

D/G C

Performed By ______________________ Date ______________________
Electrician

Were criteria satisfied? ______ Yes ______ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ________________, __________
Date

Reason for test:

______ Required by schedule

______ Other (explain) ______________________________

Results reviewed ______________________ Date ______________________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________________

Rescheduled

QA Staff ______________________ Date ______________________

Remarks ____

____

____

____

SI 4.9.A.1.b
DATA SHEET

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G C

NOTE: Step numbers correspond to numbers in the instruction.

Step		Initials/Data
3.1	Core Spray Alignment - Unit 1	
	a. CSSII vented	______
	b. FCV-75-53 closed	______
	c. FCV-75-53 power removed	______
	d. FCV-75-51 closed	______
	e. 14A-S15B NORMAL	______
	f. 14A-J1B fixture in	______
	g. 14A-S11B TEST/14A-K29B out	______
	h. 14A-K25B (1-2) booted	______
	2nd person verification	______
	i. 14A-K25B (5-6) booted	______
	2nd person verification	______
	j. 14A-K10B (7-8) jumpered	______
	2nd person verification	______
	k. CS 1D removed	______
3.2	RHR Alignment - Unit 1	
	a. FCV-74-75 closed	______
	b. FCV-74-75 power removed	______
	c. FCV-74-74 closed	______
	d. FCV-74-67 closed	______
	e. FCV-74-72 closed	______

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.2	RHR Alignment - Unit 1 (Continued)	
	f. FCV-74-78 closed	____________
	g. FCV-74-46 closed	____________
	h. FCV-78-61 closed	____________
	i. 10A-S48B NORMAL	____________
	j. 10A-K72B deenergized	____________
	k. NVA-C-1 (5-6) booted	____________
	2nd person verification	____________
	l. 10A-K105B deenergized	____________
	m. 10A-K74B deenergized	____________
	n. 10A-K9B (3-4) jumpered	____________
	2nd person verification	____________
3.3	Shutdown Bd. C Alignment	
	a. 480V Sd. Bd. 1B transferred	____________
	b. 480V Sd. Bds. 2A and 2B feeds verified	____________
	c. Fire pump C caution	____________
	d. 43SC tripped	____________
	e. DGVA-C-3 (9-10) booted	____________
	2nd person verification	____________
	f. DGVA-C-3 (11-12) booted	____________
	2nd person verification	____________
	g. DGVA-C-4 (1-2) booted	____________
	2nd person verification	____________

Data Sheet SI 4.9.A.1.b (Continued)

Step	INITIALS/DATE
3.3 Shutdown Bd. C Alignment (Continued)	
h. DGVA-C-4 (3-4) booted	______
2nd person verification	______
i. Oscillograph connections	
(1) 1718 trip ckt.	______
(2) 1812 cl. ckt.	______
(3) RHR 1B cl. ckt.	______
(4) CS 1B cl. ckt.	______
*(5) RHR Sw. B3 cl. ckt.	______
(6) 4-kV Sd. Bd. C volt	______
(7) D/G C current	______
3.4 Test Performance	
a. 1718 trip	______
b. Breaker closure	
(1) 1812	______
(2) RHR 1B	______
(3) CS 1B	______
*(4) RHRSW B3	______
c. Diesel gen. C stable	______
d. D/G C data	
(1) KW	______
(2) KVAR	______
(3) Volts	______
(4) Amps	______
(5) Frequency	______

*Revision JLD

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.4	Test Performance (Continued)	
	e. Trace no. 1-3 attached	______
3.5	D/G A Shutdown	
	a. 1718 sync. sw. ON	______
	b. Mode sw. PARALLEL WITH SYSTEM	______
	c. D/G C in sync.	______
	d. 1718 closed	______
	e. D/G C unloaded	______
	f. 1812 trip	______
	g. Control sw. STOP	______
	h. D/G idle	______
	i. 1718 sync. sw. OFF	______
	j. D/G C standby readiness	______
3.6	Core Spray Shutdown and Return to Normal - Unit 1	
	a. 14A-K10B (7-8) jumper removed	______
	2nd person verification	______
	b. 14A-J1B fixture removed	______
	2nd person verification	______
	c. 14A-K25B (1-2) boot removed	______
	2nd person verification	______
	d. 14A-K25B (5-6) boot removed	______
	2nd person verification	______
	e. 14A-S11B NORMAL	______
	2nd person verification	______

Revision ______

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.6	Core Spray Shutdown and Return to Normal - Unit 1 (Continued)	
	f. FCV-75-50 closed/FCV-75-9 open	________
	g. CS 1B trip	________
	h. FCV-75-53 power restored	________
	i. Annunciation reset	________
3.7	RHR Shutdown and Return to Normal - Unit 1	
	a. 10A-K9B (3-4) jumper removed	________
	2nd person verification	________
	b. NVA-C-1 (5-6) boot removed	________
	2nd person verification	________
	c. 10A-K105B energized	________
	d. FCV-74-71 and -73 close/-30 open	________
	e. RHR 1B trip	________
	f. FCV-74-75 power restored	________
	g. FCV-74-46 as left position	________
	h. Annunciation reset	________
3.8	Shutdown Board C Return to Normal	
	a. 43SC reset	________
	b. Fire pump C returned	________
	c. 480V Sd. Bd. 1B returned	________
	d. CS 1D returned	________
	e. DGVA-C-3 (9-10) boot removed	________
	2nd person verification	________

Data Sheet SI 4.9.A.1.b (Continued)

Step	Initials/Data
3.8 Shutdown Board C Return to Normal (Continued)	
f. DGVA-C-3 (11-12) boot removed	________
2nd person verification	________
g. DGVA-C-4 (1-2) boot removed	________
2nd person verification	________
h. DGVA-C-4 (3-4) boot removed	________
2nd person verification	________
i. Oscillograph inputs removed	________
j. EECW system in standby readiness	________

SI 4.9.A.1.b
Diesel Generator Emergency Load Acceptance Test
D/G D

1. Prerequisites

1.1 The unit 1 reactor vessel pressure shall not be greater than atmospheric.

1.2 The unit 1 core spray system shall be lined up for standby readiness as specified by Operating Instruction No. 75.

1.3 The unit 1 RHR system shall be lined up for standby readiness as specified by Operating Instruction No. 74.

*1.4 RHRSW pump D3 shall be operable.

1.5 Receive permssion from the unit 1 assistant shift engineer to perform this test.

2. Precautions

2.1 This test will render loop II of the unit 1 core spray system inoperable. Do not conduct any test on loop I simultaneously. The requirements to test other systems or loops when one system is found to be inoperable will be waived when the system is made inoperable for testing.

2.2 This test will render loop II of the unit 1 RHR system inoperable. Do not conduct any test on loop I simultaneously.

2.3 Coordinate this test with the unit 2 operator and request that no surveillance testing be performed on the unit 2 core spray and RHR systems during this test.

3. Procedure

3.1 Core Spray Alignment - Unit 1

a. Vent the CSSII discharge piping through valves 75-584B and 75-585B until a steady stream of water is observed to flow out of the vent line into the open funnel.

3. Procedure (Continued)

3.1 Core Spray Alignment - Unit 1 (Continued)

b. Verify FCV-75-53 is closed by observing position indicating lights on pnl. 9-3.

c. Remove control power from FCV-75-53 by tripping breaker in compartment 7E on 480V Reactor MOV Bd. 1B.

d. Verify FCV-75-51 is closed by observing position indicating lights on pnl. 9-3.

e. Verify test switch 14A-S15B (pnl. 9-33) is in the NORMAL position.

f. Plug core spray test fixture into jack 14A-J1B (pnl. 9-33).

CAUTION: Assure the test fixture switch is in the OFF position.

g. Place switch 14A-S13B (pnl. 9-33) in the TEST position and verify relay 14A-K31B (pnl. 9-33) drops out.

h. Block contact 1-2 on relay 14A-K26B (pnl. 9-33) open with an insulated boot per Standard Practice BFA25.

i. Block contact 5-6 on relay 14A-K26B (pnl. 9-33) open with an insulated boot per Standard Practice BFA25.

j. Place a jumper between contact terminals 3 and 4 on relay 14A-K10B (pnl. 9-33) per Standard Practice BFA25. There are 2 wires on terminal 3 and one wire on terminal 4.

k. Remove CS pump 1B breaker (4KV Sd Bd C, pnl. 6) from the operate position.

3.2 RHR Alignment - Unit 1

a. Verify FCV-74-75 is closed by observing position indicating lights on pnl. 9-3.

b. Remove power from FCV-74-75 by tripping breaker 10E on 480V Reactor MOV Bd. 1B.

3. Procedure (Continued)

3.2 RHR Alignment - Unit 1 (Continued)

c. Verify FCV-74-74 is closed by observing position indicating lights on pnl. 9-3.

d. Verify FCV-74-67 is closed by observing position indicating lights on pnl. 9-3.

e. Verify FCV-74-72 is closed by observing position indicating lights on pnl. 9-3.

f. Verify FCV-74-78 is closed by observing position indicating lights on pnl. 9-3.

g. Verify FCV-74-46 is closed by observing the indicating lights on pnl. 9-3. Close the valve if it is open.

h. Verify that FCV-78-61 is closed by observing the indicating lights on pnl. 9-4.

i. Verify switch 10A-S48B (pnl. 9-33) is in the NORMAL position.

j. Verify that relay 10A-K76B (pnl. 9-33) is deenergized.

k. Block contact 5-6 on relay NVA-D-1 (pnl. 25-45D) open with an insulated boot in accordance with Standard Practice BFA25.

l. Verify that relay 10A-K105D (pnl. 9-33) is deenergized.

m. Verify that relay 10A-K74B (pnl. 9-33) is deenergized.

n. Place a jumper between contact terminals 7 and 8 on relay 10A-K9B (pnl. 9-33) in accordance with BFA25. There is one wire on terminal 7 and one wire on terminal 8.

NOTE: When RHR 1D pump breaker closes, it cannot be tripped locally.

3.3 Shutdown Board D Alignment

a. Transfer 480V Shutdown Bd. 2B feed from TS2B to TS2E.

b. Transfer 480V Diesel Aux. Bd. B feed from TDB to TDE.

3. Procedure (Continued)

3.3 Shutdown Board D Alignment (Continued)

c. Trip 43SD (pnl. 9-23) to manual.

d. Block contact 9-10 on relay DGVA-D-3 open with an insulated boot in accordance with Standard Practice BFA25.

e. Block contact 11-12 on relay DGVA-D-3 open with an insulated boot in accordance with Standard Practice BFA25.

f. Block contact 1-2 on relay DGVA-D-4 open with an insulated boot in accordance with Standard Practice BFA25.

g. Block contact 3-4 on relay DGVA-D-4 open with an insulated boot in accordance with Standard Practice BFA25.

h. Connect oscillograph channels to monitor the following:

(1) 1724 trip circuit

(2) 1816 close circuit

(3) RHR pump 1D close circuit

(4) CS pump 1D close circuit

*(5) RHRSW pump D3 close circuit

(6) 4-KV Shutdown Board D bus voltage

(7) D/G D current

3.4 Test Performance

NOTE: Because the sequence of events in this test is critical, a communication link should be established between 4-KV Shutdown Board D and panel 9-3, unit 1, prior to test initiation.

NOTE: As soon as core spray pump 1D and RHR pump 1D start, open their test loop valves from pnl. 9-3 - FCV-75-50, and FCV-74-71 and FCV-74-73, respectively. Continue until rated flows are established. (7000 to 10000 gpm for RHR and 3000 to 3125 gpm for core spray)

*Revision JKD

3. Procedure (Continued)

3.4 Test Performance (Continued)

a. With the oscillograph running, trip breaker 1724. (Leave the oscillograph on for 45 seconds.)

b. Verify that the following breakers closed:

(1) 1816

(2) RHR pump 1D

(3) CS pump 1D

*(4) RHRSW pump D3

c. Verify that diesel generator D voltage and current are stable.

d. Record the following D/G D data from metering on pnl. 9-23:

(1) KW

(2) KVAR

(3) Volts

(4) Amps

(5) Frequency

e. Mark oscillogram as trace no. 1-4 and attach to the data sheet.

3.5 Diesel Generator D Shutdown

a. Turn breaker 1724 synchronizing switch to ON position.

b. Place diesel generator D operational mode switch in PARALLEL WITH SYSTEM and verify associated mode light is on.

c. Adjust frequency and voltage until the diesel generator is in synchronism with Shutdown Bus 2.

d. Close breaker 1724.

e. Unload diesel generator.

*Revision JBD

3. Procedure (Continued)

3.5 Diesel Generator D Shutdown (Continued)

f. Trip breaker 1816.

g. Pull diesel generator D control switch to STOP position.

h. Verify diesel generator speed drops to idle (450 rpm).

i. Place 1724 synchronizing switch in OFF position.

j. When diesel generator stops verify diesel generator system D is in standby readiness per OI 82.

3.6 Core Spray Shutdown And Return To Normal - Unit 1

a. Remove jumper between contact terminals 3 and 4 on relay 14A-K10B (pnl. 9-33) in accordance with BFA25. There should be two wires left on terminal 3 and one wire left on terminal 8.

b. Remove core spray test fixture from jack 14A-J1B (pnl. 9-33).

c. Remove boot from contact 1-2 on relay 14A-K26B (pnl. 9-33) in accordance with Standard Practice BFA25.

d. Remove boot from contact 5-6 on relay 14A-K26B (pnl. 9-33) in accordance with BFA25.

e. Return switch 14A-S13B (pnl. 9-33) to NORMAL position.

f. Close FCV-75-50. Verify FCV-75-37 opens as flow decreases.

g. Trip CS pump 1D.

h. Restore power to FCV-75-53 and verify position indicating light is on.

i. Reset all core spray annunciation.

3.7 RHR Shutdown And Return To Normal - Unit 1

a. Remove jumper between contact terminals 7 and 8 on relay 10A-K9B (pnl. 9-33) in accordance with Standard Practice BFA25. There should be one wire left on terminal 7 and one wire on terminal 8.

b. Remove boot from contact 5-6 on relay NVA-D-1 (pnl. 25-45D) in accordance with BFA25.

3. Procedure (Continued)

3.7 RHR Shutdown And Return To Normal - Unit 1 (Continued)

c. Verify relay 10A-K105D (pnl. 9-33) is energized.

d. Close FCV-74-71 and FCV-74-73. Verify that FCV-74-30 open as flow decreases.

e. Trip RHR pump 1D.

f. Restore power to FCV-74-75 and verify position indicating light is on.

g. Return FCV-74-46 to the position required by the shift engineer. Indicate the position on the data sheet.

h. Reset all RHR annunciation.

3.8 Shutdown Board D Return To Normal

a. Reset 43SD (pnl. 9-23) to auto.

b. Return 480V Shutdown Bd. 2B feed to TS2B.

c. Return 480V Diesel Aux. Bd. B feed to TDB.

d. Return CS pump 1B breaker to operate position.

e. Remove boot from contact 9-10 on relay DGVA-D-3 in accordance with BFA25.

f. Remove boot from contact 11-12 on relay DGVA-D-3 in accordance with BFA25.

g. Remove boot from contact 1-2 on relay DGVA-D-4 in accordance with BFA25.

h. Remove boot from contact 3-4 on relay DGVA-D-4 in accordance with BFA25.

i. Remove oscillograph inputs.

j. Return the EECW system to standby readiness per OI 67.

3. Procedure (Continued)

3.9 Test Completion

a. The unit 1 core spray system, the unit 1 RHR system, and Diesel Generator D are now normal and in standby readiness.

b. Verify by signature and date on Data Cover Sheet that Diesel Generator D was tested in accordance with this instruction.

3.10 Acceptance Criteria

a. Diesel generator D reaches rated speed and voltage, and breaker 1816 closes within 11.5 seconds after 1724 trips.

b. RHR pump 1D starts within 1 second of 1816 closure.

c. CS pump 1D starts 7 ± 1 second after 1816 closure.

*d. RHRSW pump D3 starts 14 ± 1 second after 1816 closure.

e. All three pumps successfully accelerate on diesel generator power.

f. Diesel generator D is stable following the test.

*Revision JBD

SI 4.9.A.1.b

DATA COVER SHEET

Diesel Generator Emergency Load Acceptance Test

D/G D

Performed By ______________________ Date ______________________
Electrician

Were criteria satisfied? _____ Yes _____ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ______________, ______________
Date

Reason for test:

_____ Required by schedule.

_____ Other (explain) ______________________________

Results reviewed ______________________ Date ______________________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________________

Rescheduled

QA Staff ______________________ Date ______________________

Remarks ____

____

____

____

SI 4.9.A.1.b
DATA SHEET

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G D

NOTE: Step numbers correspond to numbers in the instruction.

Step		Initials/Data
3.1	Core Spray Alignment - Unit 1	
	a. CSSII vented	________
	b. FCV-75-53 closed	________
	c. FCV-75-53 power removed	________
	d. FCV-75-51 closed	________
	e. 14A-S15B NORMAL	________
	f. 14A-J1B fixture in	________
	g. 14A-S13B TEST/14A-K31B out	________
	h. 14A-K25B (1-2) booted	________
	2nd person verification	________
	i. 14A-K25B (5-6) booted	________
	2nd person verification	________
	j. 14A-K10B (3-4) jumpered	________
	2nd person verification	________
	k. CS 1B removed	________
3.2	RHR Alignment - Unit 1	
	a. FCV-74-75 closed	________
	b. FCV-74-75 power removed	________
	c. FCV-74-74 closed	________
	d. FCV-74-67 closed	________
	e. FCV-74-72 closed	________

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.2	RHR Alignment - Unit 1 (Continued)	
	f. FCV-74-78 closed	
	g. FCV-74-46 closed	
	h. FCV-78-61 closed	
	i. 10A-S48B NORMAL	
	j. 10A-K76B deenergized	
	k. NVA-D-1 (5-6) booted	
	2nd person verification	
	l. 10A-K105D deenergized	
	m. 10A-K74B deenergized	
	n. 10A-K9B (7-8) jumpered	
	2nd person verification	
3.3	Shutdown Bd. D Alignment	
	a. 480V Sd. Bd. 2B transferred	
	b. 480V Diesel Aux. Bd. B transferred	
	c. 43SD tripped	
	d. DGVA-D-3 (9-10) booted	
	2nd person verification	
	e. DGVA-D-3 (11-12) booted	
	2nd person verification	
	f. DGVA-D-4 (1-2) booted	
	2nd person verification	

Data Sheet SI 4.9.A.1.b (Continued)

Step			INITIALS/DATE
3.3	Shutdown Bd. D Alignment (Continued)		
	g.	DGVA-A-4 (3-4) booted	
		2nd person verification	
	h.	Oscillograph connections	
		(1) 1724 trip ckt.	
		(2) 1816 cl. ckt.	
		(3) RHR 1D cl. ckt.	
		(4) CS 1D cl. ckt.	
		*(5) RHRSW D3 cl. ckt.	
		(6) 4-kV Sd. Bd. D volt.	
		(7) D/G D current	
3.4	Test Performance		
	a.	1724 trip	
	b.	Breaker closure	
		(1) 1816	
		(2) RHR 1D	
		(3) CS 1D	
		*(4) RHRSW D3	
	c.	Diesel gen. D stable	
	d.	D/G D data	
		(1) KW	
		(2) KVAR	
		(3) Volts	

*Revision JBD

Data Sheet SI 4.9.A.1.b (Continued)

Step	Initials/Data
3.4 Test Performance (Continued)	
d. D/G D data (Continued)	
(4) Amps	______
(5) Frequency	______
e. Trace no. 1-4 attached	______
3.5 D/G D Shutdown	
a. 1724 sync. sw. ON	______
b. Mode sw. PARALLEL WITH SYSTEM	______
c. D/G D in sync.	______
d. 1724 closed	______
e. D/G D unloaded	______
f. 1816 trip	______
g. Control sw. STOP	______
h. D/G idle	______
i. 1724 sync. sw. OFF	______
j. D/G D standby readiness	______
3.6 Core Spray Shutdown And Return to Normal - Unit 1	
a. 14A-K10B (3-4) jumper removed	______
2nd person verification	______
b. 14A-J1B fixture removed	______
2nd person verification	______
c. 14A-K25B (1-2) boot removed	______
2nd person verification	______
d. 14A-K25B (5-6) boot removed	______
2nd person verification	______

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.6	Core Spray Shutdown And Return to Normal - Unit 1 (Continued)	
	e. 14A-S13B NORMAL	______
	f. FCV-75-50 closed/FCV-75-37 open	______
	g. CS 1D trip	______
	h. FCV-75-53 power restored	______
	i. Annunciation reset	______
3.7	RHR Shutdown and Return to Normal - Unit 1	
	a. 10A-K9A (7-8) jumper removed	______
	2nd person verification	______
	b. NVA-D-1 (5-6) boot removed	______
	2nd person verification	______
	c. 10A-K105D energized	______
	d. FCV-74-71 and -73 close/-30 open	______
	e. RHR 1D trip	______
	f. FCV-74-75 power restored	______
	g. FCV-74-46 as left position	______
	h. Annunciation reset	______
3.8	Shutdown Board D Return to Normal	
	a. 43SD reset	______
	b. 480V Sd. Bd. 2B returned	______
	c. 480V Diesel Aux. Bd. B returned	______
	d. CS 1B returned	______

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.8	Shutdown Board D Return to Normal (Continued)	
	e. DGVA-D-3 (9-10) boot removed	
	2nd person verification	
	f. DGVA-D-3 (11-12) boot removed	
	2nd person verification	
	g. DGVA-D-4 (1-2) boot removed	
	2nd person verification	
	h. DGVA-D-4 (3-4) boot removed	
	2nd person verification	
	i. Oscillograph inputs removed	
	j. EECW in standby readiness	

SI 4.9.A.1.b
DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G 3A

1. Prerequisites

1.1 The unit 3 reactor vessel pressure shall not be greater than atmospheric.

1.2 The unit 3 core spray system shall be lined up for standby readiness as specified by Operating Instruction No. 75.

1.3 The unit 3 RHR system shall be lined up for standby readiness as specified by Operating Instruction No. 74.

*1.4 RHRSW pump A3 shall be operable.

