

July 9, 2015

AEP-NRC-2015-60
10 CFR 50.90

Docket Nos. 50-315
50-316

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Donald C. Cook Nuclear Plant Units 1 and 2
Response to a Request for Additional Information Regarding the License Amendment
Request to Revise Technical Specification Section 3.8.1, "AC Sources – Operating,"
Surveillance Requirements 3.8.1.10, 3.8.1.11, and 3.8.1.15

References:

1. Letter from J. P. Gebbie, Indiana Michigan Power Company (I&M), to U. S. Nuclear Regulatory Commission (NRC), "Donald C. Cook Nuclear Plant Unit 1 and Unit 2 Docket Nos. 50-315 and 50-316, License Amendment Request Regarding Technical Specification Section 3.8.1, "AC Sources – Operating," Surveillance Requirements 3.8.1.10, 3.8.1.11, and 3.8.1.15," AEP-NRC-2014-70, dated December 17, 2014, Agencywide Documents Access and Management System (ADAMS) Accession No. ML14356A022.
2. Letter from A. W. Dietrich, NRC, to L. J. Weber, I&M, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Request for Additional Information Regarding License Amendment Request to Revise Technical Specification 3.8.1 (TAC Nos. MF5436 and MF5437)," dated June 15, 2015, ADAMS Accession No. ML15163A167.

This letter provides Indiana Michigan Power Company's (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2, response to a Request for Additional Information (RAI) by the U. S. Nuclear Regulatory Commission (NRC) regarding a License Amendment Request to modify the notes to Technical Specification (TS) 3.8.1, "AC Sources – Operating."

By Reference 1, I&M submitted a request to amend the TS to Facility Operating Licenses DPR-58 and DPR-74. I&M proposes to change TS 3.8.1 to allow surveillance testing of the onsite standby emergency diesel generators during modes in which it is currently restricted. By Reference 2, the NRC transmitted RAIs regarding the proposed emergency amendment. This letter provides I&M's response to Reference 2.

A001
LRR

Enclosure 1 to this letter provides an affirmation statement pertaining to the information contained herein. Enclosure 2 provides I&M's response to the NRC's RAI contained in Reference 2. Enclosure 3 provides copies of the CNP site-specific records of bus voltage data that was monitored during the last two performances of SR 3.8.1.10 and SR 3.8.1.11, respectively, in Modes 5 and 6.

Copies of this letter and its enclosures are being transmitted to the Michigan Public Service Commission and Michigan Department of Environmental Quality, in accordance with the requirements of 10 CFR 50.91.

There are no new regulatory commitments made in this letter. Should you have any questions, please contact Mr. Michael K. Scarpello, Regulatory Affairs Manager, at (269) 466-2649.

Sincerely,



Joel P. Gebbie
Site Vice President

JMT/ams

Enclosures:

1. Affirmation
2. Response to a Request for Additional Information Regarding the License Amendment Request to Revise Technical Specification Section 3.8.1, "AC Sources – Operating," Surveillance Requirements 3.8.1.10, 3.8.1.11, and 3.8.1.15
3. Previous Cook Nuclear Plant Diesel Generator Load Rejection Testing Results, 1(2)-OHP-4030-132-217A(B), Attachment 9

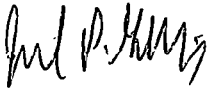
c: A. W. Dietrich, NRC Washington, D.C.
J. T. King – MPSC
MDEQ – RMD/RPS
NRC Resident Inspector
C. D. Pederson, NRC Region III
A. J. Williamson, AEP Ft. Wayne, w/o enclosures

Enclosure 1 to AEP-NRC-2015-60

AFFIRMATION

I, Joel P. Gebbie, being duly sworn, state that I am Site Vice President of Indiana Michigan Power (I&M), that I am authorized to sign and file this request with the U. S. Nuclear Regulatory Commission on behalf of I&M, and that the statements made and the matters set forth herein pertaining to I&M are true and correct to the best of my knowledge, information, and belief.