1.5 Receive permission from the unit 3 assistant shift engineer to perform this test.

2. Precautions

2.1 This test will render loop I of the unit 3 core spray system inoperable. Do not conduct any test on loop II simultaneously. The requirements to test other systems or loops when one system is found to be inoperable will be waived when the system is made inoperable for testing.

3. Procedure

3.1 Core Spray Alignment - Unit 3

a. Vent the CSSI discharge piping through valves 75-584A and 75-585A until a steady stream of water is observed to flow out of the vent line into the open funnel.

b. Verify FCV-75-25 is closed by observing position indicating lights on panel 9-3.

*Revison JSD

3. Procedure (Continued)

3.1 Core Spray Alignment - Unit 3 (Continued)

c. Remove control power from FCV-75-25 by tripping breaker in compartment 14B on 480V Reactor MOV Bd. 3A.

d. Verify FCV-75-23 is closed by observing position indicating lights on panel 9-3.

e. Verify test switch 14A-S15A (panel 9-32) is in the NORMAL position.

f. Plug core spray system test fixture into jack 14A-J1A (panel 9-32).

CAUTION: Assure the test fixture switch is in the OFF position.

g. Place switch 14A-S11A (panel 9-32) in TEST position and verify relay 14A-K29A (panel 9-32) drops out.

h. Block contact 1-2 on relay 14A-K25A (panel 9-32) open with an insulated boot per Standard Practice BFA25.

i. Block contact 5-6 on relay 14A-K25A (panel 9-32) open with an insulated boot per Standard Practice BFA25.

j. Place a jumper between contact terminals 7 and 8 on relay 14A-K10A (panel 9-32) per BFA25.

k. Remove CS pump 3C breaker (4-kV Sd. Bd. 3EB, panel 5) from the operate position.

3.2 RHR Alignment - Unit 3

a. Venting of the RHR system shall have been accomplished no longer than 30 days prior to the implementation of this test. This can be verified by checking the last running date of SI 4.5.B.1.a, SI 4.5.B.1.b, or SI 4.5.B.1.d. If venting has not been accomplished, vent the RHRs at the following locations:

3. Procedure (Continued)

3.2 RHR Alignment - Unit 3 (Continued)

a. (Continued)

Solenoid Valve	Valve Location
FSV-74-142	A heat exchanger
FSV-74-143	C heat exchanger
FSV-74-139	Sys. I drywell spray line
FSV-74-140	Sys. I LPCI injection line
FSV-74-144	B heat exchanger
FSV-74-145	D heat exchanger
FSV-74-146	Units 2 and 3 return cross connect line
FSV-74-141	Sys. II LPCI injection line
FSV-74-138	Reactor head spray line

b. Verify FCV-74-61 is closed by observing position indicating lights on panel 9-3.

c. Remove power from FCV-74-61 by tripping breaker 11E on 480V Reactor MOV Bd. 3A.

d. Verify FCV-74-60 is closed by observing position indicating lights on panel 9-3.

e. Verify FCV-74-53 is closed by observing position indicating lights on panel 9-3.

f. Verify FCV-74-58 is closed by observing position indicating lights on panel 9-3.

g. Verify FCV-74-78 is closed by observing position indicating lights on panel 9-3.

3. <u>Procedure</u> (Continued)

3.2 RHR Alignment - Unit 3 (Continued)

h. Verify that FCV-74-46 is closed by observing the indicating lights on panel 9-3 close the valve if it is open.

i. Verify that FCV-78-61 is closed by observing the indicating lights on panel 9-4.

j. Verify switch 10A-S48A (panel 9-32) is in the NORMAL position.

k. Verify that relay 10A-K72A (panel 9-32) is deenergized.

l. Block contact 5-6 on relay NVA-A-1 (4-kV Sd. Bd. 3EA) open with an insulated boot in accordance with Standard Practice BFA25.

m. Verify relay 10A-K105A (panel 9-32) is deenergized.

n. Place a jumper between contact terminals 3 and 4 on relay 10A-K9A (panel 9-32) in accordance with BFA25.

<u>NOTE</u>: When RHR 3A pump breaker closes, it cannot be tripped locally.

3.3 Shutdown Board 3EA Alignment

a. Transfer 480V Shutdown Bd. 3A feed from TS3A to TS3E.

b. Caution unit 3 operator not to use CRD pump 3B during this test.

c. Trip 43SEA (panel 9-23) to manual.

d. Connect oscillograph channels to monitor the following:

(1) 1334 trip circuit

(2) 1838 close circuit

(3) RHR pump 3A close circuit

(4) CS pump 3A close circuit

*(5) RHRSW pump A3 close circuit

(6) 4-kV Shutdown Board 3EA bus voltage

(7) D/G 3A current

*Revision JGD

3. Procedure (Continued)

3.4 Test Performance

NOTE: Because the sequence of events in this test is critical, a communication link should be established between 4-kV Shutdown Board 3EA and panel 9-3, unit 3, prior to test initiation.

NOTE: As soon as core spray pump 3A and RHR pump 3A start, open their test loop valves from panel 9-3 - FCV-75-22 and FCV-74-57 and FCV-74-59 respectively. Continue until rated flows are established. (7000 to 10000 gpm for RHR and 3000 to 3125 gpm for core spray)

a. With the oscillograph running, trip breaker 1334. (Leave the oscillograph on for 45 seconds.)

b. Verify that the following breakers closed:

(1) 1838

(2) RHR pump 3A

(3) CS pump 3A

*(4) RHRSW pump A3

c. Verify that diesel generator 3A voltage and current are stable.

d. Record the following D/G 3A data from metering on panel 9-23:

(1) KW

(2) KVAR

(3) VOLTS

(4) AMPS

(5) FREQUENCY

e. Mark oscillogram as trace no. 3-1 and attach to the data sheet.

3.5 Diesel Generator 3A Shutdown

a. Turn breaker 1334 synchronizing switch to ON position.

b. Place diesel generator 3A operational mode switch in PARALLEL WITH SYSTEM and verify associated mode light is on.

*Revision JSD

3. Procedure (Continued)

3.5 Diesel Generator 3A Shutdown (Continued)

c. Adjust frequency and voltage until the diesel generator is in synchronism with 4-kV unit bd. 3A.

d. Close breaker 1334.

e. Unload diesel generator.

f. Trip breaker 1838.

g. Pull diesel generator 3A control switch to STOP position.

h. Verify diesel generator speed drops to idle (450 rpm).

i. Place 1334 synchronizing switch in OFF position.

j. When diesel generator stops, verify diesel generator system 3A is in standby readiness per OI 82.

3.6 Core Spray Shutdown And Return To Normal - Unit 3

a. Remove jumper between contact terminals 7 and 8 on relay 14A-K10A (panel 9-32) in accordance with Standard Practice BFA25.

b. Remove core spray system test fixture from jack 14A-J1A (panel 9-32).

c. Remove boot from contact 1-2 on relay 14A-K25A (panel 9-32) in accordance with Standard Practice BFA25.

d. Remove boot from contact 5-6 on relay 14A-K25A (panel 9-32) in accordance with Standard Practice BFA25.

e. Return switch 14A-S11A (panel 9-32) to NORMAL position.

f. Close FCV-75-22. Verify FCV-75-9 opens as flow decreases.

g. Trip CS pump 3A.

h. Restore power to FCV-75-25 and verify position indicating light is on.

i. Reset all core spray annunciation.

3. Procedure (Continued)

3.7 RHR Shutdown And Return To Normal - Unit 3

a. Remove jumper between contact terminals 3 and 4 on relay 10A-K9A (panel 9-32) in accordance with Standard Practice BFA25.

b. Remove boot from contact 5-6 on relay NVA-A-2 (4-kV Sd. Bd. 3EA) in accordance with BFA25.

c. Verify relay 10A-K105A (panel 9-32) is energized.

d. Close FCV-74-59 and FCV-74-57. Verify that FCV-74-7 opens as flow decreases.

e. Trip RHR pump 3A.

f. Restore power to FCV-74-61 and verify position indicating light is on.

g. Return FCV-74-46 to the position required by the shift engineer. Indicate the position on the data sheet.

h. Reset all RHR annunciation.

3.8 Shutdown Board 3EA Return To Normal

a. Reset 43SEA (panel 9-23) to auto.

b. Inform unit 3 operators that CRD pump 3B is now ready for operation.

c. Return 480V Shutdown Board 3A feed to TS3A.

d. Return CS pump 3C breaker to operate position.

e. Remove oscillograph inputs.

f. Return the unit 3 EECW system to standby readiness per OI 67.

3. <u>Procedure</u> (Continued)

3.9 Test Completion

a. The unit 3 core spray system, the unit 3 RHR system, and Diesel Generator 3A are now normal and in standby readiness.

b. Verify by signature and date on data cover sheet that Diesel Generator 3A was tested in accordance with this instruction.

3.10 Acceptance Criteria

a. Diesel generator 3A reaches rated speed and voltage, and breaker 1838 closes within 11.5 seconds after 1334 trips.

b. RHR pump 3A starts within 1 second of 1838 closure.

c. CS pump 3A starts 7 $\pm$ 1 second after 1838 closure.

*d. RHRSW pump A3 starts 14 $\pm$ 1 second after 1838 closure.

e. All three pumps successfully accelerate on diesel generator power.

f. Diesel generator 3A is stable following the test.

*Revision JBD

SI 4.9.A.1.b

DATA COVER SHEET

Diesel Generator Emergency Load Acceptance Test

D/G 3A

Performed By ______________________ Date ______________________
Electrician

Were criteria satisfied? ______ Yes ______ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ______________, ____________
Date

Reason for test:

______ Required by schedule

______ Other (explain) ______________________________

Results reviewed ______________________ Date ______________________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________________

Rescheduled

QA Staff ______________________ Date ______________________

Remarks ____

SI 4.9.A.1.b
DATA SHEET

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G 3A

NOTE: Step numbers correspond to numbers in the instruction.

Step		Initials/Data
3.1	Core Spray Alignment - Unit 3	
	a. CSSI vented	________
	b. FCV-75-25 closed	________
	c. FCV-75-25 power removed	________
	d. FCV-75-23 closed	________
	e. 14A-S15A NORMAL	________
	f. 14A-J1A fixture in	________
	g. 14A-S11A TEST/14A-K29A out	________
	h. 14A-K25A (1-2) booted	________
	2nd person verification	________
	i. 14A-K25A (5-6) booted	________
	2nd person verification	________
	j. 14A-K10A (7-8) jumpered	________
	2nd person verification	________
	k. CS 3C removed	________
3.2	RHR Alignment - Unit 3	
	a. RHR vented	________
	b. FCV-74-61 closed	________
	c. FCV-74-61 power removed	________
	d. FCV-74-60 closed	________

Data Sheet SI 4.9.A.1.b (Continued)

Step		INITIALS/DATE
3.2	RHR Alignment - Unit 3 (Continued)	
	e. FCV-74-53 closed	___
	f. FCV-74-58 closed	___
	g. FCV-74-78 closed	___
	h. FCV-74-46 closed	___
	i. FCV-78-61 closed	___
	j. 10A-S48A NORMAL	___
	k. 10A-K72A deenergized	___
	l. NVA-A-2 (5-6) booted	___
	2nd person verification	___
	m. 10A-K105A deenergized	___
	n. 10A-K9A (3-4) jumpered	___
	2nd person verification	___
3.3	Shutdown Bd. 3EA Alignment	
	a. 480V Sd. Bd. 3A transferred	___
	b. CRD pump 3B caution	___
	c. 43SEA tripped	___
	d. Oscillograph connections	
	(1) 1334 trip ckt.	___
	(2) 1838 cl. ckt.	___
	(3) RHR 3A cl. ckt.	___
	(4) CS 3A cl. ckt.	___
	*(5) RHRSW A3 cl. ckt.	___

*Revision 9bD

Data Sheet SI 4.9.A.1.b (Continued)

Step	INITIALS/DATE
3.3 Shutdown Bd. 3EA Alignment (Continued)	
d. (Continued)	
(6) 4-kV Sd. Bd. 3EA volt.	______
(7) D/G 3A current	______
3.4 Test Performance	
a. 1334	______
b. Breaker closure	
(1) 1838	______
(2) RHR 3A	______
(3) CS 3A	______
*(4) RHRSW A3	______
c. Diesel gen. 3A stable	______
d. D/G 3A data	
(1) KW	______
(2) KVAR	______
(3) Volts	______
(4) Amps	______
(5) Frequency	______
e. Trace no. 3-1 attached	______
3.5 D/G 3A Shutdown	
a. 1334 sync. sw. ON	______
b. Mode sw. PARALLEL WITH SYSTEM	______
c. D/G A in sync.	______

*Revision JSD

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.5	D/G 3A Shutdown (Continued)	
	d. 1334 closed	____
	e. D/G 3A unloaded	____
	f. 1838 trip	____
	g. Control sw. STOP	____
	h. D/G idle	____
	i. 1334 sync. sw. OFF	____
	j. D/G 3A standby readiness	____
3.6	Core Spray Shutdown and Return to Normal - Unit 3	
	a. 14A-K10A (7-8) jumper removed	____
	2nd person verification	____
	b. 14A-J1A fixture removed	____
	2nd person verification	____
	c. 14A-K25A (1-2) boot removed	____
	2nd person verification	____
	d. 14A-K25A (5-6) boot removed	____
	2nd person verification	____
	e. 14A-S11A NORMAL	____
	f. FCV-75-22 closed/FCV-75-9 open	____
	g. CS 3A trip	____
	h. FCV-75-25 power restored	____
	i. Annunciation reset	____
3.7	RHR Unit 3 Shutdown and Return to Normal	
	a. 14A-K9A (3-4) jumper removed	____
	b. NVA-A-2 (5-6) boot removed	____

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.7	RHR Unit 3 Shutdown and Return to Normal (Continued)	
	c. 10A-K105A energized	______
	d. FCV-74-59 and -57 close/-7 open	______
	e. RHR 3A trip	______
	f. FCV-74-61 power restored	______
	g. FCV-74-46 as left position	______
	* h. Annunciation reset	______
3.8	Shutdown Board 3EA Return to Normal	
	a. 43SEA reset	______
	b. CRD 3B returned	______
	c. 480V Sd. Bd. 3A returned	______
	d. CS 3C returned	______
	e. Oscillograph inputs removed	______
	f. EECW system in standby readiness	______

*Revision ______

SI 4.9.A.1.b
Diesel Generator Emergency Load Acceptance Test
D/G 3B

1. Prerequisites

1.1 The unit 3 reactor vessel pressure shall not be greater than atmospheric

1.2 The unit 3 core spray system shall be lined up for standby readiness as specified by Operating Instruction No. 75.

1.3 The unit 3 RHR system shall be lined up for standby readiness as specified by Operating Instruction No. 74.

1.4 RHRSW pump C3 shall be operable.

1.5 Receive permission from the unit 1 assistant shift engineer to perform this test.

2. Precautions

2.1 This test will render loop I of the unit 3 core spray system inoperable. Do not conduct any test on loop II simultaneously. The requirements to test other systems or loops when one system is found to be inoperable will be waived when the system is made inoperable for testing.

3. Procedure

3.1 Core Spray Alignment - Unit 3

a. Vent the CSSI discharge piping through valves 75-584A and 75-585A until a steady stream of water is observed to flow out of the vent line into the open funnel.

b. Verify FCV-75-25 is closed by observing position indicating lights on pnl. 9-3.

3. Procedure (Continued)

3.1 Core Spray Alignment - Unit 3 (Continued)

c. Remove control power from FCV-75-25 by tripping breaker in compartment 14B on 480V Reactor MOV Bd. 3A.

d. Verify FCV-75-23 is closed by observing position indicating lights on pnl. 9-3.

e. Verify test switch 14A-S15A (pnl. 9-32) is in the NORMAL position.

f. Plug core spray test fixture into jack 14A-J1A (pnl. 9-32).

CAUTION: Assure the test fixture switch is in the OFF position.

g. Place switch 14A-S13A (pnl. 9-32) in the TEST position and verify relay 14A-K31A drops out.

h. Block contact 1-2 on relay 14A-K26A (pnl. 9-32) open with an insulated boot per Standard Practice BFA25.

i. Block contact 5-6 on relay 14A-K26A (pnl. 9-32) open with an insulated boot per Standard Practice BFA25.

j. Place a jumper between contact terminals 3 and 4 on relay 14A-K10A (pnl. 9-32) per Standard Practice BFA25.

k. Place CS pump 3A breaker (4-KV Sd 3EA, pnl. 6) in the test position.

3.2 RHR Alignment - Unit 3

a. Verify FCV-74-61 is closed by observing position indicating lights on pnl. 9-3.

b. Remove power from FCV-74-61 by tripping breaker 11E on 480V Reactor MOV Bd. 3A.

c. Verify FCV-74-60 is closed by observing position indicating lights on pnl. 9-3.

3. Procedure (Continued)

3.2 RHR Alignment - Unit 3 (Continued)

d. Verify FCV-74-53 is closed by observing position indicating lights on pnl. 9-3.

e. Verify FCV-74-58 is closed by observing position indicating lights on pnl. 9-3.

f. Verify FCV-74-78 is closed by observing position indicating lights on pnl. 9-3.

g. Verify that FCV-74-46 is closed by observing the indicating lights on pnl. 9-3. Close the valve if it is open.

h. Verify that FCV-78-61 is closed by observing the indicating lights on pnl. 9-4.

i. Verify switch 10A-S48A (pnl. 9-32) is in the NORMAL position.

j. Verify that relay 10A-K76A (pnl. 9-32) is deenergized.

k. Block contact 5-6 on relay NVA-B-2 (4-KV Sd Bd 3EB) open with an insulated boot in accordance with Standard Practice BFA25.

l. Verify relay 10A-K105C (pnl. 9-32) is deenergized.

m. Place a jumper between contact terminals 9 and 10 on relay 10A-K9A (pnl. 9-32) in accordance with BFA25.

NOTE: When RHR 3C pump breaker closes, it cannot be tripped locally.

3.3 Shutdown Board 3EB Alignment

a. Verify that neither 480V Shutdown Bd. 3A or 3B is feeding from TS3E.

b. Trip SEB (pnl. 9-23) to manual.

c. Connect oscillograph channels to monitor the following:

(1) 1336 trip circuit

(2) 1842 close circuit

(3) RHR pump 3C close circuit

3. Procedure (Continued)

3.3 Shutdown Board 3EB Alignment (Continued)

(4) CS pump 3C close circuit

*(5) RHRSW pump C3 close circuit

(6) 4-KV Shutdown Board 3EB bus voltage

(7) D/G 3B current

3.4 Test Performance

NOTE: Because the sequence of events in this test is critical, a communication link should be established between 4-KV Shutdown Board 3EB and panel 9-3, unit 3, prior to test initiation.

NOTE: As soon as core spray pump 3C and RHR pump 3C start, open their test loop valves from pnl. 9-3 - FCV-75-22, and FCV-74-57 and FCV-74-59, respectively. Continue until rated flows are established. (7000 to 10000 gpm for RHR and 3000 to 3125 gpm for core spray.)

a. With the oscillograph running, trip breaker 1336. (Leave the oscillograph on for 45 seconds.)

b. Verify that the following breakers closed:

(1) 1842

(2) RHR pump 3C

(3) CS pump 3C

(4) RHRSW pump C3

c. Verify that diesel generator 3B voltage and current are stable.

d. Record the following D/G 3B data from metering on pnl. 9-23:

(1) KW

(2) KVAR

(3) Volts

(4) Amps

(5) Frequency

e. Mark oscillogram as trace no. 3-2 and attach to the data sheet.

*Revision JBD

3. Procedure (Continued)

3.5 Diesel Generator 3B Shutdown

a. Turn breaker 1336 synchronizing switch to ON position.

b. Place diesel generator B operational mode switch in PARALLEL WITH SYSTEM and verify associated mode light is on.

c. Adjust frequency and voltage until the diesel generator is in synchronism with 4-KV unit board 3A.

d. Close breaker 1336.

e. Unload diesel generator.

f. Trip breaker 1842.

g. Pull diesel generator 3B control switch to STOP position.

h. Verify diesel generator speed drops to idle (450 rpm).

i. Place 1336 synchronizing switch in OFF position.

j. When diesel generator stops verify diesel generator system 3B is in standby readiness per OI 82.

3.6 Core Spray Shutdown And Return To Normal - Unit 3

a. Remove jumper between contact terminals 3 and 4 on relay 14A-K10A (pnl. 9-32) in accordance with Standard Practice BFA25.

b. Remove core spray system test fixture from jack 14A-J1A (pnl. 9-32).

c. Remove boot from contact 1-2 on relay 14A-K26A (pnl. 9-32) in accordance with BFA25.

d. Remove boot from contact 5-6 on relay 14A-K26A (pnl. 9-32) in accordance with BFA25.

e. Return switch 14A-S13A (pnl. 9-32) to the NORMAL position.

f. Close FCV-75-22. Verify FCV-75-9 opens as flow decreases.

g. Trip CS pump 3C.

h. Restore power to FCV-75-25 and verify position indicating light is on.

i. Reset all core spray annunciation.

3. Procedure (Continued)

3.7 RHR Shutdown And Return To Normal - Unit 3

a. Remove jumper between contact terminals 9 and 10 on relay 10A-K9A (pnl. 9-32) in accordance with Standard Practice BFA25.

b. Remove boot from contact 5-6 on relay NVA-B-2 in accordance with BFA25.

c. Verify relay 10A-K105C (pnl. 9-32) is energized.

d. Close FCV-74-59 and FCV-74-57. Verify that FCV-74-7 opens as flow decreases.

e. Trip RHR pump 3C.

f. Restore power to FCV-74-61 and verify position indicating lights is on.

g. Return FCV-74-46 to the position required by the shift engineer. Indicate the position on the data sheet.

h. Reset all RHR annunciation.

3.8 Shutdown Board 3EB Return To Normal

a. Reset 43SEB (pnl. 9-23) to auto.

b. Return CS pump 3A breaker to operate position.

c. Remove oscillograph inputs.

d. Return the unit 3 EECW system to standby readiness per OI 67.

3.9 Test Completion

a. The unit 3 core spray system, the unit 3 RHR system, and Diesel Generator 3B are now normal and in standby readiness.

b. Verify by signature and date on Data Cover Sheet that Diesel Generator 3B was tested in accordance with this instruction.

3.10 Acceptance Criteria

a. Diesel generator 3B reaches rated speed and voltage, and breaker 1842 closes within 11.5 seconds after 1336 trips.

b. RHR pump 3C starts within 1 second of 1842 closure.

c. CS pump 3C starts 7 ± 1 second after 1842 closure.

3. Procedure (Continued)

3.10Acceptance Criteria (Continued)

*d. RHRSW pump C3 starts 14 ± 1 second after 1842 closure.

e. All three pumps successfully accelerate on diesel generator power.

f. Diesel generator 3B is stable following the test.

*Revision JBD

SI 4.9.A.1.b

DATA COVER SHEET

Diesel Generator Emergency Load Acceptance Test

D/G 3B

Performed By ______________________ Date ______________________
Electrician

Were criteria satisfied? _____ Yes _____ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ______________, __________
Date

Reason for test:

_____ Required by schedule

_____ Other (explain) ______________________________

Results reviewed ______________________ Date ______________________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________________

Rescheduled

QA Staff ______________________ Date ______________________

Remarks ____

SI 4.9.A.1.b
DATA SHEET

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G 3B

<u>NOTE:</u> Step numbers correspond to numbers in the instruction.

<u>Step</u>		<u>Initials/Data</u>
3.1	Core Spray Alignment - Unit 3	
	a. CSSI vented	______
	b. FCV-75-25 closed	______
	c. FCV-75-25 power removed	______
	d. FCV-75-23 closed	______
	e. 14A-S15A NORMAL	______
	f. 14A-J1A fixture in	______
	g. 14A-S13A TEST/14A-K31A out	______
	h. 14A-K26A (1-2) booted	______
	2nd person verification	______
	i. 14A-K26A (5-6) booted	______
	2nd person verification	______
	j. 14A-K10A (3-4) jumpered	______
	2nd person verification	______
	k. CS 3A removed	______
3.2	RHR Alignment - Unit 3	
	a. FCV-74-61 closed	______
	b. FCV-74-61 power removed	______
	c. FCV-74-60 closed	______
	d. FCV-74-53 closed	______

Data Sheet SI 4.9.A.1.b (Continued)

Step		INITIALS/DATE
3.2	RHR Alignment - Unit 3 (Continued)	
	e. FCV-74-58 closed	________
	f. FCV-74-78 closed	________
	g. FCV-74-46 closed	________
	h. FCV-78-61 closed	________
	i. 10A-S48A NORMAL	________
	j. 10A-K76A deenergized	________
	k. NVA-B-1 (5-6) booted	________
	2nd person verification	________
	l. 10A-K105C deenergized	________
	m. 10A-K9A (9-10) jumpered	________
3.3	Shutdown Bd. 3EB Alignment	
	a. 480V Sd. Bds. 3A and 3B feeds verified	________
	b. 43SEB tripped	________
	c. Oscillograph connections	
	(1) 1336 trip ckt.	________
	(2) 1842 cl. ckt.	________
3.:	(3) RHR 3C cl. ckt.	________
	(4) CS 3C cl. ckt.	________
	*(5) RHRSW C3 cl. ckt.	________
	(6) 4-kV Sd. Bd. 3EB volt	________
	(7) D/G 3B current	________

*Revision JBD

Data Sheet SI 4.9.A.1.b (Continued)

Step		INITIALS/DATE
3.4	Test Performance	
	a. 1336 trip	________
	b. Breaker closure	
	(1) 1842	________
	(2) RHR 3C	________
	(3) CS 3C	________
	*(4) RHRSW C3	________
	c. Diesel gen. 3B stable	________
	d. D/G 3B data	
	(1) KW	________
	(2) KVAR	________
	(3) Volts	________
	(4) Amps	________
	(5) Frequency	________
	e. Trace no. 3-2 attached	________
3.5	D/G A Shutdown	
	a. 1336 sync. sw. ON	________
	b. Mode sw. PARALLEL WITH SYSTEM	________
	c. D/G 3B in sync.	________
	d. 1336 closed	________
	e. D/G 3B unloaded	________
	f. 1842 trip	________
	g. Control sw. STOP	________
	h. D/G idle	________

*Revision JSD

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.5	D/G 3B Shutdown (Continued)	
	i. 1336 sync. sw. OFF	________
	j. D/G 3B standby readiness	________
3.6	Core Spray Shutdown and Return to Normal - Unit 3	
	a. 14A-K10A (3-4) jumper removed	________
	2nd person verification	________
	b. 14A-J1A fixture removed	________
	2nd person verification	________
	c. 14A-K26A (1-2) boot removed	________
	2nd person verification	________
	d. 14A-K26A (5-6) boot removed	________
	2nd person verification	________
	e. 14A-S13A NORMAL	________
	2nd person verification	________
	f. FCV-75-22 closed/FCV-75-9 open	________
	g. CS 3C trip	________
	h. FCV-75-25 power restored	________
	i. Annunciation reset	________
3.7	RHR Shutdown and Return to Normal - Unit 3	
	a. 14A-K9A (9-10) jumper removed	________
	2nd person verification	________
	b. NVA-B-2 (5-6) boot removed	________
	2nd person verification	________

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.7	RHR Shutdown and Return to Normal - Unit 3 (Continued)	
	c. 10A-K105C energized	______
	d. FCV-75-59 and -57 close/-7 open	______
	e. RHR 3C trip	______
	f. FCV-74-61 power restored	______
	g. FCV-74-46 as left position	______
	h. Annunciation reset	______
3.8	Shutdown Board 3EB Return to Normal	
	a. 43SEB reset	______
	b. CS3A returned	______
	c. Oscillograph inputs removed	______
	d. EECW in standby readiness	______

3.7

SI 4.9.A.1.b
Diesel Generator Emergency Load Acceptance Test
D/G 3C

1. Prerequisites

1.1 The unit 3 reactor vessel pressure shall not be greater than atmospheric.

1.2 The unit 3 core spray system shall be lined up for standby readiness as specified by Operating Instruction No. 75.

1.3 The unit 3 RHR system shall be lined up for standby readiness as specified by Operating Instruction No. 74.

*1.4 RHRSW pump B1 shall be operable.

1.5 Receive permission from the unit 3 assistant shift engineer to perform this test.

2. Precautions

2.1 This test will render loop II of the unit 3 core spray system inoperable. Do not conduct any test on loop I simultaneously. The requirements to test other systems or loops when one system is found to be inoperable will be waived when the system is made inoperable for testing.

2.2 This test will render loop II of the unit 3 RHR system inoperable. Do not conduct any test on loop I simultaneously.

3. Procedure

3.1 Core Spray Alignment - Unit 3

a. Vent the CSSII discharge piping through valves 75-584B and 75-585B until a steady stream of water is observed to flow out of the vent line into the open funnel.

*Revision JBD

3. Procedure (Continued)

3.1 Core Spray Alignment - Unit 3 (Continued)

b. Verify FCV-75-53 is closed by observing position indicating lights on pnl. 9-3.

c. Remove control power from FCV-75-53 by tripping breaker in compartment 15E on 480V Reactor MOV Bd. 3B.

d. Verify FCV-75-51 is closed by observing position indicating lights on pnl. 9-3.

e. Verify test switch 14A-S15B (pnl. 9-33) is in the NORMAL position.

f. Plug core spray system test fixture into jack 14A-J1B (pnl. 9-33).

g. Place switch 14A-S11B (pnl. 9-33) in the TEST position and verify relay 14A-K29B (pnl. 9-33) drops out.

h. Block contact 1-2 on relay 14A-K25B (pnl. 9-33) open with an insulated boot per Standard Practice BFA25.

i. Block contact 5-6 on relay 14A-K25B (pnl. 9-33) open with an insulated boot per Standard Practice BFA25.

j. Place a jumper between contact terminals 7 and 8 on relay 14A-K10B (pnl. 9-33) per Standard Practice BFA25.

k. Remove CS pump 3D breaker (4KV Sd B 3ED, pnl. 11) from the operate position.

3.2 RHR Alignment - Unit 3

a. Verify FCV-74-75 is closed by observing position indicating lights on pnl. 9-3.

b. Remove power from FCV-74-75 by tripping breaker 10E on 480V Reactor MOV Bd. 3B.

c. Verify FCV-74-74 is closed by observing position indicating lights on pnl. 9-3.

3. Procedure (Continued)

3.2 RHR Alignment - Unit 1 (Continued)

d. Verify FCV-74-67 is closed by observing position indicating lights on pnl. 9-3.

e. Verify FCV-74-72 is closed by observing position indicating lights on pnl. 9-3.

f. Verify FCV-74-78 is closed by observing position indicating lights on pnl. 9-3.

g. Verify that FCV-74-46 is closed by observing the indicating lights on pnl. 9-3. Close the valve if open.

h. Verify switch 10A-S48B (pnl. 9-33) is in the NORMAL position.

i. Verify that relay 10A-K72B (pnl. 9-33) is in the NORMAL position.

j. Block contact 5-6 on relay NVA-C-2 (4KV Sd Bd 3EC) open with an insulated boot in accordance with Standard Practice BFA25.

k. Verify that relay 10A-K105B (pnl. 9-33) is deenergized.

l. Place a jumper between contact terminals 3 and 4 on relay 10A-K9B (pnl. 9-33) in accordance with BFA25.

NOTE: When RHR 3B pump breaker closes, it cannot be tripped locally.

3.3 Shutdown Board 3EC Alignment

a. Transfer 480V Shutdown Bd. 3B feed from TS3B to TS3E.

b. Trip 43SEC (pnl. 3-9-23) to manual.

c. Connect oscillograph channels to monitor the following:

(1) 1338 trip circuit

(2) 1832 close circuit

(3) RHR pump 3B close circuit

(4) CS pump 3B close circuit

*(5) RHRSW pump B1 close circuit

(6) 4-KV Shutdown Board 3EC bus voltage

(7) D/G 3EC current

*Revision JSD

3. Procedure (Continued)

3.4 Test Performance

NOTE: Because the sequence of events in this test is critical, a communication link should be established between 4-KV Shutdown Board 3EC and panel 9-3, unit 3, prior to test initiation.

NOTE: As soon as core spray pump 3B and RHR pump 3B start, open their test loop valves from pnl. 9-3 - FCV-75-50, and FCV-74-71 and FCV-74-73, respectively. Continue until rated flows are established. (7000 to 10000 gpm for RHR and 3000 to 3125 gpm for core spray.)

a. With the oscillograph running, trip breaker 1338. (Leave the oscillograph on for 45 seconds.)

b. Verify that the following breakers closed:

(1) 1832

(2) RHR pump 3B

(3) CS pump 3B

* (4) RHRSW pump B1

c. Verify that diesel generator 3C voltage and current are stable.

d. Record the following D/G C data from metering on pnl. 9-23:

(1) KW

(2) KVAR

(3) Volts

(4) Amps

(5) Frequency

e. Mark oscillogram as trace no. 3-3 and attach to the data sheet.

3.5 Diesel Generator 3C Shutdown

a. Turn breaker 1338 synchronizing switch to ON position.

b. Place diesel generator 3C operational mode switch in PARALLEL WITH SYSTEM and verify associated mode light is on.

c. Adjust frequency and voltage until the diesel generator is in synchronism with 4KV unit board 3B.

*Revision JBD

3. Procedure (Continued)

3.5 Diesel Generator 3C Shutdown (Continued)

d. Close breaker 1338.

e. Unload diesel generator.

f. Trip breaker 1832.

g. Pull diesel generator 3C control switch to STOP position.

h. Verify diesel generator speed drops to idle (450 rpm).

i. Place 1718 synchronizing switch in OFF position.

j. When diesel generator stops verify diesel generator system C is in standby readiness per OI 82.

3.6 Core Spray Shutdown And Return To Normal - Unit 3

a. Remove jumper between contact terminals 7 and 8 on relay 14A-K10B (pnl. 9-33) in accordance with BFA25.

b. Remove core spray system test fixture from jack 14A-J1B (pnl. 9-33).

c. Remove boot from contact 1-2 on relay 14A-K25B (pnl. 9-33) in accordance with BFA25.

d. Remove boot from contact 5-6 on relay 14A-K25B (pnl. 9-33) in accordance with BFA25.

e. Return switch 14A-S11B (pnl. 9-33) to NORMAL position.

f. Close FCV-75-50. Verify FCV-75-37 opens as flow decreases.

g. Trip CS pump 3B.

h. Restore power to FCV-75-53 and verify position indicating light is on.

i. Reset all core spray annunciation.

3.7 RHR Shutdown And Return To Normal - Unit 3

a. Remove jumper between contact terminals 3 and 4 on relay 10A-K9B (pnl. 9-33) in accordance with Standard Practice BFA25.

3. Procedure (Continued)

3.7 RHR Shutdown And Return To Normal - Unit 3 (Continued)

b. Remove boot from contact 5-6 on relay NVA-C-2 (4KV Sd Bd 3EC) in accordance with BFA25.

c. Verify relay 10A-K105B (pnl. 9-33) is energized.

d. Close FCV-74-71 and FCV-74-73. Verify that FCV-74-30 opens as flow decreases.

e. Trip RHR pump 3B.

f. Restore power to FCV-74-75 and verify position indicating light in on.

g. Return FCV-74-46 to the position required by the shift engineer. Indicate the position on the data sheet.

h. Reset all RHR annunciation.

3.8 Shutdown Board 3EC Return To Normal

a. Reset 43SEC (pnl. 9-23) to auto.

b. Return 480V Shutdown Bd 3B feed to TS3B.

c. Return CS pump 3D breaker to operate position.

d. Remove oscillograph inputs.

e. Return the unit 3 EECW to standby readiness per OI 67.

3.9 Test Completion

a. The unit 3 core spray system, the unit 3 RHR system, and Diesel Generator 3C are now normal and in standby readiness.

b. Verify by signature and date on Data Cover Sheet that Diesel Generator 3C was tested in accordance with this instruction.

3.10 Acceptance Criteria

a. Diesel generator 3C reaches rated speed and voltage, and breaker 1832 closes within 11.5 seconds after 1338 trips.

b. RHR pump 3B starts within 1 second of 1832 closure.

3. <u>Procedure</u> (Continued)

3.10 Acceptance Criteria (Continued)

c. CS pump 3B starts 7 ± 1 second after 1832 closure.

*d. RHRSW pump B1 starts 14 ± 1 second after 1832 closure.

e. All three pumps successfully accelerate on diesel generator power

f. Diesel generator 3C is stable following the test.

SI 4.9.A.1.b

DATA COVER SHEET

Diesel Generator Emergency Load Acceptance Test

D/G 3C

Performed By ______________________ Date ____________________
Electrician

Were criteria satisfied? _____ Yes _____ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ________________, ____________
Date

Reason for test:

_____ Required by schedule

_____ Other (explain) ______________________________

Results reviewed ____________________ Date ____________________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ____________________ Date ____________________

Rescheduled

QA Staff ____________________ Date ____________________

Remarks ____

____

____

____

SI 4.9.A.1.b
DATA SHEET

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G 3C

NOTE: Step numbers correspond to numbers in the instruction.

Step		Initials/Data
3.1	Core Spray Alignment - Unit 3	
	a. CSSII vented	________
	b. FCV-75-53 closed	________
	c. FCV-75-53 power removed	________
	d. FCV-75-51 closed	________
	e. 14A-S15B NORMAL	________
	f. 14A-J1B fixture in	________
	g. 14A-S11B TEST/14A-K29B out	________
	h. 14A-K25B (1-2) booted	________
	2nd person verification	________
	i. 14A-K25B (5-6) booted	________
	2nd person verification	________
	j. 14A-K10B (7-8) jumpered	________
	2nd person verification	________
	k. CS 3D removed	________
3.2	RHR Alignment - Unit 3	
	a. FCV-74-75 closed	________
	*b. FCV-74-75 power removed	________
	c. FCV-74-74 closed	________
	d. FCV-74-67 closed	________

*Revision

Data Sheet SI 4.9.A.1.b (Continued)

Step		INITIALS/DATE
3.2	RHR Alignment - Unit 3 (Continued)	
	e. FCV-74-72 closed	
	f. FCV-74-78 closed	
	g. FCV-74-46 closed	
	h. 10A-S48B NORMAL	
	i. 10A-K72B deenergized	
	j. NVA-C-1 (5-6) booted	
	k. 10A-K105B deenergized	
	l. 10A-K9B (3-4) jumpered	
	2nd person verification	
3.3	Shutdown Bd. 3EC Alignment	
	a. 480V Sd. Bd. 3B transferred	
	b. 43SEC tripped	
	c. Oscillograph connections	
	(1) 1338 trip ckt.	
	(2) 1832 cl. ckt.	
	(3) RHR 3B cl. ckt.	
	(4) CS 3B cl. ckt.	
	*(5) RHRSW B1 cl. ckt.	
	(6) 4-kV Sd. Bd. 3EC volt.	
	(7) D/G 3C current	

*Revision JLD

Data Sheet SI 4.9.A.1.b (Continued)

Step	INITIALS/DATE
3.4 Test Performance	
a. 1338 trip	________
b. Breaker closure	
(1) 1832	________
(2) RHR 3B	________
(3) CS 3B	________
*(4) RHRSW B1	________
c. Diesel gen. 3C stable	________
d. D/G 3C data	
(1) KW	________
(2) KVAR	________
(3) Volts	________
(4) Amps	________
(5) Frequency	________
e. Trace no. 3-3 attached	________
3.5 D/G 3C Shutdown	
a. 1338 sync. sw. ON	________
b. Mode sw. PARALLEL WITH SYSTEM	________
c. D/G 3C in sync.	________
d. 1338 closed	________
e. D/G C unloaded	________
f. 1832 trip	________
g. Control sw. STOP	________
h. D/G idle	________

*Revision JSD

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.5	D/G 3C Shutdown (Continued)	
	i. 1338 sync. sw. OFF	______
	j. D/G 3C standby readiness.	______
3.6	Core Spray Shutdown and Return to Normal - Unit 3	
	a. 14A-K10B (7-8) jumper removed	______
	2nd person verification	______
	b. 14A-J1B fixture removed	______
	2nd person verification	______
	c. 14A-K25B (1-2) boot removed	______
	2nd person verification	______
	d. 14A-K25B (5-6) boot removed	______
	2nd person verification	______
	e. 14A-S11B NORMAL	______
	2nd person verification	______
	f. FCV-75-50 closed/FCV-75-9 open	______
	g. CS 3B trip	______
	h. FCV-75-53 power restored	______
	i. Annunciation reset	______
3.7	RHR Shutdown and Return to Normal - Unit 3	
	a. 14A-K9B (3-4) jumper removed	______
	2nd person verification	______
	b. NVA-C-1 (5-6) boot removed	______
	2nd person verification	______
	c. 10A-K105B energized	______

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.7	RHR Shutdown and Return to Normal - Unit 3 (Continued)	
	d. FCV-74-71 and -73 close/-30 open	________
	e. RHR 3B trip	________
	f. FCV-74-75 power restored	________
	g. FCV-74-46 as left position	________
	h. Annunciation reset	________
3.8	Shutdown Board 3EC Return to Normal	
	a. 43SEC reset	________
	b. 480V Sd. Bd. 3B returned	________
	c. CS 3B returned	________
	d. Oscillograph inputs removed	________
	e. EECW in standby readiness	________

SI 4.9.A.1.b
Diesel Generator Emergency Load Acceptance Test
D/G 3D

1. Prerequisites

1.1 The unit 3 reactor vessel pressure shall not be greater than atmospheric.

1.2 The unit 3 core spray system shall be lined up for standby readiness as specified by Operating Instruction No. 75.

1.3 The unit 3 RHR system shall be lined up for standby readiness as specified by Operating Instruction No. 74.

*1.4 RHRSW pump D1 shall be operable.