Indiana Michigan Power



Joel P. Gebbie
Site Vice President

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 9 DAY OF July, 2015


Notary Public

My Commission Expires 04-04-2018

DANIELLE BURGOYNE
Notary Public, State of Michigan
County of Berrien
My Commission Expires 04-04-2018
Acting in the County of Berrien

Enclosure 2 to AEP-NRC-2015-60

Response to a Request for Additional Information Regarding the License Amendment Request to Revise Technical Specification Section 3.8.1, "AC Sources – Operating," Surveillance Requirements 3.8.1.10, 3.8.1.11, and 3.8.1.15

By letter dated December 17, 2014 (Agencywide Documents Access Management System Accession No. ML14356A022), Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2, submitted a license amendment request (LAR) to revise Facility Operating Licenses DPR-58 and DPR-74 for CNP, Unit 1 and Unit 2. The proposed amendments would revise the Technical Specifications (TS) 3.8.1, "AC Sources – Operating," to allow testing of the onsite standby emergency diesel generators (EDGs) during modes in which it is currently restricted. Specifically, the proposed changes would remove the mode restrictions in the notes of the Surveillance Requirements (SR) 3.8.1.10 (EDG single largest load rejection test), 3.8.1.11 (EDG full load rejection test), and 3.8.1.15 (EDG endurance run).

The U.S. Nuclear Regulatory Commission (NRC) Electrical Engineering Branch (EEEB) has determined that the additional information below is needed to complete the review. By letter dated June 15, 2015 (ML15163A167), the NRC transmitted a request for additional information (RAI) regarding the December 17, 2014 LAR. This enclosure provides I&M's response to the RAI.

EEEB-RAI-1

In Sections 4.1.1.2 and 4.2.1.2 of the LAR, the licensee stated that the concern during the performance of the diesel generator (DG) single largest load rejection test (Surveillance Requirement (SR) 3.8.1.10) and the DG full load rejection test (SR 3.8.1.11) in Modes 1 or 2 is that suddenly disconnecting the DG from the associated bus could cause a voltage fluctuation on that bus that could potentially perturb the onsite alternating current (AC) electrical system. The licensee also stated that, based on industry experience, performing these tests in any modes of operation would not cause a significant perturbation that would adversely affect the onsite AC electrical system.

- a. Please provide a copy of the CNP site-specific records of bus voltage data that was monitored during the last two performances of SR 3.8.1.10 and SR 3.8.1.11, respectively, in Modes 5 and 6.*
- b. Please provide a copy of the summary of computer simulation of the above load rejection tests in Modes 1 and 2 to confirm that these SRs would not adversely affect the plant onsite AC electrical system during normal plant operation.*

Response to EEEB-RAI-1a

Enclosure 3 to this letter contains a copy of the CNP records of the 3500/600 kilowatt Load Rejection Testing procedures that have bus voltage data that was monitored during the last two performances of SR 3.8.1.10 and SR 3.8.1.11, respectively, in Modes 5 and 6. These SRs are performed using an attachment to the CNP Diesel Generator Load Sequencing & Engineered Safety Feature (ESF) Testing procedures. In Section 4.2.10 of procedures 1-OHP-4030-132-217B, 2-OHP-4030-232-217A, and 2-OHP-4030-232-217B, TS SR 3.8.1.10 requirements are verified to be satisfied. For procedure 1-OHP-4030-132-217A that verification is done in Section 4.2.9. The recorded data in the completed procedures in Enclosure 3 of this letter meet all CNP criteria which is more conservative than the TS SR for SR 3.8.1.10.

TS SR 3.8.1.11 requirements are verified to be satisfied in Sections 4.1.1 and 4.2.1 for all four of the above surveillance procedures. The recorded data in the completed procedures, in Enclosure 3 of this letter meet all TS SR for SR 3.8.1.11.

Response to EEEB-RAI-1b

A load flow simulation was performed using the latest version (Version 12.6.5) of the ETAP software which is commonly used in the industry for power system analysis. The model was based on as-built configuration of the CNP electrical system. For this simulation, this type of transient will appear as a load addition to the auxiliary transformers which are rated over 20 megavolt amps (MVA). Given their relative sizes, the 3.5 megawatt (MW) load addition is less than 20 percent (%) of the transformer rating and expected to be a routine loading transient. A transient from addition of a 3.5 MW load at 85% power factor is less severe than the transient associated with starting a large non-safety motor, e.g. circulating water pump that has over 10 MVA reactive load. The load flow analysis shows that when the 4 kilovolt (kV) buses are energized from the main generator via the Unit Auxiliary Transformers (UATs), the voltage reduction on the bus is expected to be approximately 3%. This assumes no reactive power support from the main generator once the EDG is separated from the bus, which is conservative. The normal operating bus voltage on the 4kV buses is maintained at approximately 100%; therefore, a reduction of 3% in bus voltage will not have any adverse impact on the operating loads or challenge any protective relaying. If the 4kV buses were energized from offsite power via the Reserve Auxiliary Transformers (RATs), the voltage reduction on the bus is only 1.7%. This assumes no Load Tap Changer support from the RATs.