1.5 Standby gas treatment trains A and B must be operable.

1.6 Receive permission from the unit 3 assistant shift engineer to perform this test.

2. Precautions

2.1 This test will render loop II of the unit 3 core spray system inoperable. Do not conduct any test on loop I simultaneously. The requirements to test other systems or loops when one system is found to be inoperable will be waived when the system is made inoperable for testing.

2.2 This test will render loop II of the unit 3 RHR system inoperable. Do not conduct any test on loop I simultaneously.

2.3 Do not conduct any test on standby gas treatment trains A and B during this test.

*Revision JBD

3. Procedure

3.1 Core Spray Alignment - Unit 3

a. Vent the CSSII discharge piping through valves 75-584B and 75-585B until a steady stream of water is observed to flow out of the vent line into the open funnel.

b. Verify FCV-75-53 is closed by observing position indicating lights on panel 9-3.

c. Remove control power from FCV-75-53 by tripping breaker in compartment 15E on 480V Reactor MOV Bd. 3B.

d. Verify FCV-75-51 is closed by observing position indicating lights on panel 9-3.

e. Verify test switch 14A-S15B (panel 9-33) is in the NORMAL position.

f. Plug core spray test fixture into jack 14A-J1B (panel 9-33).

CAUTION: Assure the test fixture switch is in the OFF position.

g. Place switch 14A-S13B (panel 9-33) in the TEST position and verify relay 14A-K31B (panel 9-33) drops out.

* h. Block contact 1-2 on relay 14A-K26B (panel 9-33) open with an insulated boot per Standard Practice BFA25.

i. Block contact 5-6 on relay 14A-K26B (panel 9-33) open with an insulated boot per Standard Practice BFA25.

j. Place a jumper between contact terminals 3 and 4 on relay 14A-K10B (panel 9-33) per Standard Practice BFA25.

k. Remove CS pump 3B breaker (4-kV Sd. Bd. 3EC, panel 13).

3.2 RHR Alignment - Unit 3

*a. Verify FCV-74-75 is closed by observing position indicating lights on panel 9-3

*Revision

3. Procedure (Continued)

3.2 RHR Alignment - Unit 3 (Continued)

b. Remove power from FCV-74-75 by tripping breaker 10E on 480V Reactor MOV Bd. 3B.

c. Verify FCV-74-74 is closed by observing position indicating lights on panel 9-3.

d. Verify FCV-74-67 is closed by observing position indicating lights on panel 9-3.

e. Verify FCV-74-72 is closed by observing position indicating lights on panel 9-3.

f. Verify FCV-74-78 is closed by observing position indicating lights on panel 9-3.

g. Verify that FCV-74-46 is closed by observing the indicating lights on panel 9-3. Close the valve if it is open.

h. Verify switch 10A-S48B (panel 9-33) is in the NORMAL position.

i. Verify that relay 10A-K76B (panel 9-33) is deenergized.

j. Block contact 5-6 on relay NVA-D-2 (4-kV Sd Bd 3ED) open with an insulated boot in accordance with Standard Practice BFA25.

k. Verify that relay 10A-K105D (panel 9-33) is deenergized.

l. Place a jumper between contact terminals 7 and 8 on relay 10A-K9B (panel 9-33) in accordance with BFA25.

NOTE: When RHR 3D pump breaker closes, it cannot be tripped locally.

3.3 Shutdown Board 3ED Alignment

a. Trip 43SED (panel 3-9-23) to manual.

3. Procedure (Continued)

3.3 Shutdown Board 3ED Alignment (Continued)

b. Connect oscillograph channels to monitor the following:

(1) 1342 trip circuit

(2) 1836 close circuit

(3) RHR pump 3D close circuit

(4) CS pump 3D close circuit

*(5) RHRSW pump D1 close circuit

(6) 4-kV Shutdown Board 3ED bus voltage

(7) D/G 3D current

3.4 Test Performance

NOTE: Because the sequence of events in this test is critical, a communication link should be established between 4-kV Shutdown Board 3ED and panel 9-3, unit 3, prior to test initiation.

NOTE: As soon as core spray pump 3D and RHR pump 3D start, open their test loop valves from panel 9-3 - FCV-75-50, and FCV-74-71 and FCV-74-73, respectively. Continue until rated flows are established. (7000 to 10000 gpm for RHR and 3000 to 3125 gpm for core spray.)

a. With the oscillograph running, trip breaker 1342. (Leave the oscillograph on for 45 seconds.)

b.. Verify that the following breakers closed:

(1) 1836

(2) RHR pump 3D

(3) CS pump 3D

*(4) RHRSW pump D1

c. Verify that diesel generator 3D voltage and current are stable.

d. Record the following D/G 3D data from metering on panel 3-9-23:

(1) KW

(2) KVAR

*Revision JBD

3. <u>Procedure</u> (Continued)

3.4 Test Performance (Continued)

d. (Continued)

(3) Volts

(4) Amps

(5) Frequency

e. Mark oscillograph trace no. 3-4 and attach to the data sheet.

3.5 Diesel Generator 3D Shutdown

a. Turn breaker 1342 synchronizing switch to ON position.

b. Place diesel generator 3D operational mode switch in PARALLEL WITH SYSTEM and verify associated mode light is on.

c. Adjust frequency and voltage until the diesel generator is in synchronism with 4-kV unit bd. 3B.

d. Close breaker 1342.

e. Unload diesel generator.

f. Trip breaker 1836.

g. Pull diesel generator 3D control switch to STOP position.

h. Verify diesel generator speed drops to idle (450 rpm).

i. Place 1836 synchronizing switch in OFF position.

j. When diesel generator stops, verify diesel generator system 3D is in standby readiness per OI 82.

3.6 Core Spray Shutdown And Return to Normal - Unit 3

a. Remove jumper between contact terminals 3 and 4 on relay 14A-K10B (panel 9-33) in accordance with BFA25.

b. Remove core spray test fixture from jack 14A-J1B (panel 9-33).

3. <u>Procedure</u> (Continued)

3.6 Core Spray Shutdown And Return to Normal - Unit 3 (Continued)

c. Remove boot from contact 1-2 on relay 14A-K26B (panel 9-33) in accordance with Standard Practice BFA25.

d. Remove boot from contact 5-6 on relay 14A-K26B (panel 9-33) in accordance with BFA25.

e. Return switch 14A-S13B (panel 9-33) to NORMAL position.

f. Close FCV-75-50. Verify FCV-75-37 opens as flow decreases.

g. Trip CS pump 3D.

h. Restore power to FCV-75-53 and verify position indicating light is on.

i. Reset all core spray annunciation.

3.7 RHR Shutdown And Return to Normal - Unit 3

a. Remove jumper between contact terminals 7 and 8 on relay 10A-K9B (panel 9-33) in accordance with Standard Practice BFA25.

b. Remove boot from contact 5-6 on relay NVA-D-2 (4-kV Sd. Bd. 3ED) (panel 25-45D) in accordance with BFA25.

c. Verify relay 10A-K105D (panel 9-33) is energized.

d. Close FCV-74-71 and FCV-74-73. Verify that FCV-74-30 opens as flow decreases.

e. Trip RHR pump 3D.

f. Restore power to FCV-74-75 and verify position indicating light is on.

g. Return FCV-74-46 to the position required by the shift engineer. Indicate the position on the data sheet.

h. Reset all RHR annunciation.

3. Procedure (Continued)

3.8 Shutdown Board 3ED Return to Normal

a. Reset 43SED (panel 9-23) to auto.

b. Return CS pump 3B breaker to operate position.

c. Remove oscillograph inputs.

d. Return the unit 3 EECW system to standby readiness per OI 67.

3.9 Test Completion

a. The unit 3 core spray system, the unit 3 RHR system, and Diesel Generator 3D are now normal and in standby readiness.

b. Verify by signature and date on data cover sheet that Diesel Generator 3D was tested in accordance with this instruction.

3.10 Acceptance Criteria

a. Diesel generator 3D reaches rated speed and voltage, and breaker 1816 closes within 11.5 seconds after 1342 trips.

b. RHR pump 3D starts within 1 second of 1836 closure.

c. CS pump 3D starts 7 ± 1 second after 1836 closure.

*d. RHRSW pump D1 starts 14 ± 1 second after 1836 closure.

e. All three pumps successfully accelerate on diesel generator power.

f. Diesel generator 3D is stable following the test.

*Revision JBD

SI 4.9.A.1.b

DATA COVER SHEET

Diesel Generator Emergency Load Acceptance Test

D/G 3D

Performed By ______________________ Date ______________________
Electrician

Were criteria satisfied? ______ Yes ______ No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _____ Yes (explain in remarks)
_____ No (explain in remarks)

Verified by Shift Engineer ________________, ____________
Date

Reason for test:

______ Required by schedule

______ Other (explain) ______________________________________

Results reviewed ______________________ Date ______________________
Electrical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ______________________

Rescheduled

QA Staff ______________________ Date ______________________

Remarks ____

____

____

____

SI 4.9.A.1.b
DATA SHEET

DIESEL GENERATOR EMERGENCY LOAD ACCEPTANCE TEST
D/G 3D

NOTE: Step numbers correspond to numbers in the instruction.

Step		Initials/Data
3.1	Core Spray Alignment - Unit 3	
	a. CSSII vented	______
	b. FCV-75-53 closed	______
	c. FCV-75-53 power removed	______
	d. FCV-75-51 closed	______
	e. 14A-S15B NORMAL	______
	f. 14A-J1B fixture in	______
	*g. 14A-S13B TEST/14A-K31B out	______
	h. 14A-K26B (1-2) booted	______
	2nd person verification	______
	i. 14A-K26B (5-6) booted	______
	2nd person verification	______
	j. 14A-K10B (3-4) jumpered	______
	2nd person verification	______
	k. CS 3B removed	______
3.2	RHR Alignment - Unit 3	
	a. FCV-74-75 closed	______
	b. FCV-74-75 power removed	______
	c. FCV-74-74 closed	______
	d. FCV-74-67 closed	______

*Revision [signature]

Data Sheet S I4.9.A.1.b (Continued)

Step	INITIALS/DATE
3.2 RHR Alignment - Unit 3 (Continued)	
e. FCV-74-72 closed	______
f. FCV-74-78 closed	______
g. FCV-74-46 closed	______
h. 10A-S48B NORMAL	______
i. 10A-K76B deenergized	______
j. NVA-D-2 (5-6) booted	______
2nd person verification	______
k. 10A-K105D deenergized	______
l. 10A-K9B (7-8) jumpered	______
2nd person verification	______
3.3 Shutdown Bd. 3ED Alignment	
a. 43SED tripped	______
b. Oscillograph connections	
(1) 1342 trip ckt.	______
(2) 1836 cl. ckt.	______
(3) RHR 3D cl. ckt.	______
(4) CS 3D cl. ckt.	______
*(5) RHRSW D1 cl. ckt.	______
(6) 4-kV Sd. Bd. 3ED volt.	______
(7) D/G 3D current	______
3.4 Test Performance	
a. 1342 trip	______
b. Breaker closure	
(1)	______

*Revision JBD

Data Sheet SI 4.9.A.1.b (Continued)

Step	INITIALS/DATE
3.4 Test Performance (Continued)	
b. (Continued)	
(2) RHR 3D	________
(3) CS 3D	________
*(4) RHRSW D1	________
c. Diesel gen. 3D stable	________
d. D/G 3D data	
(1) KW	________
(2) KVAR	________
(3) Volts	________
(4) Amps	________
(5) Frequency	________
e. Trace no. 3-4 attached	________
3.5 D/G 3D Shutdown	
a. 1342 sync. sw. ON	________
b. Mode sw. PARALLEL WITH SYSTEM	________
c. D/G 3D in sync.	________
d. 1342 closed	________
e. D/G 3D unloaded	________
f. 1836 trip	________
g. Control sw. STOP	________
h. D/G idle	________

*Revision JBP

Data Sheet SI 4.9.A.1.b (Continued)

Step		Initials/Data
3.7	RHR Shutdown and Return to Normal - Unit 3 (Continued)	
	c. 10A-K105D energized	____________
	d. FCV-74-71 and -73 close/-30 open	____________
	e. RHR 3D trip	____________
	f. FCV-74-75 power restored	____________
	g. FCV-74-46 as left position	____________
	h. Annunciation reset	____________
3.8	Shutdown Board 3ED Return to Normal	
	a. 43SED reset	____________
	b. CS 3B returned	____________
	c. Oscillograph inputs removed	____________
	d. EECW in standby readiness	____________

Data Sheet SI 4.9.A.1.b (Continued)

SI Step		Initials/Data
3.5	D/G 3D Shutdown (Continued)	
	i. 1342 sync. sw. OFF	______
	j. D/G 3D standby readiness	______
3.6	Core Spray Shutdown And Return to Normal - Unit 3	
	a. 14A-K10B (3-4) jumper removed	______
	2nd person verification	______
	b. 14A-J1B fixture removed	______
	2nd person verification	______
	c. 14A-K26B (1-2) boot removed	______
	2nd person verification	______
	d. 14A-K26B (5-6) boot removed	______
	2nd person verification	______
	e. 14A-S13B NORMAL	______
	2nd person verification	______
	f. FCV-75-50 closed/FCV-75-37 open	______
	g. CS 3D trip	______
	h. FCV-75-53 power restored	______
	i. Annunciation reset	______
3.7	RHR Shutdown and Return to Normal - Unit 3	
	a. 10A-K9B (7-8) jumper removed	______
	2nd person verification	______
	b. NVA-D-2 (5-6) boot removed	______
	2nd person verification	______

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

SURVEILLANCE INSTRUCTION 4.9.A.1.d

DIESEL GENERATOR ANNUAL INSPECTION

Units 1 AND 2 OR UNIT 3

Approved: H J Green
Plant Superintendent

Date: April 14, 1976
General Revision

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

DIESEL GENERATOR ANNUAL INSPECTION

Description

This surveillance instruction is used to comply with requirements of technical specification 4.9.A.1.d. The following table lists the required surveillance items regarding this instruction:

TABLE SI 4.9.A.1.d - SURVEILLANCE REQUIREMENTS

Frequency	Requirement
Annually	Each diesel generator shall be given an inspection in accordance with instructions based on the manufacturer's recommendations.

This inspection is designed to supplement all other surveillance tests and maintenance inspections on the diesel generator system and its auxiliary equipment. The implementation of this instruction will prove operability of some divices that normally are not called upon to function as well as reveal any deterioration of items such as loose connections, foul fluids, burned or tarnished break points, etc. This instruction is written in two parts because of the independence of the mechanical and electrical tests and adjustments. Conditions may arise, however, that allow "dove-tailing" of parts of the two sub-instructions for man-hour efficiency and safe practice; and the conditions will be examined by the maintenance department prior to each performance of this instruction.

Reference: Electro-Motive Division Maintenance Instruction M.I. 1742.

SI 4.9.A.1.d
DIESEL GENERATOR ANNUAL INSPECTION
ELECTRICAL

1. Prerequisites

1.1 The shift engineer's approval shall be obtained prior to the performance of this instruction.

1.2 Limiting conditions satisfied in the technical specifications.

1.3 Obtain a clearance on the following for the diesel generator being tested.

a. 4kV diesel generator breaker including trip circuit and close circuit fuses.

b. Associated PT fuses

c. The logic breaker located on the 125V distribution panel (this deenergizes panel 25-46 for units 1 and 2 and the panel at the associated 4kV Shutdown Board for Unit 3).

d. Start circuit 1 and 2 breakers at the electrical control cabinet.

2. Precautions

2.1 Alert the unit operator in the main control room that he will receive sporatic annunciation on the appropriate sections of panel 9-23-7 or 8 and panel 25-41 (Units 1 and 2 only).

2.2 Alert the unit operator in the Unit 3 control room that he will receive sporatic annunciation on the appropriate sections of 3-9-23 and at the appropriate shutdown board room (Unit 3 only).

2.3 Diesel generator starting and running noises are irritating to the ears. Ear defenders are provided and should be worn when conditions warrant.

2.4 Exercise care when removing wires and jumpering terminals. Circuits are energized with 125VDC.

3. Procedure

NOTE: Verify results and record data after each step unless otherwise specified, as appropriate, on the data sheets. The sections, do not have to be performed in sequence although steps within a section should be performed in sequence.

3.1 Verify that the following breakers are in the OFF position.

a. exciter breaker (125V dist. pnl.)

b. DC control breaker (125V dist. pnl.)

c. protective relay panel (Pn125-47) breaker (125V dist. pnl.)

d. alarm control breaker (elect. cont. pnl.)

e. AC control breaker (elect. cont. panel)

f. start circuit 1 breaker (elect. cont. pnl.)

g. start circuit 2 breaker (elect. cont. pnl.)

h. DC control breaker (elect. cont. pnl.)

i. logic breaker for panel 25-46 - (125V dist. pnl.) (Unit 1 and 2)

j. logic breaker for 4kV Sd. Bd. - (125V dist. pnl) (Unit 3)

3.2 Alarm Tests

a. Turn alarm control breaker (elect. cont. pnl.) on

b. Turn DC control breaker (125V dist. pnl.)

c. Air Pressure 1

(1) Turn air compressor 1 control switch to OFF position

(2) Open any one of the following drain valves for the appropriate unit.

(a) Unit 1 and 2: 0-86-534___, 0-86-535___, 0-86-536___, 0-86-537___, 0-86-538___

(b) Unit 3: 0-86-584-3___, 0-86-585-3___, 0-86-586-3___, 0-86-587-3___, 0-86-588-3___

(3) Verify alarm light and bell pickup when the pressure drops below 165lbs. (165 ± 5 lbs) on STARTING AIR RB gauge.

3. Procedure (Continued)

(4) Close drain valve

(5) Return air compressor 1 control switch to AUTO position.

(6) Silence alarm (light can be reset when pressure increases to about 175 lbs.)

d. Air Pressure 2

(1) Turn air compressor 2 control switch to the OFF position

(2) Open any one of the following drain vavles for the appropriate unit

(a) Unit 1 and 2: 0-86-516___, 0-86-517___, 0-86-518___, 0-86-519___, 0-86-520___

(b) Unit 3: 0-86-566-3___. 0-86-567-3___, 0-86-568-3___, 0-86-569-3___, 0-86-570-3___

(3) Verify alarm light and bell pickup when the pressure drops below 165 lbs (165 ± 5 lbs) on the STARTING AIR R.B. gauge.

(4) Close drain valve

(5) Return air compressor 2 control switch to AUTO position.

(6) Silence alarm (light can be reset when pressure increases to about 175 lbs.)

(7) Close the following 12 air supply isolation vavles for the D/G being inspected. The Unit 3 valve numbers are given in parenthesis.

(a) 0-86-504___ (0-86-554-3___)

(b) 0-86-505___ (0-86-555-3___)

(c) 0-86-506___ (0-86-556-3___)

(d) 0-86-507___ (0-86-557-3___)

(e) 0-86-508___ (0-86-558-3___)

(f) 0-86-524___ (0-86-574-3___)

(g) 0-86-525___ (0-86-575-3___)

3. Procedure (Continued)

3.2 Alarm Tests (Continued)

d. Air Pressure 2 (Continued)

(h) 0-86-526___ (0-86-576-3___)

(i) 0-86-527___ (0-86-577-3___)

(j) 0-86-528___ (0-86-578-3___)

(k) 0-86-523___ (0-86-573-3___)

(l) 0-86-503___ (0-86-553-3___)

NOTE: Leave these valves closed until the engine is cranked in step 3.11.

e. Not Auto

(1) Turn DC control breaker (elect. cont. pnl) on.

(2) Verify field breaker (elect. cont. pnl) is closed.

(3) Turn air compressor 1 control switch to OFF position.

(4) Verify alarm light and bell pick up.

(5) Return switch to AUTO position.