The above scenarios were also performed in the CNP control room simulator. The observed voltage transient on the 4kV buses fed from the UATs was negligible due to compensation from the main generator voltage regulator response. The voltage transient when connected to the RATs was approximately 1%. These results are consistent with the results of the ETAP model simulation.

Based on the simulated model, the worst case transient from full load reject on the bus voltage is expected to be less than 3%, which is acceptable since the buses are normally operated at 100% rated voltage and the connected motors are rated to function down to 90% voltage level.

EEEEB-RAI-2

In Sections 4.1.1.3, 4.2.1.3, and 4.3.1.2 of the LAR, regarding non-emergency trip features in effect to protect the DG during the performance of SRs 3.8.1.10, 3.8.1.11, and 3.8.1.15, the licensee stated, in part, that:

If an emergency (ESF [engineered safeguard features] and/or LOOP [loss of offsite power]) demand occurs with these non-emergency trips in effect, the affected DG will automatically revert to the emergency mode and bypass these trips. No operator action is required. Upon detection of under voltage on the safety-related 4160v [Volt] bus, load shedding for all vital loads and non-permanently connected loads from the 4160v bus would occur followed by re-sequencing of the vital loads back onto the affected 4160v bus."

- a. *Please discuss all electrical protective devices provided for the DG.*
- b. *Please discuss whether the DG will be overloaded while operating in parallel with an offsite source if a LOOP occurs during performance of the above SRs in Modes 1 or 2. Discuss the DG overload protection during this scenario.*
- c. *Discuss the sequencing of vital loads for each of these events: (a) LOOP, (b) loss-of-coolant accident (LOCA), and (c) LOOP concurrent with LOCA, if they occur while the DG is operating in parallel with the offsite power during performance of the above SRs in Modes 1 or 2.*

Response to EEEB-RAI-2a

The following electrical protective devices are provided for the EDG:

- Generator Overcurrent
- Generator Differential
- Generator Neutral Overcurrent

When the EDG operates in response to an emergency automatic fast start signal, the only trip signals which are effective are:

- Electronic Overspeed
- Generator Differential
- Emergency Trip Pushbutton

Response to EEEB-RAI-2b

During a non-emergency condition, if offsite power supplying the auxiliary load is lost while the EDG was paralleled, the connected load on the 4kV balance of plant (BOP) bus may result in the EDG overloading. The overloading duration however will be limited to the analyzed capability of the generator. Once the setpoint is reached, the overcurrent relay will trip the EDG output circuit breaker. The overcurrent relay will actuate the EDG lockout relay which will require manual reset at the control room panel. This lockout; however, is the same response that would also occur for existing surveillances performed every month when the EDG is paralleled to the safety buses. This is a recognized condition; therefore, the EDG is declared

inoperable during surveillance testing. Dedicated operators are at the EDG control panel during surveillance testing if the EDG were to lockout due to overloading from a loss of offsite power (LOOP) event and required resetting of the relay.

The following sequence of events occur during a LOOP scenario:

- Once the EDG trips, the undervoltage relays would sense the loss of voltage and initiate a loss of power (LOP) signal. The LOP signal is generated by the loss of voltage (LOV) relays on the 4kV safety buses, when the voltage on a bus is less than approximately 78% nominal voltage for a duration of two seconds. Each 4kV safety bus is equipped with a set of three undervoltage relays configured in a 2/3 logic. The function of these relays is to generate the LOOP signal which actuates a series of auxiliary relays (master load shedding relays) that initiate load shedding.
- The offsite power supply breakers would trip open in less than three cycles.
- Load shedding of the Class 1E 4.16 kV ESF bus would occur. The 4kV distribution system automatically sheds all 4kV motor and 600V block loads. Each 4kV safety bus is equipped with a set of three undervoltage relays configured in a 2/3 logic. The function of these relays is to generate the LOOP signal upon recognition of the loss of voltage on the safety bus, as defined above. The LOOP signal actuates a series of auxiliary relays (master load shedding relays) that initiate load shedding. The total response time from initiation of LOOP signal to the opening of load breakers is less than 0.5 seconds.
- The EDG would restart in the emergency mode after the lockout relay is manually reset.
- The EDG output breaker would re-close onto the Class 1E 4.16 ESF kV bus when rated voltage/frequency are reached.
- Required loads would automatically re-sequence onto the Class 1E 4.16 ESF kV bus.