(6) Reset alarm.

(7) Turn air compressor 2 control switch to OFF position.

(8) Verify alarm light and bell pick up.

(9) Return switch to AUTO position.

(10) Reset alarm.

(11) Turn field breaker (elect. cont. pnl) off.

(12) Verify alarm light and bell pick up.

(13) Turn field breaker on.

(14) Reset alarm.

3. Procedure (Continued)

3.2 Alarm Tests (Continued)

f. Oil and Water Pressure 1

*(1) Place a jumper from wire AJX to wire AP1 on relay LWD.

*(2) Verify 'oil pressure' alarm.

*(3) Place a jumper from AK5 to AJ1 on RWS pressure switch and verify alarm bell and alarm light for raw water pick up.

*(4) Remove AJX to AP1, jumper on LWD relay.

*(5) Remove AK5 to AJ1 jumper on RWS pressure switch.

*(6) Reset alarms.

g. Oil and Water Pressure 2

*(1) Place a jumper from terminal 35A-R4 to terminal 35A-R5 in electrical control cabinet.

*(2) Verify "OIL PRESSURE" and "RAW WATER" alarms.

*(3) Remove jumper from 35A-R4 to 35A-R5.

*(4) Reset alarms.

h. Circuit Malfunction

(1) Place a jumper from wire AP13 to wire AE on relay ZSR1.

(2) Place a jumper from wire AEA5 to wire AE on relay SCR.

(3) Verify alarm bell and light for CIRCUIT MAL pick up.

(4) Remove jumper on relay ZSR1.

(5) Remove jumper on relay SCR.

(6) Reset alarm.

i. No Field

(1) Place a jumper from wire AP14 to wire AF on relay FSR1.

(2) Place a jumper from wire AFA1 to wire AF on relay 40T.

CAUTION: If above jumpers remain on for 2 minutes, relay LWD will pick up causing OIL PRESSURE and RAW WATER alarms to pick up.

(3) Verify alarm bell and lights for NO FLD and CIRCUIT MAL pick up.

(4) Remove jumper on relay FSR1.

*Revision

3. Procedure (Continued)

3.2 Alarm Tests (Continued)

i. No Field (Continued)

(5) Remove jumper on relay 40T.

(6) Reset alarms.

j. Fuel Transfer (high level)

(1) Momentarily electrically short from wire AP33 to wire AU5 on relay FTH and verify alarm bell and light for FUEL TRANSFER pick up.

(2) Reset alarm.

k. Fuel Transfer (low level)

(1) Momentarily electrically short from wire AP31 to wire AU on relay FTL and verify alarm bell and light for FUEL TRANSFER pick up.

(2) Reset alarm.

l. Fuel Pressure (system 1)

(1) Momentarily electrically short from wire AP43 to wire AT on pressure switch HFP1 and verify alarm bell and light for FUEL PRESSURE pick up.

(2) Reset alarm.

m. Fuel Pressure (system 2)

(1) Momentarily electrically short from wire AP44 to wire AT5 on pressure switch HFP2 and verify alarm bell and light for FUEL PRESSURE pick up.

(2) Reset alarm.

3. <u>Procedure</u> (Continued)

3.2 Alarm Tests (Continued)

n. Lube Oil Level

<u>NOTE</u>: If engine lube oil is to be changed during the inspection, this annunciation can be verified when oil level is dropped.

(1) Momentarily electrically short from terminal 25B7 to wire AR5 on pt. 14 in annunciator cabinet and verify alarm bell and light for LUBE OIL LEVEL pick up.

(2) Reset alarm.

o. Engine Temperature

(1) Push test button on temperature switch ETS.

(2) Verify alarm bell and light for ENGINE HOT pick up.

(3) Allow test button to spring return to normal.

(4) Reset alarm.

p. Start Failure

(1) Momentarily electrically short from wire AP16 to wire AHB3 on relay PFD1 and verify alarm bell and light for START FAIL pick up.

(2) Reset alarm.

q. Crankcase Pressure

(1) Using a piece of Tygon tubing, apply suction to crankcase pressure detector vent.

(2) Verify alarm light and bell pick up.

(3) Reset alarm.

<u>NOTE</u>: In order to reset alarm, the plunger which popped out on the crankcase pressure detector will have to be pushed back in. If plunger will not stay in, you will have to wait until engine is cranked to reset.

r. Lube Oil Temperature

(1) Momentarily electrically short from terminal 25C-10 to wire AQB5 on pt. 15 in annunciator cabinet and verify alarm light and bell pick up.

3. <u>Procedure</u> (Continued)

3.2 Alarm Tests (Continued)

r. Lube Oil Temperature (Continued)

(2) Reset Alarm.

s. Turn alarm control breaker (elect. cont. pnl.) off.

3.3 Timer Tests and Setpoint Correction

This section provides individual instructions for timing each time delay relay in the diesel generator control panels. This instruction makes use of EMI 15 which contains instructions for timing every combination of time delay relays. Each relay instruction section will contain a description of the relay, instructions governing the isolation of the relay, contact terminals to use as the trigger contact, and the location of the power source to use for coil voltage.

a. SFB1

This is a time delay pickup relay. Its pickup time is 1 ± 0.1 seconds.

(1) Isolate relay SFB1 by performing the following steps:

(a) Remove wire S1N7 from the left coil terminal.

(b) Remove wire S1PD from the right coil terminal.

(c) Remove wires AP27 and AP26 from the top lift time delay contact A terminal.

(d) Remove wires AHB5 and AHB 2 from the right time delay contact A terminal.

<u>NOTE:</u> SFB1 should now be totally isolated from panel wiring.

(2) Time relay SFB1 per EMI 15, step 1 using the following information:

(a) the right coil terminal is positive

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

a. SFB1 (Continued)

(2) Time relay SFB1 per EMI 15 . . . . (Continued)

(b) the left coil terminal is negative

(c) the right and left time delay contact A terminals are the trigger contacts.

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at tht top of the DC control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay SFB1 to normal by performing the following steps:

(a) Reterminate wire S1N7 on the left coil terminal

(b) Reterminate wire S1PD on the right coil terminal

(c) Reterminate wires AP27 and AP26 on the left time delay contact A terminal

(d) Reterminate wires AHB5 and AHB2 on the right time delay contact A terminal

(4) Inspect relay SFB1 and surrounding area to assure there are no loose connections.

b. SFB2

This is a time delay pickup relay. Its pickup time is 1 ± 0.1 seconds.

(1) Isolate relay SFB2 by performing the following steps:

(a) Remove wire S2Pd from the right coil terminal

(b) Remove wire S2N7 from the left coil terminal

(c) Remove wire AP27 from the left time delay contact A terminal.

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

b. SFB2 (Continued)

(1) Isolate relay SFB2 . . . . (Continued)

(d) Remove wires AHB4 and AHB5 from the right time delay contact A terminal.

<u>NOTE</u>: SFB2 should now be totally isolated from panel wiring.

(2) Time relay SFB2 per EMI 15, step 1 using the following information

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the right and the left time delay contact A terminals are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay SFB2 to normal by performing the following steps:

(a) Reterminate wire S2PD on the right coil terminal

(b) Reterminate wire S2N7 on the left coil terminal .

(c) Reterminate wire AP27 on the left time delay contact A terminal

(d) Reterminate wires AHB4 and AHB5 on the right time delay contact A terminal

(4) Inspect relay SFB2 and surrounding area to assure there are no loose connections

c. PFD1

This is a time delay pickup relay, its pickup time is 3 ± 0.2 seconds.

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

c. PFD1 (Continued)

(1) Isolate relay PFD1 by performing the following steps:

(a) Remove wires S1Z from the right coil terminal

(b) Remove wires S1N3 and S1N4 from the left coil terminal

(c) Remove wires S1J1 and S1J from the bottom right instantaneous contact terminal

(d) Remove wires S1QX1 and S1QX2 from the bottom left instantaneous contact terminal

(e) Remove wire AHB3 from the left time delay contact A terminal

(f) Remove wires AP15 and AP16 from the right time delay contact A terminal

(g) Remove wire S1U from the left time delay contact B terminal

(h) Remove wire S1T from the right time delay contact B terminal

NOTE: PFD1 should now be totally isolated from panel wiring

(2) Time relay PFD1 per EMI 15, step 1 using the following information

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the left and right time delay contact A terminals are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC.control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

3. <u>Prodecure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

c. PFD1 (Continued)

(3) Return relay PFD1 to normal by performing the following steps:

(a) Reterminate wire S1Z on right coil terminal

(b) Reterminate wires S1N3 and S1N4 on left coil terminal

(c) Reterminate wires S1J1 and S1J on the bottom right instantaneous contact terminal

(d) Reterminate wires S1QX1 and S1QX2 on the bottom left instantaneous contact

(e) Reterminate wire AHB3 on the left time delay contact A terminal

(f) Reterminate wires AP15 and AP16 on the right time delay contact A terminal

(g) Reterminate wire S1U on the left time delay contact B terminal

(h) Reterminate wire S1T on the right time delay contact B terminal

(4) Inspect relay PFD1 and surrounding area to assure there are no loose connections

d. PFD2

This is a time delay pickup relay. Its pickup time is 3 ± 0.2 seconds.

(1) Isolate relay PFD2 by performing the following steps:

(a) Remove wires S2N3 and S2N4 from the left coil terminal

(b) Remove wire S2Z from the right coil terminal

(c) Remove wires S2QX1 and S2QX2 from the bottom left instantaneous contact terminal

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

d. PFD2 (Continued)

(1) Isolate relay PFD2 . . . . (Continued)

(d) Remove wires S2J1 and S2J from the bottom right instantaneous contact terminal

(e) Remove wires AP24 and AP25 from the right time delay contact A terminal

(f) Remove wires AHB3 and AHB2 from the left time delay contact A terminal

(g) Remove wire S2T from the right time delay contact B terminal

(h) Remove wire S2U from the left time delay contact B terminal

(2) Time relay PFD2 per EMI 15, step E, using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the right and left time delay contact A terminals are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

d. PFD2 (Continued)

(3) Return relay PFD2 to normal by performing the following steps:

(a) Reterminate wires S2N3 and S2N4 on the left coil terminal

(b) Reterminate wire S2Z on the right coil terminal

(c) Reterminate wires S2QX1 and S2QX2 on the bottom left instantaneous contact terminal

(d) Reterminate wires S2J1 and S2J on the bottom right instaneous contact terminal

(e) Reterminate wires AP24 and AP25 on the right time delay contact A terminal

(f) Reterminate wires AHB3 and AHB2 on the left time delay contact A terminal

(g) Reterminate wire S2T on the right time delay contact B terminal

(h) Reterminate wire S2U on the left time delay contact B terminal

(4) Inspect relay PFD2 and surrounding area to assure there are no loose connections

e. SFD1

This is a time delay pickup relay. Its pickup time is 4 ± 0.4 seconds.

(1) Isolate relay SFD1 by performing the following steps:

(a) Remove wires S1N2 and S1N3 from the left coil terminal

(b) Remove wire S1Y from the right coil terminal

(c) Remove wire S1K from the bottom left instantaneous contact terminal

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

e. SFD1 (Continued)

(1) Isolate relay SFD1 . . . . (Continued)

(d) Remove wire S1L from the bottom right instantaneous contact terminal

(e) Remove wires AHB1 and AHB4 from the left time delay contact A terminal.

(f) Remove wire AP16 from the right time delay contact A terminal

(g) Remove wire S1V from the left time delay contact B terminal

(h) Remove wire S1U from the right time delay contact B terminal

(2) Time relay SFD1 per EMI 15, step 1 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the left and right time delay contact A terminals are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay SFD1 to normal by performing the following steps:

(a) Reterminate wires S1N2 and S1N3 on the left coil terminal

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

e. SFD1 (Continued)

(3) Return relay SFD1 to normal . . . . (Continued)

(b) Reterminate wire S1Y on the right coil terminal

(c) Reterminate wire S1K on the bottom left instantaneous contact terminal

(d) Reterminate wire S1L on the bottom right instantaneous contact terminal

(e) Reterminate wires AHB1 and AHB4 on the left time delay contact A terminal

(f) Reterminate wire AP16 on the right time delay contact A terminal

(g) Reterminate wire S1V on the left time delay contact B terminal

(h) Reterminate wire S1U on the right time delay contact B terminal

(4) Inspect relay SFD1 and surrounding area to assure there are no loose connections

f. SFD2

This is a time delay pickup relay. Its pickup time is 4 ± 0.4 seconds.

(1) Isolate relay SFD2 by performing the following steps:

(a) Remove wires S2N2 and S2N3 from the left coil terminal

(b) Remove wire S2Y from the right coil terminal

(c) Remove wire S2K from the bottom left instantaneous contact terminal

(d) Remove wire S2L from the bottom right instantaneous contact terminal

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

f. SFD2 (Continued)

(1) Isolate relay SFD2. . . . . (Continued)

(e) Remove wires AHB and AHB1 from the left time delay contact A terminal

(f) Remove wires AP24 and AP23 from the right time delay contact A terminal

(g) Remove wire S2V from the left time delay contact B terminal

(h) Remove wire S2U from the right time delay contact B terminal

(2) Time relay SFD2 per EMI 15, step 1 using the following information:

(a) the left coil terminal is negative

(b) the right coil terminal is positive

(c) the left and right time delay contact A terminals are the trigger contacts

(d) use wire P4 on the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 on top of the DC control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay SFD2 to normal by performing the following steps:

(a) Reterminate wires S2N2 and S2N3 on the left coil terminal

(b) Reterminate wire S2Y on the right coil terminal

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

f. SFD2 (Continued)

(3) Return relay SFD2 to normal . . . . (Continued)

(c) Reterminate wire S2K on the bottom left instantaneous contact terminal

(d) Reterminate wire S2L on the bottom right instantaneous contact terminal

(e) Reterminate wires AHB and AHB1 on the left time delay contact A terminal

(f) Reterminate wires AP24 and AP23 on the right time delay contact A terminal

(g) Reterminate wire S2V on the left time delay contact B terminal

(h) Reterminate wire S2U on the right time delay contact B terminal

(4) Inspect relay SFD2 and surrounding area to assure there are no loose connections.

g. STL01

This is a time delay pickup relay. Its pickup time is 5.5 (+1, -0) seconds.

(1) Isolate relay STL01 by performing the following steps:

(a) Remove wires S1N14 and S1N13 from the left coil terminal

(b) Remove wire S1R from the right coil terminal

(c) Remove wires AS1 and AS from point Q on the instantaneous contact block

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

g. STL01 (Continued)

(1) Isolate relay STL01 . . . . (Continued)

(d) Remove wire ASY from point R on the instantaneous contact block

(e) Remove wires CP19 and CP18 from point N on the instantaneous contact block

(f) Remove wire CAM2 from point P on the instantaneous contact block

(g) Remove wire F1XA from point L on the instantaneous contact block

(h) Remove wires F1B3 and F1B from point M on the instantaneous contact block

(i) Remove wires S1P5 and S1P2 from point J on the instantaneous contact block

(j) Remove wires S1Q and S1Q1 from point K on the instantaneous contact block

(k) Remove wire DGXA (B, C, or D) from the left time delay contact A terminal

(l) Remove wire DGXA1 (B1, C1, or D1) from the right time delay contact A terminal

(m) Remove wire F1C from the left time delay contact B terminal

(n) Remove wire F1D from the right time delay contact B terminal

(2) Time relay STL01 per EMI 15, step 1 using the following information:

(a) the right coil terminal is positive

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

g. STL01 (Continued)

(2) Time relay STL01 per EMI 15 . . . . (Continued)

(b) the left coil terminal is negative

(c) the left and right time delay contact A terminals are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay STL01 to normal by performing the following steps:

(a) Reterminate wires S1N14 and S1N13 on the left coil terminal

(b) Reterminate wire S1R on the right coil terminal

(c) Reterminate wires AS1 and AS on point Q on the instantaneous contact block

(d) Reterminate wire ASY on point R on the instantaneous contact block

(e) Reterminate wires CP19 and CP18 on point N on the instanteneous contact block

(f) Reterminate wire CAM2 on point P on the instantaneous contact block

(g) Reterminate wire F1XA on point L on the instantaneous contact block

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

g. STL01 (Continued)

(3) Return relay STL01 to normal . . . . (Continued)

(h) Reterminate wires F1B3 and F1B on point M on the instantaneous contact block

(i) Reterminate wires S1P5 and S1P2 on point J on the instantaneous contact block

(j) Reterminate wires S1Q and S1Q1 on point K on the instantaneous contact block

(k) Reterminate wire DGXA (B, C, or D) on the left time delay contact A terminal

(l) Reterminate wire DGXA1 (B1, C1, or D1) on the top right time delay contact A terminal

(m) Reterminate wire F1C on the left time delay contact B terminal

(n) Reterminate wire F1D on the right time delay contact B terminal

(4) Inspect relay STL01 and surrounding area to assure that there are no loose terminals

h. STL02

This is a time delay pickup relay. Its pickup time is 5.5 (+1, -0) seconds.

(1) Isolate relay STL02 by performing the following steps:

(a) Remove wires S2N14 and S2N13 from the left coil terminal

(b) Remove wire S2R from the right coil terminal

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

h. STL02 (Continued)

(1) Isolate relay STL02 . . . . (Continued)

(c) Remove wires ASX and ASX1 from point R on the instantaneous contact block

(d) Remove wire ASY from point Q on the instantaneous contact block

(e) Remove wires CP15 and CP12 from point N on the instantaneous contact block

(f) Remove wires CAM2 and CAM1 from point P on the instantaneous contact block

(g) Remove wire F2XA from point L on the instantaneous contact block

(h) Remove wires F2B3 and F2B from point M on the instanteneous contact block

(i) Remove wires S2P5 and S2P2 from point J on the instantaneous contact block

(j) Remove wires S2Q and S2Q1 from point K on the instantaneous contact block

(k) Remove 2 wires labeled DGXA (B, C, or D) from left time delay contact A terminal

(l) Remove 2 wires labeled DGXA1 (B1, C1, or D1) from the right time delay contact A terminal

(m) Remove wire F2C from bottom left time delay contact B terminal

(n) Remove wire F2D from bottom right time delay contact B terminal

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

h. STL02 (Continued)

(2) Time relay STL02 per EMI 15, step 1 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the left and right time delay contact A terminals are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay STL02 to normal by performing the following steps:

(a) Reterminate wires S2N14 and S2N13 on the left coil terminal

(b) Reterminate wire S2R on the right coil terminal

(c) Reterminate wires ASX and ASX1 on point R on the instantaneous contact block

(d) Reterminate wire ASY on point Q on the instantaneous contact block

(e) Reterminate wires CP15 and CP12 on point N on the instantaneous contact block

(f) Reterminate wires CAM2 and CAM1 on point P on the instantaneous contact block

3: Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

h. STL02 (Continued)

(3) Return relay STL02 to normal . . . . (Continued)

(g) Reterminate wire F2XA on point L on the instantaneous contact block

(h) Reterminate wires F2B3 and F2B on point M on the instantaneous contact block

(i) Reterminate wires S2P5 and S2P2 on point J on the instantaneous contact block

(j) Reterminate wires S2Q and S2Q1 on point K on the instantaneous contact block

(k) Reterminate 2 wires labeled DGXA (B, C, or D) on the left time delay contact A terminal

(l) Reterminate 2 wires labeled DGXA1 (B1, C1, or D1) on the top right time delay contact A terminal

(m) Reterminate wire F2C on the left time delay contact B terminal

(n) Reterminate wire F2D on the right time delay contact B terminal

(4) Inspect relay STL02 and surrounding area to assure that there are no loose terminals

i. ESTD

This is a time delay drop out relay. Its dropout time is 15 ± 1 minutes.

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

i. ESTD (Continued)

(1) Isolate relay ESTD by performing the following steps:

(a) Remove wires CN13 and CN14 from the left coil terminal

(b) Remove wires CAT1 and CAT from the right coil terminal

(c) Remove wire CAV1 from contact point No. 3

(d) Remove wire CAX from contact point No. 5

(2) Time relay ESTD per EMI 15, step 4 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) contact points 3 and 5 are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC control breaker as the negative side of the DC source

(f) record as found dropout time

(g) record as left dropout time

(3) Return relay ESTD to normal by performing the following steps:

(a) Reterminate wires CN13 and CN14 on the left coil terminal

(b) Reterminate wires CAT1 and CAT on the right coil terminal

(c) Reterminate wire CAV1 on contact point No. 3

(d) Reterminate wire CAX on contact point No. 5

(4) Inspect relay ESTD and surrounding area to assure that there are no loose terminals.

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

j. PFDA1

This is a time delay dropout relay. Its dropout time is 0.5 ± 0.1 seconds.

(1) Isolate relay PFDA1 by performing the following steps:

(a) Remove wires S1N5 and S1N4 from the left coil terminal

(b) Remove wire S1SX from the right coil terminal

(c) Remove wire F1C from the top 1A terminal on the time delay contact block

(d) Remove wire F1K from the bottom 1A terminal on the time delay contact block

(e) Remove wire F2K from the top 2A terminal on the time delay contact block

(f) Remove wire F2B2 from the bottom 2A terminal on the time delay contact block

(2) Time relay PFDA1 per EMI 15, step 3 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the 1A contact terminals are the trigger contacts

(d) use wire P4 on the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 on the top of the DC control breaker as the negative side of the DC source

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

j. PFDA1 (Continued)

(2) Time relay PFDA1 per EMI 15 . . . . (Continued)

(f) record as found dropout time

(g) record as left dropout time

(3) Return relay PFDA1 to normal by performing the following steps:

(a) Reterminate wires S1N5 and S1N4 on the left coil terminal

(b) Reterminate wire S1SX on the right coil terminal

(c) Reterminate wire F1C on the top 1A contact terminal

(d) Reterminate wire F1K on the bottom 1A contact terminal

(e) Reterminate wire F2K on the top 2A contact terminal

(f) Reterminate wire F2B2 on the bottom 2A contact terminal

(4) Inspect relay PFDA1 and surrounding area to assure there are no loose connections.

k. PFDA2

This is a time delay dropout relay. Its dropout time is 0.5 ± 0.1 seconds.

(1) Isolate relya PFDA2 by performing the following steps:

(a) Remove wires S2N5 and S2N4 from the left coil terminal

(b) Remove wire S2SX from the right coil terminal

(c) Remove wire F1K from the top 1A terminal on the time delay contact block

(d) Remove wire F1B2 from the bottom 1A terminal on the time delay contact block

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

k. PFDA2 (Continued)

(1) Isolate relay PFDA2 . . . . (Continued)

(e) Remove wire F2C from the top 2A terminal on the time delay contact block

(f) Remove wire F2K from the bottom 2A terminal on the time delay contact block

(2) Time relay PFDA2 per EMI 15, step 3 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the 1A contact terminals are the trigger contacts

(d) use wire P4 on the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 on the top of the DC control breaker as the negative side of the DC source

(f) record as found dropout time

(g) record as left dropout time

(3) Return relay PFDA2 to normal by performing the following steps:

(a) Reterminate wires S2N5 and S2N4 on the left coil terminal

(b) Reterminate wire S2SX on the right coil terminal

(c) Reterminate wire F1K on the top 1A contact terminal

(d) Reterminate wire F1B2 on the bottom 1A contact terminal

(e) Reterminate wire F2C on the top 2A contact terminal

(f) Reterminate wire F2K on the bottom 2A contact terminal

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

k. PFDA2 (Continued)

(4) Inspect relay PFDA2 and surrounding area to assure there are no loose connections.

l. LWD

This is a time delay pickup relay. Its pickup time is 2 minutes ± 10 seconds.

(1) Isolate relay LWD by performing the following steps:

(a) Remove wires AN2 and AN4 from the left coil terminal (Unit 1 and 2 only)

(b) Remove wire AN2 from the left coil terminal (Unit 3 only)

(c) Remove wire AEX from the right coil terminal

(d) Remove wire AC from contact point 1

(e) Remove wire AP1 from contact point 2

(f) Remove wire ACA from contact point 5

(g) Remove wire AJX from contact point 6

<u>NOTE</u>: LWD should now be totally isolated from panel wiring.

(2) Time relay LWD per EMI 15, step 1 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) contact points 1 and 5 are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC control breaker as the negative side of the DC source

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

1. LWD (Continued)

(2) Time relay LWD per EMI 15 . . . . (Continued)

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay LWD to normal by performing the following steps:

(a) Reterminate wires AN2 and AN4 on the left coil terminal (Unit 1 and 2 only)

(b) Reterminate wire AN2 from the left coil terminal (Unit 3 only)

(c) Reterminate wire AEX on the right coil terminal

(d) Reterminate wire AC on contact point 1

(e) Reterminate wire AP1 on contact point 2

(f) Reterminate wire ACA on contact point 5

(g) Reterminate wire AJX on contact point 6

(4) Inspect relay LWD and surrounding area to assure there are no loose connections

m. 40T

This is a time delay pickup relay. Its pickup time is 3 ± 0.3 seconds.

(1) Isolate relay 40T by performing the following steps:

(a) Remove wires CN17 and CN18 from the left coil terminal

(b) Remove wire CAF from the right coil terminal

(c) Remove wires AFA1 and AFA from the left time delay contact A terminal

(d) Remove wire AF from the right time delay contact A terminal

<u>NOTE</u>: 40T should now be totally isolated from panel wiring

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

m. 40T (Continued)

(2) Time relay 40T per EMI 15, step 1 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the left and right time delay contact A terminals are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay 40T to normal by performing the following steps:

(a) Reterminate wires CN17 and CN18 on the left coil terminal

(b) Reterminate wire CAF on the right coil terminal

(c) Reterminate wires AFA1 and AFA on the top left time delay contact A terminal

(d) Reterminate wire AF on the top right time delay contact A terminal

(4) Inspect relay 40T and surrounding area to assure there are no loose connections

n. 52V

This is a time delay pickup relay. Its pickup time is 3 $\pm$ 0.3 seconds.

(1) Isolate relay 52V by performing the following steps:

(a) Remove wires CN19 and CN18 from the left coil terminal

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

n. 52V (Continued)

(1) Isolate relay 52V by performing the following steps: (Continued)

(b) Remove wires CAJ2 and CAJ from the right coil terminal

(c) Remove wire CAE from the left time delay contact A terminal

(d) Remove wires CAA1 and CAA3 from the right time delay contact A terminal

NOTE: 52V should now be completely isolated from all panel wiring

(2) Time relay 52V per EMI 15, step 1 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the left and right time delay contact A terminals are the trigger contacts

(d) use wire N4 at the top of the DC control breaker as the negative side of the DC source

(e) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay 52V to normal by performing the following steps:

(a) Reterminate wires CN19 and CN 18 on the left coil terminal

(b) Reterminate wires CAJ2 and CAJ on the right coil terminal

(c) Reterminate wire CAE on the left time delay contact A terminal

(d) Reterminate wires CAA1 and CAA3 on the right time delay contact A terminal

3. <u>Procedure</u> (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

n. 52V (Continued)

(4) Inspect relay 52V and surrounding area to insure there are no loose connections

o. ECR

This is a time delay pickup relay. Its pickup time is 11.5 ± 1 minutes

(1) Isolate relay ECR by performing the following steps:,

(a) Remove wires CN13 and CN12 from the left coil terminal

(b) Remove wires CAX and CAX1 from the right coil terminal

(c) Remove wires CAV and CAV1 from contact point 1

(d) Remove wire AJ from contact point 4

(e) Remove wires CAW1 and CAW from contact point 5

(f) Remove wire AJX from contact point 6

<u>NOTE</u>: ECR should now be totally isolated from panel wiring.

(2) Time relay ECR per EMI 15, step 1 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) contact points 1 and 5 are the trigger contacts

(d) use wire P4 at the top of the DC control breaker as the positive side of the DC source

(e) use wire N4 at the top of the DC control breaker as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay ECR to normal by performing the following steps:

(a) Reterminate wires CN13 and CN12 on the left coil terminal

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

o. ECR (Continued)

(3) Return relay ECR to normal by performing the following steps: (Continued)

(b) Reterminate wires CAX and CAX1 on the right coil terminal

(c) Reterminate wires CAV and CAV1 on contact point 1

(d) Reterminate wire AJ on contact point 4

(e) Reterminate wires CAW1 and CAW on contact point 5

(f) Reterminate wire AJX on contact point 6

(4) Inspect relay ECR and surrounding area to assure there are no loose connections.

p. SCR (located in engine control cabinet)

This is a time delay pickup relay. Its pickup time is 30 $\pm$ 3 seconds

(1) Isolate relay SCR by performing the following steps:

(a) Remove wire CN2 from the left coil terminal

(b) Remove wire CAW from the right coil terminal

(c) Remove wires AEA5 and AEA from the left time delay contact A terminal

(d) Remove wire AE from the right time delay contact A terminal

NOTE: SCR should now be completely isolated from all panel wiring

(2) Time relay SCR per EMI 15, step 1 using the following information:

(a) the right coil terminal is positive

(b) the left coil terminal is negative

(c) the left and right time delay contact A terminals are the trigger contacts

(d) use terminal 25E-12 as the negative side of the DC source

3. Procedure (Continued)

3.3 Timer Tests and Setpoint Correction (Continued)

p. SCR (located in engine control cabinet) (Continued)

(2) Time relay SCR per EMI 15, step 1 using the following information: (Continued)

(e) use terminal 25E-12 as the negative side of the DC source

(f) record as found pickup time

(g) record as left pickup time

(3) Return relay SCR to normal by performing the following steps:

(a) Reterminate wire CN2 on the left coil terminal

(b) Reterminate wire CAW on the right coil terminal

(c) Reterminate wires AEA5 and AEA on the left time delay contact A terminal.

(d) Reterminate wire AE on the right time delay contact A terminal

(4) Inspect relay SCR and surrounding area to insure there are no loose connections

3.4 Immersion Heater

a. Visually inspect the heater contactor in the engine control cabinet for burned or distorted contact surfaces, loose connections, and foreign material. Exercise caution because the circuit will not be de-energized.

b. Verify proper operation of the immersion heater.

(1) Electrically short from 25E1 to 25E3 in the electrical control cabinet

(2) Verify the heater contactor energizes.

(3) Using a clamp-on ammeter, measure and record the current in lead L1, L2, and L3 at the contactor

3. Procedure (Continued)

3.4 Immersion Heater (Continued)

b. Verify proper operation of the immersion heater. (Continued)

(4) Measure and record the voltage at the contactor between L1 and L2, L2 and L3, and L3 and L1

(5) Remove the electrical short placed in step 3.4.b(1)

(6) Calculate the heater capacity using the following formula:

$$\text{Power (kw)} = \frac{3}{\sqrt{3}} \times \frac{IV}{1000} = (0.00173)VI$$

I(amps): minimum value obtained in step 3

V(volts): minimum value obtained in step 4

*(7) Verify heater capacity is between 12kw and 15kw.

3.5 Relay Inspection

a. Verify that the following breakers are off

(1) exciter breaker (125V dist. pnl.)

(2) DC control breaker (125V dist. pnl.)

(3) protective pnl. breaker (125V dist. pnl.)

(4) alarm control breaker (elect. cont. pnl.)

(5) AC control breaker (elect. cont. pnl.)

(6) DC control breaker (elect. cont. pnl.)

(7) logic breaker (125V dist. pnl.)

b. Visually inspect the following relays for burned or distorted contact surfaces, loose connections, and foreign material.

NOTE: Exercise caution during the inspection. Although all coils of the following relays will be de-energized, some of the relay contacts may be hot.

*Revision

3. <u>Procedure</u> (Continued)

3.5 Relay Inspection (Continued)

b. Visually inspect the following relays . . . (Continued)

(1) VSR1

(2) VSR2

(3) ZSR1

(4) ZSR2

(5) FPR

(6) ESR1

(7) ESR2

(8) PFDA1

(9) PFDA2

(10) FSR1

(11) FSR2

(12) MSR1

(13) MSR2

(14) ECR

(15) ECRA

(16) ESTD

(17) 40V

(18) GS

(19) LWD

(20) 40T

(21) 52V

(22) FFCO

(23) ESTR

(24) SFB1

*Revision.

3. <u>Procedure</u> (Continued)

3.5 Relay Inspection (Continued)

b. Visually inspect the following relays . . . (Continued)

(25) SFB2

(26) OTR

(27) PFD1

(28) PFD2

(29) VSD1

(30) VSD2

(31) SFD1

(32) SFD2

(33) STLO1

(34) STLO2

(35) STR1

(36) STR2

(37) FFC

(38) SSP1 (complete panel)

(39) SSP2 (complete panel)

(40) SCR (engine cont. cab)

(41) FTH (engine cont. cab)

(42) FTL (engine cont. cab)

(43) FTC1 (engine cont. cab)

(44) FTC2 (engine cont. cab)

(45) CPMC (engine cont. cab)

(46) OL1 (engine cont. cab)

(47) OL2 (engine cont. cab)

(48) OLCPM (engine cont. cab)

3. <u>Procedure</u> (Continued)

3.5 Relay Inspection (Continued)

b. Visually inspect the following relays . . . (Continued)

(49) OL1H (engine cont. cab)

(50) annunciator relays (engine cont. cab)

<u>NOTE</u>: The logic panel for Unit 3 is located at the associated 4KV shutdown board.

(51) OMR__ - 1 (logic pnl.)

(52) OMR__ - 2 (logic pnl.)

(53) OMR__ - 3 (logic pnl.)

(54) OMR__ - 4 (logic pnl.) (Unit 1 and 2 only)

(55) OMR__ - 5 (logic pnl.) (Unit 1 and 2 only)

(56) TR__ - 1 (logic pnl.)

(57) TR__ - 2 (logic pnl.)

(58) TR__ - 3 (logic pnl.)

(59) TR__ - 4 (logic pnl.)

(60) TR__ - 5 (logic pnl.)

(61) DCPF__ - 1 (logic pnl.)

(62) DCPF__ - 2 (logic pnl.)

(63) SUDR (logic pnl.)

(64) 27/1AX (logic pnl.) (D/G A only)

(65) R1__ (logic pnl.) (Unit 1 and 2 only)

(66) ASLR (logic pnl.)

(67) ASLR-X (logic pnl.)

(68) USR__ (logic pnl.)

(69) DRR__ - 1 (logic pnl.)

(70) DRR__ - 2 (logic pnl.)

(71) DRR__ - 3 (logic pnl.)

3. Procedure (Continued)

3.5 Relay Inspection (Continued)

b. Visually inspect the following relays . . . (Continued)

(72) ASR__ - 1 (logic pnl.)

(73) ASR__ - 2 (logic pnl.)

(74) ASR__ - 3 (logic pnl.)

(75) CASR (logic pnl.)

(76) CR__ (logic pnl.)

(77) GRR__ (logic pnl.)

(78) GLR__ (logic pnl.)

(79) VRR__ (logic pnl)

(80) VLR__ (logic pnl.)

(81) OTX (logic pnl.)

(82) 27/1BX (logic pnl.) (D/G C only)

(83) CAR (protective relay cab.)

(84) 51VZ (protective relay cab.)

(85) 27/3AX (Sd Bd 3EA only)

(86) 27/3BX (Sd Bd 3EC only)

(87) R3A (Unit 3 only)

During this inspection, also check all terminal connections in each relay and control cabinet for tightness. Special attention should be given to all connections subject to vibration.

3.6 Voltage Regulator Inspection

a. Visually inspect the complete voltage regulator panel for loose connections, burned contact surfaces, and dirty rectifier plates.

3.7 Fuse Compartment Inspection

a. Check each of the following fuse compartments for loose fuse

3. Procedure (Continued)

3.7 Fuse Compartment Inspection (Continued)

a. Continued

clips, proper fit of fuse drawer, and good contact surface of fuse stabs:

(1) control power transformer fuses

(2) potential transformer fuses 1-3

(3) potential transformer fuses 4-6

3.8 Electrical Control Panel Inspection

a. Remove the back covers from the electrical control panel and visually inspect all PT's, CT's, reactors, and rectifiers for loose or burned connections.

3.9 Generator Inspection

a. Use low pressure air to remove dust from collector rings and stator

b. Remove oil, grease, or accumulation of dirt from collector with clean, bound end, lintless wiping cloths

c. Check collector rings for uneven wear, pits, and rough spots

d. Check generator brushes for tightness and wear

3.10 Protective Relays

a. Verify the operability of the following relays (to be performed by the DPSO Browns Ferry Nuclear Plant field crew)

(1) diesel generator overload - 51X

(2) diesel generator field overcurrent - 76X

(3) diesel generator ground overcurrent - 59X

(4) reverse power - 32

(5) diesel generator overcurrent - 51V

(6) diesel generator differential - 87

3. Procedure (Continued)

3.11 Fuel Oil Pump Motor Inspection

(a) Check DC control breaker for electrical control cabinet is OFF.

(b) Inspect the brushes and commutator of the fuel oil pump motor. Replace the motor brushes if they are worn shorter than 3/4-inch. Inspect the commutator and clean if its condition warrants. If the interior of the motor is dirty blow it out with low pressure air.

3.12 Lube Oil Circulating Pump Inspection

(a) Obtain a clearance on the lube oil circulating pump breaker per the following table:

Diesel Generator	Board	Panel
A	480V Diesel Aux Bd A	3E
B	480V Diesel Aux Bd A	4E
C	480V Diesel Aux Bd B	4E
D	480V Diesel Aux Bd B	3E
3A	480V Diesel Aux Bd 3EA	2B1
3B	480V Diesel Aux Bd 3EA	5B1
3C	480V Diesel Aux Bd 3EB	2B1
3D	480V Diesel Aux Bd 3EB	5B1

(b) Every two years, (Even years for Unit 3 Diesels, odd years for Unit 1 & 2 Diesels) change the lube oil circulating pump motor bearing and meggar the motor winding. Meggar the motor with a 500V meggar. The insulation resistance must be 1 megohm or greater.

(c) Release the clearance obtained.

3.13 Motor Operated Potentiometer

(a) Lubricate the motor-operated potentiometer once a year with a light weight machine oil.

3.14 (a) Electrical sections 3.1 through 3.13 must be complete before performing sections 3.15 and 3.16. Electricians to verify sections 3.1 through 3.13 are complete.

(b) Machinists to verify mechanical portion of SI 4.9.A.1.d is complete before Electricians proceed with sections 3.15 and 3.16.

*Addendum

3. Procedure (Continued)

NOTE: Sections 3.1 through 3.10 must be complete before performing sections 3.11 and 3.12.

*3.15 Governor and Voltage Control Checks

a. Turn DC control breaker (125V dist. pnl.) on

b. Turn DC control breaker (125V dist. pnl.) on

c. Turn alarm control breaker on

d. Turn excitation (field flashing) breaker (125V dist. pnl.) on

e. Turn AC control breaker (elect. cont. pnl.) on

f. Push engine stop pushbuttons

g. Verify field breaker (elect. cont. pnl.) is closed

h. Verify 86GA reset

i. Open the following air shutoff valves for the diesel generator being inspected. The Unit 3 valves are given in parenthesis.

(1) 0-86-524__ (0-86-574-3__)

(2) 0-86-525__ (0-86-575-3__)

(3) 0-86-526__ (0-86-576-3__)

(4) 0-86-527__ (0-86-577-3__)

(5) 0-86-528__ (0-86-578-3__)

(6) 0-86-504__ (0-86-554-3__)

(7) 0-86-505__ (0-86-555-3__)

(8) 0-86-506__ (0-86-556-3__)

(9) 0-86-507__ (0-86-557-3__)

(10) 0-86-508__ (0-86-558-3__)

(11) 0-86-503__ (0-86-553-3__)

(12) 0-86-523__ (0-86-573-3__)

*Revision

3. Procedure (Continued)

*3.15 Governor and Voltage Control Checks (Continued)

j. Release hold order obtained in the prerequisites. (Do not turn start circuit breakers or logic breaker on until instruction calls for them)

NOTE: Allow 15 minutes to expire between step 3.11.f and the next step.

k. Use governor control switch on engine control cabinet to move governor to lowest setting.

l. Turn start circuit 1 and 2 breakers on

m. Turn protective relay panel breaker on

n. Depress fuel prime pushbutton until pressure reaches 30psi.

o. Push engine start pushbutton (engine should start and level at idle speed: 450rpm)

p. Allow engine to idle for 10 minutes.

NOTE: If any alarms occur other than NOT AUTO, do not continue until permission is obtained from maintenance department.

q. Use governor control switch to increase engine speed until the speed limit is reached - record engine speed (950 - 960rpm)

r. Depress field flashing pushbutton until voltage on generator builds up - record generator voltage and engine speed (900 ± 5rpm)

s. Turn the logic breaker on

t. From the control room, have the ASE lower the speed until speed decrease stops - record engine speed (855 - 870rpm)

u. From the control room, have the ASE raise the speed until speed increase stops - record engine speed (940 - 950rpm)

v. From the control room, have the ASE lower the speed until speed reaches 900rpm

*Revision JbD

3. Procedure (Continued)

*3.15 Governor and Voltage Control Checks (Continued)

w. From the control room, have the ASE lower the voltage until voltage decrease stops and record voltage.

x. From the control room, have the ASE raise the voltage until voltage increase stops and record voltage (4900 ± 50 volts). Do not increase the voltage above 4950 volts.

y. From the control room, have the ASE lower the voltage to approximately 4150 volts

z. Open the logic breaker

aa. Depress engine stop pushbuttons and record engine speed (450 ± 10rpm) when the engine is idling

*3.16 Overspeed Trip Test

a. After the engine has shutdown for at least 15 minutes, use the governor control switch on the engine control cabinet to move the governor to its lowest setting

b. Depress fuel prime pushbutton until pressure reaches 30psi.

c. Push engine start pushbutton (engine should start and level at idle speed: 450rpm).

d. Use the governor control switch to increase the engine speed to 900rpm.

e. Set up a strobe-tachometer to monitor engine speed. Follow engine speed increase as closely as possible in step f. Verify that the strobe is reading 900rpm.