Response to EEEB-RAI-2c

LOOP Sequence and the EDG in parallel

The response of the EDG will be the same as discussed above. The EDG will lockout on overcurrent and will require a manual reset. As previously stated, this lockout; however, is the same response that would occur for existing surveillances performed monthly when the EDG is paralleled to the safety buses. The EDG will restart after the lockout is reset manually. When the output breaker closes, the vital pumps are loaded automatically with sequence timers as follows:

- Component Cooling Pumps
- Essential Service Water Pumps
- Motor driven Auxiliary Feed Water Pumps
- Non-Essential Service Water (NESW) Pumps

Loss of Coolant Accident (LOCA) sequence without LOOP and the EDG in parallel

When the EDG is in test mode, the safety injection (SI) signal will automatically trip the 4kV Output Breaker. This will separate the EDG from the safety bus and keep it operating in a standby mode. Following a reactor trip, during a LOCA event, the main generator trip is delayed for 30 seconds and then the normal source breakers (from the UATs) to the plant non-safety related 4kV buses are tripped and the reserve feed source breakers (from the RATs) are closed. The engineered safety system (ESS) loads will be powered from the plant safety related buses via the RATs and the EDG will remain operating in a standby mode. The following loads will be sequenced on if they were not already running.

- Centrifugal Charging Pumps
- Safety Injection Pumps
- Residual Heat Removal Pumps
- Component Cooling Pumps
- Essential Service Water Pumps
- Motor driven Auxiliary Feed Water Pumps
- Containment Spray Pumps
- Non-Essential Service Water (NESW) Pumps

* Containment Spray Pumps start on a Phase B isolation signal only and the NESW Pumps are shed.

LOOP with LOCA and the EDG in parallel

When the EDG is in test mode, the SI or load shed signal will automatically trip the 4kV Output Breaker during EDG test mode (these signals are blocked after two seconds, and therefore SI signal is prevented from reopening the breaker if a load shed occurs first, trips the breaker, then the breaker closes to load the EDG and a SI signal is initiated some time later). In a LOOP event prior to LOCA with EDG paralleled, loss of voltage will not actuate since the buses remain energized by the EDG. Following a reactor trip, the main generator trip is delayed for 30 seconds and then the normal source (from the UATs) breakers to the plant non-safety related 4kV buses are tripped and the reserve feed source breakers (from the RATs) are closed. Since there is no offsite power available, all the loads connected to the 4kV BOP and safety buses will be carried by the EDG. The EDG size (3.5MW) is much smaller than the connected load of almost 15MW, therefore, EDG will be extremely overloaded and tripped by the overcurrent relays and lockout if LOCA signal was not present. If LOCA occurs prior to LOOP while EDG is in test, the SI signal also trips the EDG main output breaker, which will keep the EDG in standby. If there is no offsite power available, the standing LOOP/LOCA signals automatically load shed all 4kV motors (ESS and BOP) and 600V block loads. The safety loads will be sequenced on to the EDG. In summary, depending upon the timing of the LOOP, with respect to LOCA, the EDG may remain operating in standby and accept LOCA loads after the safety bus is separated from the offsite source or may lockout from overload due to BOP connected load and require manual relay reset to restart the EDG. The ESS load sequence is the same as that for LOCA without LOOP, as follows:

- Centrifugal Charging Pumps
- Safety Injection Pumps
- Residual Heat Removal Pumps
- Component Cooling Pumps
- Essential Service Water Pumps
- Motor driven Auxiliary Feed Water Pumps
- Containment Spray Pumps
- Non-Essential Service Water Pumps

* Containment Spray Pumps start on a Phase B isolation signal only and the NESW Pumps are shed

EEEEB-RAI-3

Please provide an analysis of the scenario(s) if a fault occurs on any bus upstream of the DG-connected bus while the DG is operating in parallel with an offsite source with the DG bus fed from Unit Auxiliary Transformer or Reserve Auxiliary Transformer in Modes 1 or 2. Also, discuss the DG protection during these scenarios, and clarify whether the DG can lockout on overcurrent.