NOTE: The next step must not take longer than 30 seconds.

f. Smoothly push the injector control lever towards the engine until the engine trips due to overspeed. Record speed at trip point. The trip point should be greater than 1000 and less than 1050rpm.

*Revision

3. Procedure (Continued)

*3.16 Overspeed Trip Test (Continued)

g. Verify that overspeed trip alarm comes in

h. Push both engine stop pushbuttons

NOTE: Allow 15 minutes to expire before next step.

i. Return overspeed trip lever to the 9 o'clock position. (It will latch into position.)

j. Reset overspeed trip alarm

*3.17 Return to Operation

a. Return the following breakers to operating condition:

(1) exciter breaker

(2) DC control breaker(125V dist. panel)

(3) protective relay panel breaker

(4) alarm control breaker

(5) DC control breaker

(6) AC control breaker

(7) start circuit 1 breaker

(8) start circuit 2 breaker

(9) logic breaker

*3.18 Acceptance Criteria

a. The acceptance criteria for this instruction is that each section be completed as called for in the instruction.

*3.19 Notify the shift engineer that the diesel generator may now be placed in standby readiness in accordance with OI-82 and operability verified by SI 4.9.A.1.a.

*Revision

DATA COVER SHEET SI 4.9.A.1.d
Diesel Generator Annual Inspection

Electrical
D/G___

Performed By______________________________ Date____________________
Electrician

Were criteria satisfied? ______________Yes ___________No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? _________Yes (explain in remarks)
_________No (explain in remarks)

Verified by Shift Engineer________________, ________________
Date

Reason for test:

___________ Required by schedule

___________ Other (explain) ____

____

____

Results reviewed______________________________ Date____________________
Electrical Engineer

Results Review and Approval

Cognizant Engineer____________________________ Date____________________

Rescheduled

QA Staff ______________________________________ Date____________________

Remarks ____

____

____

DATA SHEET
SI 4.9.A.1.d

DIESEL GENERATOR ANNUAL INSPECTION
ELECTRICAL

D/G __________

NOTE: Step numbers correspond to numbers in the instruction

Step	Initials-Date/Data
3.1 Breakers OFF	
a. exciter	
b. DC control (125V dist. pnl.)	
c. protective relay pnl.	
d. alarm control	
3. AC control	
f. start circuit 1	
g. start circuit 2	
h. DC control (elect. cont. pnl.)	
i. logic breaker (125 dist. pnl.) (Unit 1 and 2 only)	
j. logic breaker (125 dist. pnl.) (Unit 3 only)	
3.2 Alarm Test	
a. alarm breaker ON	
b. DC control breaker ON	
c. Air Pressure 1	
(1) a.c. 1 switch OFF	
(2) drain valve open	
(3) alarm (165 $\pm$ 5psi)	
(4) drain valve closed	
(5) a.c. 1 switch AUTO	
(6) alarm silenced	

Data Sheet SI 4.9.A.1.d (Continued)

Step	Initials-Date/Data
3.2 Alarm Test (Continued)	
d. Air Pressure 2	
(1) a.c. 2 switch OFF	________
(2) drain valve open	________
(3) alarm (165 $\pm$ 5 psi)	________
(4) drain valve closed	________
(5) a.c. 2 switch AUTO	________
(6) alarm silenced	________
(7) valves closed (Unit 3 valve numbers are in parenthesis)	
(a) 504__ (554-3__)	________
(b) 505__ (555-3__)	________
(c) 506__ (556-3__)	________
(d) 507__ (557-3__)	________
(e) 508__ (558-3__)	________
(f) 524__ (574-3__)	________
(g) 525__ (577-3__)	________
(h) 526__ (576-3__)	________
(i) 527__ (577-3__)	________
(j) 528__ (578-3__)	________
(k) 523__ (573-3__)	________
(l) 503__ (553-3__)	________

Data Sheet SI 4.9.A.1.d (Continued)

Step	Initials/Date/Data
3.2 Alarm Test (Continued)	
e. Not Auto	
(1) DC control breaker on	
(2) field breaker closed	
(3) a.c. 1 switch OFF	
(4) alarm	
(5) a.c. 1 switch AUTO	
(6) alarm reset	
(7) a.c. 2 switch OFF	
(8) alarm	
(9) a.c. 2 switch AUTO	
(10) alarm reset	
(11) field breaker off	
(12) alarm	
(13) field breaker on	
(14) alarm reset	
*f. Oil and Water Pressure 1	
*(1) Jumper AJX to AP1	
Second Person Verification	
*(2) 'Oil Pressure' alarm	
*(3) Jumper AK5 to AJ1	
Second Person Verification	
'Raw Water' alarm	
*(4) AJX to AP1 jumper removed	
Second Person Verification	
*(5) AK5 to AJ1 jumper removed	
Second Person Verification	

*Revision JHD

Data Sheet SI 4.9.A.1.d (Continued)

Step	Initials/Date/Data
3.2 Alarm Test (Continued)	
f. Oil and Water Pressure 1 (Continued)	
(6) Alarms reset	______
g. Oil and Water Pressure 2	
(1) Jumper 35A-R4 to 35A-R5	______
Second Person Verification	______
(2) 'Oil Pressure' alarm	______
'Raw Water' alarm	______
(3) 35A-R4 to 35A-R5 jumper removed	______
Second Person Verification	______
(4) Alarms reset	______

*Addendum JHD

Data Sheet SI 4.9.A.1.d (Continued)

Step	Initials-Date/Data
3.2 Alarm Test (Continued)	
h. Circuit Malfunction	
(1) jumper AP13 to AE	
second person verification	
(2) jumper AEA5 to AE	
second person verification	
(3) CIRCUIT MAL alarm	
(4) jumper removed from AP13 to AE	
second person verification	
(5) jumper removed from AEA5 to AE	
second person verification	
(6) alarm reset	
i. No Field	
(1) jumper AP14 to AF	
second person verification	
(2) jumper AFA1 to AFA	
second person verification	
(3) NO FLD alarm	
CIRCUIT MAL alarm	
(4) jumper removed from AP14 to AF	
second person verification	
(5) jumper removed from AFA1 to AF	
second person verification	

Data Sheet SI 4.9.A.1.d (Continued)

Step	Initials-Date/Data
3.2 Alarm Test (Continued)	
j. Fuel Transfer (high level)	
(1) FUEL TRANSFER alarm	______
(2) alarm reset	______
k. Fuel Transfer (low level)	
(1) FUEL TRANSFER alarm	______
(2) alarm reset	______
l. Fuel Pressure (system 1)	
(1) FUEL PRESSURE alarm	______
(2) alarm reset	______
m. Fuel Pressure (system 2)	
(1) FUEL PRESSURE alarm	______
(2) alarm reset	______
n. Lube Oil Level	
(1) LUBE OIL LEVEL alarm	______
(2) alarm reset	______
o. Engine Temperature	
(1) ETS depressed	______
(2) ENGINE HOT alarm	______
(3) ETS normal	______
(4) alarm reset	______
p. Start Failure	
(1) START FAIL alarm	______
(2) alarm reset	______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.2 Alarm Test (Continued)		
q. Crankcase Pressure		
(1) suction applied		________
(2) alarm		________
(3) alarm reset		________
r. Lube Oil Temperature		
(1) alarm		________
(2) alarm reset		________
s. Alarm control breaker off		________
3.3 Timer Tests		
a. SFB1 (1 ± 0.1 seconds)		
(1) relay isolation		
(a) Wire S1N7 removed	____	________
second person verification		________
(b) Wire S1PD removed	____	________
second person verification		________
(c) Wires AP27 and AP26 removed	____	________
second person verification		________
(d) Wires AHB5 and AHB2 removed	____	________
second person verification		________
(2) timing		
(a) - (e) information		
(f) as found time		________ sec.
(g) as left time		________ sec.

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
a. SFB1 (1 ± 0.1 seconds) (Continued)		
(3) return to normal		
(a) S1N7 reterminated	______	______________
second person verification		______________
(b) S1PD reterminated	______	______________
second person verification		______________
(c) AP27 and AP26 reterminated	______	______________
second person verification		______________
(d) AHB5 and AHB2 reterminated	______	______________
second person verification		______________
(4) SFB1 inspected		______________
b. SFB2 (1 ± 0.1 seconds)		
(1) relay isolation		
(a) S2PD removed	______	______________
second person verification		______________
(b) S2N7 removed	______	______________
second person verification		______________
(c) AP27 removed	______	______________
second person verification		______________
(d) AHB4 and AHB5 removed	______	______________
second person verification		______________

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
b. SFB2 (1 ± 0.1 seconds) (Continued)		
(2) timing		
(a) - (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) S2PD reterminated	______	______
second person verification		______
(b) S2N7 reterminated	______	______
second person verification		______
(c) AP27 reterminated	______	______
second person verification		______
(d) AHB4 and AHB5 reterminated	______	______
second person verification		______
(4) SFB2 inspected		______
c. PFD1 (3 ± 0.2 seconds)		
(1) relay isolation		
(a) S1Z removed	______	______
second person verification		______
(b) S1N3 and S1N4 removed	______	______
second person verification		______
(c) S1J1 and S1J removed	______	______
second person verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step		Wires On Terminal	Initials-Date/Data
3.3	Timer Tests (Continued)		
	c. PFD1 (3 ± 0.2 seconds) (Continued)		
	(1) relay isolation (Continued)		
	(d) S1QX1 and S1QX2 removed	______	______________
	second person verification		______________
	(e) AHB3 removed	______	______________
	second person verification		______________
	(f) AP15 and AP16 removed	______	______________
	second person verification		______________
	(g) S1U removed	______	______________
	second person verification		______________
	(h) S1T removed	______	______________
	second person verification		______________
	(2) timing		
	(a) - (e) information		
	(f) as found time		____________ sec.
	(g) as left time		____________ sec.
	(3) return to normal		
	(a) S1Z reterminated	______	______________
	second person verification		______________
	(b) S1N3 and S1N4 reterminated	______	______________
	second person verification		______________
	(c) S1J1 and S1J reterminated	______	______________
	second person verification		______________

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
c. PFD1 (3 ± 0.2 seconds) (Continued)		
(3) return to normal (Continued)		
(d) S1QX1 and S1QX2 reterminated	______	______
second person verification		______
(e) AHB3 reterminated	______	______
second person verification		______
(f) AP15 and AP16 reterminated	______	______
second person verification		______
(g) S1U reterminated	______	______
second person verification		______
(h) S1T reterminated	______	______
second person verification		______
(4) PFD1 inspected		______
d. PFD2 (3 ± 0.2 seconds)		
(1) relay isolation		
(a) S2N3 and S2N4 removed	______	______
second person verification		______
(b) S2Z removed	______	______
second person verification		______
(c) S2QX1 and S2QX2 removed	______	______
second person verification		______
(d) S2J1 and S2J removed	______	______
second person verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
d. PFD2 (3 ± 0.2 seconds) (Continued)		
(1) relay isolation (Continued)		
(e) AP24 and AP25 removed	______	______
Second Person Verification		______
(f) AHB3 and AHB2 removed	______	______
Second Person Verification		______
(g) S2T removed	______	______
Second Person Verification		______
(h) S2U removed	______	______
Second Person Verification		______
(2) timing		
(a) - (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) S2N3 and S2N4 reterminated	______	______
Second Person Verification		______
(b) S2Z reterminated	______	______
Second Person Verification		______
(c) S2QX1 and S2QX2 reterminated	______	______
Second Person Verification		______
(d) S2J1 and S2J reterminated	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
d. PFD2 (3 ± 0.2 seconds) (Continued)		
(3) return to normal (Continued)		
(e) AP24 and AP25 reterminated	______	______
Second Person Verification		______
(f) AHB3 and AHB2 reterminated	______	______
Second Person Verification		______
(g) S2T reterminated	______	______
Second Person Verification		______
(h) S2U reterminated	______	______
Second Person Verification		______
(4) PFD2 inspected		______
e. SFD1 (4 ± 0.4 seconds)		
(1) relay inspection		
(a) S1N2 and S1N3 removed	______	______
Second Person Verification		______
(b) S1Y removed	______	______
Second Person Verification		______
(c) S1K removed	______	______
Second Person Verification		______
(d) S1L removed	______	______
Second Person Verification		______
(e) AHB1 and AHB4 removed	______	______
Second Person Verification		______
(f) AP16 removed	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
e. SFD1 (4 ± 0.4 seconds) (Continued)		
(1) relay inspection (Continued)		
(g) S1V removed	______	______
Second Person Verification		______
(h) S1U removed	______	______
Second Person Verification		______
(2) timing		
(a) - (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) S1N2 and S1N3 reterminated	______	______
Second Person Verification		______
(b) S1Y reterminated	______	______
Second Person Verification		______
(c) S1K reterminated	______	______
Second Person Verification		______
(d) S1L reterminated	______	______
Second Person Verification		______
(e) AHB1 and AHB4 reterminated	______	______
Second Person Verification		______
(f) AP16 reterminated	______	______
Second Person Verification		______
(g) S1V reterminated	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
e. SFD1 (4 ± 0.4 seconds) (Continued)		
(3) return to normal (Continued)		
(h) S1U reterminated	________	________
Second Person Verification		________
(4) SFD1 inspected		________
f. SFD2 (4 ± 0.4 seconds)		
(1) relay isolation		
(a) S2N2 and S2N3 removed	________	________
Second Person Verification		________
(b) S2Y removed	________	________
Second Person Verification		________
(c) S2K removed	________	________
Second Person Verification		________
(d) S2L removed	________	________
Second Person Verification		________
(e) AHB and ABH1 removed	________	________
Second Person Verification		________
(f) AP24 and AP23 removed	________	________
Second Person Verification		________
(g) S2V removed	________	________
Second Person Verification		________
(h) S2U removed	________	________
Second Person Verification		________

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
f. SFD2 (4 ± 0.4 seconds) (Continued)		
(2) timing		
(a) - (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) S2N2 and S2N3 reterminated	______	______
Second Person Verification		______
(b) S2Y reterminated	______	______
Second Person Verification		______
(c) S2K reterminated	______	______
Second Person Verification		______
(d) S2L reterminated	______	______
Second Person Verification		______
(e) AHB and AHB1 reterminated	______	______
Second Person Verification		______
(f) AP24 and AP23 reterminated	______	______
Second Person Verification		______
(g) S2V reterminated	______	______
Second Person Verification		______
(h) S2U reterminated	______	______
Second Person Verification		______
(4) SFD2 inspected		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
g. STL01 (5.5 + 1, -0 Seconds)		
(1) relay isolation		
(a) S1N14 and S1N13 removed	______	______
Second Person Verification		______
(b) S1R removed	______	______
Second Person Verification		______
(c) AS1 and AS removed	______	______
Second Person Verification		______
(d) ASY removed	______	______
Second Person Verification		______
(e) CP19 and CP18 removed	______	______
Second Person Verification		______
(f) CAM2 removed	______	______
Second Person Verification		______
(g) F1XA removed	______	______
Second Person Verification		______
(h) F1B3 and F1B removed	______	______
Second Person Verification		______
(i) S1P5 and S1P2 removed	______	______
Second Person Verification		______
(j) S1Q and S1Q1 removed	______	______
Second Person Verification		______
(k) DGX_ removed	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
g. STL01 (5.5 + 1, -0 Seconds) (Cont.)		
(1) relay isolation (Cont.)		
(l) DGX_1 removed	______	______
Second Person Verification		______
(m) F1C removed	______	______
Second Person Verification		______
(n) F1D removed	______	______
Second Person Verification		______
(2) timing		
(a) - (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) S1N14 and S1N13 reterminated	______	______
Second Person Verification		______
(b) S1R reterminated	______	______
Second Person Verification		______
(c) AS1 and AS reterminated	______	______
Second Person Verification		______
(d) ASY reterminated	______	______
Second Person Verification		______
(e) CP19 and CP18 reterminated	______	______
Second Person Verification		______
(f) CAM 2 reterminated	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
g. STL01 (5.5 + 1, -0 Seconds) (Cont.)		
(3) return to normal (Cont.)		
(g) F1XA reterminated	______	______
Second Person Verification		______
(h) F1B3 and F1B reterminated	______	______
Second Person Verification		______
(i) S1P5 and S1P2 reterminated	______	______
Second Person Verification		______
(j) S1Q and S1Q1 reterminated	______	______
Second Person Verification		______
(k) DGX_ reterminated	______	______
Second Person Verification		______
(l) DGX_1 reterminated	______	______
Second Person Verification		______
(m) F1C reterminated	______	______
Second Person Verification	______	______
(n) F1D reterminated	______	______
Second Person Verification		______
(4) STL01 inspected		______
h. STL02 (5.5 + 1, -0 Seconds)		
(1) relay isolation		______
(a) S2N14 and S2N13 removed	______	______
Second Person Verification		______
(b) S2R removed	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step		Wires On Terminal	Initials-Date/Data
3.3	Timer Tests (Continued)		
	h. STL02 (5.5 + 1, -0 Seconds) (Cont.)		
	(1) relay isolation (Cont.)		
	(c) ASX and ASX1 removed	______	______
	Second Person Verification		______
	(d) ASY removed	______	______
	Second Person Verification		______
	(e) CP15 and CP12 removed	______	______
	Second Person Verification		______
	(f) CAM2 and CAM1 removed	______	______
	Second Person Verification		______
	(g) F2XA removed	______	______
	Second Person Verification		______
	(h) F2B3 and F2B removed	______	______
	Second Person Verification		______
	(i) S2P5 and S2P2 removed	______	______
	Second Person Verification		______
	(j) S2Q and S2Q1 removed	______	______
	Second Person Verification		______
	(k) two DGX__'s removed	______	______
	Second Person Verification		______
	(l) two DGX__'s removed	______	______
	Second Person Verification		______
	(m) F2C removed	______	______
	Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
h. STL02 (5.5 + 1, -0 seconds) (Cont.)		
(1) relay isolation (Cont.)		
(n) F2D removed	________	________
Second Person Verification		________
(2) timing		
(a) thru (e) information		
(f) as found time		________ sec.
(g) as left time		________ sec.
(3) return to normal		
(a) S2N14 and S2N13 reterminated	________	________
Second Person Verification		________
(b) S2R reterminated	________	________
Second Person Verification		________
(c) ASX and ASX1 reterminated	________	________
Second Person Verification		________
(d) ASY reterminated	________	________
Second Person Verification		________
(e) CP15 and CP12 reterminated	________	________
Second Person Verification		________
(f) CAM2 and CAM1 reterminated	________	________
Second Person Verification		________
(g) F2XA reterminated	________	________
Second Person Verification		________

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
h. STL02 (5.5 + 1, -0 Seconds) (Cont.)		
(3) return to normal (Cont.)		
(h) F2B3 and F2B reterminated	________	________________
Second Person Verification		________________
(i) S2P5 and S2P2 reterminated	________	________________
Second Person Verification		________________
(j) S2Q and S2Q1 reterminated	________	________________
Second Person Verification		________________
(k) two DGX_'s reterminated	________	________________
Second Person Verification		________________
(l) two DGX_1's reterminated	________	________________
Second Person Verification		________________
(m) F2C reterminated	________	________________
Second Person Verification		________________
(n) F2D reterminated	________	________________
Second Person Verification		________________
(4) STL02 inspected		________________
i. ESTD (15 ± 1 minute)		
(1) relay isolation		
(a) CN13 and CN14	________	________________
Second Person Verification		________________
(b) CAT1 and CAT removed	________	________________
Second Person Verification		________________

Data Sheet SI 4.9.A.1.d (Continued)

Step				Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)					
	i. ESTD (15 ± 1 minute) (Cont.)				
		(1) relay isolation (Cont.)			
			(c) CAV1 removed	______	______
			Second Person Verification		
			(d) CAX removed	______	______
			Second Person Verification	______	______
		(2) Timing			
			(a) - (e) information		
			(f) as found time		______ sec.
			(g) as left time		______ sec.
		(3) return to normal			
			(a) CN13 and CN14 reterminated	______	______
			Second Person Verification		______
			(b) CAT1 and CAT reterminated	______	______
			Second Person Verification		______
			(c) CAV1 reterminated	______	______
			Second Person Verification		______
			(d) CAX reterminated	______	______
			Second Person Verification		______
		(4) ESTD inspected			______
	j. PFDA1 (0.5 ± 0.1 seconds)				
		(1) relay isolation			
			(a) S1N5 and S1N4 removed	______	______
			Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
j. PFDA1 (0.5 ± 0.1 seconds) (Cont.)		
(1) relay isolation (Cont.)		
(b) S1SX removed	______	______
Second Person Verification		______
(c) F1C removed	______	______
Second Person Verification		______
(d) F1K removed	______	______
Second Person Verification		______
(e) F2K removed	______	______
Second Person Verification		______
(f) F2B2 removed	______	______
Second Person Verification		______
(2) timing		
(a) thru (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) S1N5 and S1N4 reterminated	______	______
Second Person Verification		______
(b) S1SX reterminated	______	______
Second Person Verification		______
(c) F1C reterminated	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
j. PFDA1 (0.5 $\pm$ 0.1 seconds) (Cont.)		
(3) return to normal (Cont.)		
(d) F1K reterminated	_____	_____
Second Person Verification		_____
(e) F2K reterminated	_____	_____
Second Person Verification		_____
(f) F2B2 reterminated	_____	_____
Second Person Verification		_____
(4) PFSA1 inspected		_____
k. PFDA2 (0.5 $\pm$ 0.1 second)		
(1) relay isolation		
(a) S2N5 and S2N4 removed	_____	_____
Second Person Verification		_____
(b) S2SX removed	_____	_____
Second Person Verification		_____
(c) F1K removed	_____	_____
Second Person Verification		_____
(d) F1B2 removed	_____	_____
Second Person Verification		_____
(e) F2C removed	_____	_____
Second Person Verification		_____
(f) F2K removed	_____	_____
Second Person Verification		_____

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
k. PFDA2 (0.5 ± 0.1 second) (Cont.)		
(2) timing		
(a) thru (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) S2N5 and S2N4 reterminated	______	______
Second Person Verification		______
(b) S2SX reterminated	______	______
Second Person Verification		______
(c) F1K reterminated	______	______
Second Person Verification		______
(d) F1B2 reterminated	______	______
Second Person Verification		______
(e) F2C reterminated	______	______
Second Person Verification		______
(f) F2K reterminated	______	______
Second Person Verification		______
(4) PFDA2 inspected		______
l. LWD (2 minutes ± 10 seconds)		
(1) relay isolation		
(a) AN2 and AN4 removed (Unit 1 and 2 only)	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
1. LWD (2 minutes ± 10 seconds) (Cont.)		
(1) relay isolation (Cont.)		
(b) AN2 removed (Unit 3 only)	______	______
Second Person Verification		______
(c) AEX removed	______	______
Second Person Verification		______
(d) AC removed	______	______
Second Person Verification		______
(e) AP1 removed	______	______
Second Person Verification		______
(f) ACA removed	______	______
Second Person Verification		______
(g) AJX removed	______	______
Second Person Verification		______
(2) timing		
(a) thru (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) AN2 and AN4 reterminated (Unit 1 and 2 only)	______	______
Second Person Verification		______
(b) AN2 reterminated (Unit 3 only)	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
~~3.3~~ Timer Tests (Continued)		
1. LWD (2 minutes ± 10 seconds) (Cont.)		
(3) return to normal (Cont.)		
(c) AEX reterminated	______	______
Second Person Verification		
(d) AC reterminated	______	______
Second Person Verification		______
(e) AP1 reterminated	______	______
Second Person Verification		______
(f) ACA reterminated	______	______
Second Person Verification		______
(g) AJX reterminated	______	______
Second Person Verification		______
(4) LWD inspected		______
m. 40T (3 ± 0.3 seconds)		
(1) relay isolation		
(a) CN17 and CN18 removed	______	______
Second Person Verification		______
(b) CAF removed	______	______
Second Person Verification		______
(c) AFA1 and AFA removed	______	______
Second Person Verification		______
(d) AF removed	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
m. 40T (3 ± 0.3 seconds) (Cont.)		
(2) timing		
(a) - (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) CN17 and CN18 reterminated	______	______
Second Person Verification		______
(b) CAF reterminated	______	______
Second Person Verification		______
(c) AFA1 and AFA reterminated	______	______
Second Person Verification		______
(d) AF reterminated	______	______
Second Person Verification		______
(4) 40T inspected		______
n. 52V (3 ± 0.3 seconds)		
(1) relay isolation		
(a) CN19 and CN18 removed	______	______
Second Person Verification		______
(b) CAJ2 and CAJ removed	______	______
Second Person Verification		______
(c) CAE removed	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
n. 52V (3 ± 0.3 seconds) (Cont.)		
(1) relay isolation (Continued)		
(d) CAA1 and CAA3 removed	______	______
Second Person Verification		______
(2) timing		
(a) - (e) information		
(f) as found time		______ sec.
(g) as left time		______ sec.
(3) return to normal		
(a) CN19 and CN18 reterminated	______	______
Second Person Verification		______
(b) CAJ2 and CAJ reterminated	______	______
Second Person Verification		______
(c) CAE reterminated	______	______
Second Person Verification		______
(d) CAA1 and CAA3 reterminated	______	______
Second Person Verification		______
(4) 52V inspected		______
o. ECR (11.5 ± 1 minute)		
(1) relay isolation		
(a) CN13 and CN12 removed	______	______
Second Person Verification		______
(b) CAX and CAX1 removed	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
O. ECR (11.5 ± 1 minute) (Cont.)		
(1) relay isolation (Continued)		
(c) CAV and CAV1 removed	______	______
Second Person Verification		______
(d) AJ removed	______	______
Second Person Verification		______
(e) CAW1 and CAW removed	______	______
Second Person Verification		______
(f) AJX removed	______	______
Second Person Verification		______
(2) timing		______
(a) - (e) information	______	______
(f) as found time		______ min.
(g) as left time		______ min.
(3) return to normal		______
(a) CN13 and CN12 reterminated	______	______
Second Person Verification		______
(b) CAX and CAX1 reterminated	______	______
Second Person Verification		______
(c) CAV and CAV1 reterminated	______	______
Second Person Verification		______
(d) AJ reterminated	______	______
Second Person Verification		______

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
o. ECR (11.5 ± 1 minute) (Cont.)		
(3) return to normal (Continued)		
(e) CAW1 and CAW reterminated	______	______________
Second Person Verification		______________
(f) AJX reterminated	______	______________
Second Person Verification		______________
(4) ECR inspected		______________
p. SCR (30 ± 3 seconds)		
(1) relay isolation		
(a) CN2 removed	______	______________
Second Person Verification		______________
(b) CAW removed	______	______________
Second Person Verification		______________
(c) AEA5 and AEA removed	______	______________
Second Person Verification		______________
(d) AE removed	______	______________
Second Person Verification		______________
(2) timing		
(a) - (e) information		
(f) as found time		______________ sec.
(g) as left time		______________ sec.
(3) return to normal		
(a) CN2 reterminated	______	______________
Second Person Verification		______________

Data Sheet SI 4.9.A.1.d (Continued)

Step	Wires On Terminal	Initials-Date/Data
3.3 Timer Tests (Continued)		
p. SCR (30 ± 3 seconds (Cont.)		
(3) return to normal (Continued)		
(b) CAW reterminated	______	______
Second Person Verification		______
(c) AEA5 and AEA reterminated	______	______
Second Person Verification		______
(d) AE reterminated	______	______
Second Person Verification		______
(4) SCR inspected		______
3.4 Immersion Heater		
a. Contactor inspected		______
b. Proper operation		
(1) Electrical short placed 25E1 to 25E3		______
Second Person Verification		______
(2) Heater contactor energized		______
(3) L1		______ amps
L2		______ amps
L3		______ amps
(4) L1-L2		______ volts
L2-L3		______ volts
L3-L1		______ volts
(5) Electrical short removed 25E1 to 25E3		______
Second Person Verification		______
(6) Power (KW) = (0.00173) ( ) ( )		
Power		______ KW

Data Sheet SI 4.9.A.1.d (Continued)

Step		Initials-Date/Data
3.4	Immersion Heater (Continued)	
	b. Proper operation (Continued)	
	*(7) Power between 12kw and 15kw	____
3.5	Relay Inspection	
	a. breakers off	
	(1) exciter	____
	(2) DC control.	____
	(3) protective pnl.	____
	(4) alarm control	____
	(5) AC control	____
	(6) DC control	____
	(7) logic breaker	____
	b. relays:	
	(1) VSR1	____
	(2) VSR2	____
	(3) ZSR1	____
	(4) ZSR2	____
	(5) FPR	____
	(6) ESR1	____
	(7) ESR2	____
	(8) PFDA1	____
	(9) PFDA2	____
	(10) FSR1	____
	(11) FSR2	____

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Data Sheet SI 4.9.A.1.d (Continued)

Step	Initials-Date/Data
3.5 Relay Inspection (Continued)	
b. relays: (Continued)	
(12) MSR1	
(13) MSR2	
(14) ECR	
(15) ECRA	
(16) ESTD	
(17) 40V	
(18) GS	
(19) LWD	
(20) 40T	
(21) 52V	
(22) FFCO	
(23) ESTR	
(24) SFB1	
(25) SFB2	
(26) OTR	
(27) PFD1	
(28) PFD2	
(29) VSD1	
(30) VSD2	
(31) SFD1	
(32) SFD2	
(33) STL01	
(34) STL02	

Data Sheet SI 4.9.A.1.d (Continued)

Step		Initials-Date/Data
3.5	Relay Inspection (Continued)	
	b. relays: (Continued)	
	(35) STR1	__________
	(36) STR2	__________
	(37) FFC	__________
	(38) SSP1	__________
	(39) SSP2	__________
	(40) SCR	__________
	(41) FTH	__________
	(42) FTL	__________
	(43) FTC1	__________
	(44) FTC2	__________
	(45) CPMC	__________
	(46) OL1	__________
	(47) OL2	__________
	(48) OLCPM	__________
	(49) OL1H	__________
	(50) annunciators	__________
	(51) OMR__1	__________
	(52) OMR__2	__________
	(53) OMR__3	__________
	(54) OMR__4 (Unit 1 and 2 only)	__________
	(55) OMR__5 (Unit 1 and 2 only)	__________
	(56) TR__-1	__________
	(57) TR__-2	__________

Data Sheet SI 4.9.A.1.d (Continued)

Step	Initials-Date/Data
3.5 Relay Inspection (Continued)	
b. relays: (Continued)	
(58) TR__-3	________
(59) TR__-4	________
(60) TR__-5	________
(61) DCPF__-1	________
(62) DCPF__-2	________
(63) SUDR	________
(64) 27/1AX	________
(65) R1__ (Unit 1 and 2 only)	________
(66) ASLR	________
(67) ASLR-X	________
(68) USR__	________
(69) DRR__-1	________
(70) DRR__-2	________
(71) DRR__-3	________
(72) ASR__-1	________
(73) ASR__-2	________
(74) ASR__-3	________
(75) CASR	________
(76) CR__	________
(77) GRR__	________
(78) GLR__	________
(79) VRR__	________
(80) VLR__	________

Data Sheet SI 4.9.A.1.d (Continued)

Step	Initials-Date/Data
3.5 Relay Inspection (Continued)	
b. relays: (Continued)	
(81) OTX	______
(82) 27/1BX (D/G C only)	______
(83) CAR	______
(84) 51VZ	______
(85) 27/3AX (Sd Bd. 3EA only)	______
(86) 27/3BX (Sd Bd. 3EC only)	______
(87) R3__ (Unit 3 only)	______
3.6 Voltage Regulator Inspection	
a. condition satisfactory	______
3.7 Fuse Compartment Inspection	
(a)	
(1) control power transformer fuses	______
(2) PT fuses 1-3	______
(3) PT fuses 4-6	______
3.8 Electrical Control Panel Inspection	
(a) condition satisfactory	______
3.9 Generator Inspection	
a. collector rings and stator dusted	______
b. collector cleaned	______
c. collector satisfactory	______
d. brushes satisfactory	______

Data Sheet SI 4.9.A.1.d (Continued)

Step		Initials/Date/Data
3.10	Protective Relays	
	a. relay operability	
	(1) 51X	________
	(2) 76X	________
	(3) 59X	________
	(4) 32	________
	(5) 51V	________
3.11	Fuel Oil Pump Motor Inspection	________
	a. DC control breaker off	________
	b. Motor brushes inspected	________
	changed	________
	Commutator inspected	________
	Motor interior cleaned	________
3.12	Lube Oil Circulating Pump Inspection	
	a. Proper clearance obtained	________
	b. Motor meggered	________
	Megger ID Number ________	
	Calibration Date ________	
	Bearing changed ________	
	c. Clearance released	________

*NOTE: N/A all blanks if lube oil circulating pump inspection is not required during the year that the annual inspection is being performed.

3.13	Motor Operated Potentiometer	
	a. Lubricated	________
3.14	a. Electrical sections 3.1 through 3.13 complete	________ Electricians
	b. Mechanical portion complete	________ Machinists

*Revision ________

Data Sheet SI 4.9.A.1.d (Continued)

Step		Initials/Date/Data
3.15	Governor and Voltage Control Checks	
	a. DC control breaker (125V dist. pnl) on	______
	b. DC control breaker (elect. cont. pnl) on	______
	c. Alarm control breaker on	______
	d. Excitation (field flashing) breaker (125V dist. pnl) on	______
	e. AC control breaker (elect. cont. pnl) on	______
	f. Stop pushbuttons depressed	______
	g. Field breaker closed	______
	h. 86 GA reset	______
	i. Shutoff valves open	
	(1) 0-86-524____ (0-86-574-3__)	______
	(2) 0-86-525____ (0-86-575-3__)	______
	(3) 0-86-526____ (0-86-576-3__)	______
	(4) 0-86-527____ (0-86-577-3__)	______
	(5) 0-86-528____ (0 86-578-3__)	______

*Addendum

Data Sheet SI 4.9.A.1.d (Continued)

Step		Initital-Date/Data
*3.15	Governor and Voltage Control Checks (Continued)	
	i. Shutoff valves open (Continued)	
	(6) 0-86-504___ (0-86-554-3__)	____________
	(7) 0-86-505___ (0-86-555-3__)	____________
	(8) 0-86-506___ (0-86-556-3__)	____________
	(9) 0-86-507___ (0-86-557-3__)	____________
	(10) 0-86-508___ (0-86-558-3__)	____________
	(11) 0-86-503___ (0-86-553-3__)	____________
	(12) 0-86-523___ (0-86-573-3__)	____________
	j. Hold order released	____________
	k. governor at low setting	____________
	l. start circuit breakers on	____________
	m. protective relay pnl. breaker on	____________
	n. fuel pressure 30 psi	____________
	o. engine start	____________
	p. idle 10 minutes	____________
	q. engine speed (950-960 RPM)	____________rpm
	r. generator voltage engine speed (900 ± 5 RPM)	____________volts ____________rpm
	s. Logic bkr. on	____________
	t. engine speed (855-870 RPM)	____________rpm
	u. engine speed (940-950 RPM)	____________rpm
	v. speed 900 rpm	____________
	w. generator voltage	____________volts
	x. generator voltage (4900 ± 50 volts)	____________volts
	y. voltage 4,150	____________

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Data Sheet SI 4.9.A.1.d (Continued)

Step		Initials-Date/Data
*3.15	Governor and Voltage	
	z. Logic bkr. open	______________
	aa. engine speed (450 ± 10 RPM)	______________rpm
	generator voltage	______________volts
*3.16	Overspeed Trip Test	
	a. governor at lowest setting	______________
	b. fuel pressure 30 psi	______________
	c. Engine starts	______________
	d. engine speed 900 RPM	______________
	e. strobe reading 900	______________
	f. trip speed (1000 ≤ trip pt ≤ 1050)	______________
	g. Alarm comes in	______________
	h. stop pushbuttons depressed	______________
	i. trip lever reset	______________
	j. alarm reset	______________
*3.17	Return to Operation	
	a. breakers on	
	(1) exciter breaker	______________
	(2) DC control breaker (125V dist. pnl)	______________
	(3) protective relay pnl breaker	______________
	(4) alarm control breaker	______________
	(5) DC control breaker (elect. cont. pnl)	______________
	(6) AC control breaker	______________

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Data Sheet SI 4.9.A.1.d (Continued)

Step		Initials-Date/Data
*3.17	Return to Operation (Continued)	
	a. breakers on (Continued)	
	(7) start circuit 1 breaker	
	(8) start circuit 2 breaker	
	(9) Logic breaker	
*3.18	Acceptance Criteria	
	a. Acceptance criteria satisfied	
*3.19	Shift engineer notified	

*3.--

*Revision

SI 4.9.A.1.d
DIESEL GENERATOR ANNUAL INSPECTION
UNITS 1 and 2 or UNIT 3

MECHANICAL

1. Prerequisites

1.1 The shift engineer shall be notified before beginning work on the diesel generator units.

1.2 Hold orders shall be issued to the foreman or supervisor responsible for work activities requiring protection of equipment and personnel.

2. Precautions

2.1 Ear defenders shall be worn by personnel in the engine room when engine is started or running.

2.2 Care shall be exercised to prevent fuel and lubrication oil spillage to minimize fire hazards.

2.3 If oil is spilled and it reaches the floor drain sump, the sump pumps must be shut down to prevent oil from being discharged to the storm sewer system.

3. Procedure

NOTE: Verify results and record data after each step, as appropriate, on data sheet.

CAUTION: When engine is started, verify that all air starters disengage from starter band. If the starters do not disengage, stop the engine and notify mechanical maintenance section.

3.1 Record hour reading from elapsed time indicating meter.

3.2 Change engine lube oil per EMD engine manual, section 8, page 8-7.

3.3 Change engine lube oil strainer per EMD engine manual, section 8, page 8-7.

3. Procedure (Continued)

3.4 Visually and audibly inspect engine hydraulic exhaust valve adjusters. Listen for any unnecessary noise of valve and hydraulic adjuster; also, look for smooth opening and closing of valves without bounce.

3.5 Air intake filter and oil

(1) visually inspect filter and oil

(2) drain water from oil reservoir and record amount drained

(3) check sludge and clean if 1 inch deep or more

3.6 Remove and clean crankcase ejector assembly oil separator per EMD engine manual, section 8, pages 8 thru 10.

3.7 Perform MMI-30, Diesel Air Starting System Piping, Valves, Accumulators, Comperssors and Air Motors (Inspection, Meintenance, and Repairs)

3.8 Verify that all air starters have disengaged from the starter band. See "Caution" at the beginning of this procedure.

*3.9 Change oil in the governor actuator. Verify oil level is normal. The oil must be visible in the oil level sight glass.

3.10 Notify shift engineer upon completion of this instruction.

3.11 Verify by signature and date on Data Cover Sheet that the engine was inspected in accordance with this instruction.

*Revision

APPENDIX A

DATA COVER SHEET SI 4.9.A.1.d

Diesel Generator Annual Inspection
Mechanical

UNIT ____

D/G ____

Performed By ______________________ Date ______________
Machinist

Were cirteria satisfied? ______Yes ______No

If no, notify shift engineer.

If no, was a Limiting Condition for Operation violated? ______Yes (explain in remarks)
______No (explain in remarks)

Verified by Shift Engineer ____________________, ____________
Date

Reason for test:

_____ Maintenance complete on ______________

_____ Another system (____________________) inoperable

_____ Required by schedule

_____ Plant condition (explain) ______________________________

_____ Other (explain) ______________________________

Results reviewed ______________________ Date ____________
Mechanical Engineer

Results Review and Approval

Cognizant Engineer ______________________ Date ____________

Rescheduled

QA Staff ______________________ Date ____________

Remarks ____

____

____

DATA SHEET
SI 4.9.A.1.d

DIESEL GENERATOR ANNUAL INSPECTION
UNITS 1 AND 2 OR UNIT 3

MECHANICAL

UNIT ________

D/G ________

NOTE: Step numbers correspond to numbers in the instruction.

Step			Initials/Date
3.1	Elapsed time reading		________ hr.
3.2	Lube oil changed		________
3.3	Strainer changed		________
3.4	Cylinder No.	Check with (✓) if hydraulic adjusters are satisfactory	
	1	____ ____ ____ ____	________
	2	____ ____ ____ ____	________
	3	____ ____ ____ ____	________
	4	____ ____ ____ ____	________
	5	____ ____ ____ ____	________
	6	____ ____ ____ ____	________
	7	____ ____ ____ ____	________
	8	____ ____ ____ ____	________
	9	____ ____ ____ ____	________
	10	____ ____ ____ ____	________
	11	____ ____ ____ ____	________
	12	____ ____ ____ ____	________
	13	____ ____ ____ ____	________
	14	____ ____ ____ ____	________

Data Sheet SI 4.9.A.1.d (Continued)

Step			
3.4	(Continued)		
	Cylinder No.	Check with (✓) if hydraulic adjusters are satisfactory	Initials/Date
	15	______ ______ ______ ______	______
	16	______ ______ ______ ______	______
	17	______ ______ ______ ______	______
	18	______ ______ ______ ______	______
	19	______ ______ ______ ______	______
	20	______ ______ ______ ______	______
3.5	Air intake filter and oil		
	(1) satisfactory visually		______
	(2) water drained		______
	amount		______
	(3) sludge checked		______
	Was it cleaned?		______
3.6	Crankcase ejector oil separator cleaned		______
3.7	MMI-30 was performed		______
3.8	All air starters disengaged from starter band after engine started.		______
*3.9	Oil changed, check to see that governor actuator oil is visible in the sight glass.		______

REMARKS: ____

____

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*Revision