Response to EEEB-RAI-3

With the EDG operating in parallel with the offsite source and the EDG bus fed from UAT or RAT in Mode 1 or 2, the maximum fault at the 4kV buses is less than 42 kiloampere (kA). The maximum fault current from the EDG is 4.1kA. In non-emergency condition, the following relays remain active in the circuit.

- Generator Overcurrent
- Generator Differential
- Generator Neutral Overcurrent

For a fault at the upstream 4.16kV RCP bus, there may be a relay race between the overcurrent relays protecting the EDG and overcurrent relays protecting the main source (either UAT or the RAT). The overcurrent relays will isolate the fault by tripping the main feed breakers to the RCP bus and EDG output breaker. Regardless of which source's overcurrent relay actuates first, the fault will remain energized until both sources are disconnected by their overcurrent protection. The overcurrent relay on the EDG will also lockout the EDG and require manual reset as stated above. Once the 4.16kV buses are deenergized, the LOV relays will initiate the normal load shed and EDG restart. The faulted RCP bus will be isolated from the safety buses by the load shed circuit response similar to the LOOP event identified above. Following a manual reset, of the lockout relay, the safety bus will be automatically reloaded.

The EDG overcurrent relays are set to pick up at 960 Amps in 1.5 seconds. The EDG overload rating is estimated to be 58 minutes at 960A and therefore not a concern.

EEEEB-RAI-4

Please provide a summary of the impact of an increase in short circuit current on the switchgear ratings and on the protection settings due to the proposed DG operating in parallel with an offsite source during Modes 1 or 2, in order to perform SRs 3.8.10, 3.8.1.11, and 3.8.1.15.

Response to EEEB-RAI-4

In the NRC letter dated June 15, 2015 (ML15163A167), EEEB-RAI-4 was written as above. Specifically, the SRs listed in EEEB-RAI-4 are "3.8.10, 3.8.1.11, and 3.8.1.15." The three SRs listed in both the original LAR (ML14356A022) as well as other parts of the RAI are "3.8.1.10, 3.8.1.11, and 3.8.1.15." I&M's response to EEEB-RAI-4 will address these three SRs.

The maximum 3 phase fault contribution from the EDG is 4.1kA.

The maximum fault at the T Bus is less than 42kA including the EDG contribution.

The symmetrical interrupting rating of the 4kV switchgear and breakers is 46.9kA adjusted for the 4.16kV rating. The maximum fault current, 42kA calculated with the EDG in parallel does not exceed the fault rating of switchgear and breakers. The fault currents are conservatively estimated based on the low circuit impedances and maximum fault contribution from the system and the motors connected to the bus.

The EDG overcurrent relays (GE Type IAC) have fault thermal rating of over 60kA for 1 second.

The EDG overload relays are set to coordinate with the instantaneous phase over current relays on the 4kV motors to prevent false tripping.

Enclosure 3 to AEP-NRC-2015-60

Previous Cook Nuclear Plant Diesel Generator Load Rejection Testing Results:

**1-OHP-4030-132-217A(B), Attachment 9
2-OHP-4030-232-217A(B), Attachment 9**

and

**1-OHP-4030-132-027A(B), Data Sheet 3
2-OHP-4030-232-027A(B), Data Sheet 3**

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DG1AB Load Sequencing & ESF Testing			
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1 PURPOSE AND SCOPE

- 1.1 This attachment provides instructions to test DG1AB Emergency Diesel Generator response to full (3500 kW) and/or 600 kW load rejection (relay 1-5X-AB actuation).

2 PREREQUISITES

INIT

- 2.1 The working copy of this procedure is the current revision. 2
- 2.2 A pre-test briefing has been conducted with the Shift Manager (SM), Unit Supervisor (US), or WCC-SRO in accordance with PMP-4010-JOB-001, Pre-Job Briefs and Post-Job Reviews. 2
- 2.3 PMP-4030-EXE-001, Conduct of Surveillance Testing, Section 3.2, General Expectations for Test Prerequisite Activity, has been reviewed. 2
- 2.4 DG1AB Emergency Diesel Generator is in service. 2
- 2.5 DG1AB Emergency Diesel Generator is not loaded to the test bank. 2
- 2.6 Recorder(s) installed per Attachment 13. 2

3 PRECAUTIONS AND LIMITATIONS

- 3.1 None.

OPERATIONS DEPARTMENT
CONTROLLED DOCUMENT

OCT 07 2014

WORKING COPY ONLY

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NOTE: References: OP-1-98034, OP-1-98043, OP-1-98047, OP-1-98045, OP-1-98111, OP-1-98222 & OP-1-98285.

4 DETAILS

INIT

NOTE: Step 4.1 tests the Emergency Diesel for the response to a full load rejection. Step 4.2 tests the Emergency Diesel for the response to a 600 kW load rejection.

Steps 4.1 or 4.2 may be performed in any order.

Annunciator #119 Drop 53, DG1AB TRIPS DISABLED, will actuate when relays are actuated during the load rejection(s).

4.1 IF performing full load rejection, THEN:

NOTE: Steps 4.1.1a through 4.1.1d may be repeated as necessary to achieve desired results.

4.1.1 Verify DG1AB loaded to support full load rejection testing:

- a. Verify DG1AB loaded to ≥ 3150 kW and ≤ 3500 kW. 23

NOTE: One of the following steps (4.1.1b or 4.1.1c) is performed. It is preferred to raise EDG load to 3400 kW and use Figure 3 to verify the power factor is in the correct range.

If load is raised to another value in the ≥ 3150 kW and ≤ 3500 kW range, a manual calculation must be used to determine power factor.

- b. IF loading the EDG to 3400 kW AND using Figure 3 to verify the power factor, THEN:

1. Raise the DG1AB load to 3400 kW indicated. 27

DG1AB Load: 3400 kW. 23

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NOTE: In adjusting voltage to perform the EDG run at less than or equal to a 0.86 power factor, the current on all three phases should be within 80 amps of each other.

Figure 3 can be utilized at an EDG load of 3400 kW ONLY. [Ref. 8.2.1g]

2. Establish power factor: (SR 3.8.1.11)

- a) Calculate the average of the three phases voltage:

Phase 1 120 Volts

Phase 2 120 Volts

Phase 3 119 Volts

Average Voltage 119.67 Volts

23

- b) Adjust the EDG Auto Voltage Regulator to maintain diesel output within the operating region as indicated on Figure 3, EDG Power Factor at 3400 kW.

23

-OR-

- c. IF loading the EDG to a value other than 3400 kW, THEN:

1. Raise the DG1AB load ≥ 3150 kW and ≤ 3500 kW indicated.

DG1AB Load: _____ kW.

2. Perform Data Sheet 3, Calculating Power Factor (PF), of 1-OHP-4030-132-027AB, AB Diesel Generator Operability Test (Train B), to establish the power factor. (SR 3.8.1.11)

N/A 10-8-14
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↓

- d. Verify power factor less than or equal to .86.

23

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(3400)(16.5)
(119.67)(570)

e. Record the following information:

1. DG1AB load: 3400 kW OS
2. DG1AB Power Factor: 0.82 (.8 to .86) OS

f. Verify DG1AB output breakers - CLOSED:

1. T11A11, Emer Incoming Feed from Diesel Generator IAB (DG1AB Out Bkr to Bus T11A) OS
2. T11B4, Emer Incoming Feed from Diesel Generator IAB (DG1AB Out Bkr to Bus T11B) OS

4.1.2 Verify that the proper precautions have been taken to prevent damage to the following equipment when actuating relay 1-5X6-T11A (affected equipment with the post test positions listed below or action to be taken):

- a. Verify 1-T11A1, South Safety Injection Pump 1-PP-26S - PTLO. OS
- b. IF 1-11A4, South Plant Lightning Transformer 1-TR-LTC-9S, is closed, **THEN** open 1-SA-TS6-7, Defeats Trip of South Plant Lighting Xfmr Supply Breaker 1-11A4 During Load Shed/Conservation. mw
IV

NOTE:

A load rejection ≥ 3150 kW and ≤ 3500 kW will be initiated by manual actions in the next several steps.

4.1.3 Verify this step number is documented on Data Sheet 9, Recorder Data File Log, for the recorder(s) used. mw

4.1.4 Start the recorder(s) to measure maximum voltage. IV

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- 4.1.5 Manually actuate relay 1-5X6-T11A, 4KV Bus T11A Master Load Shedding Relay #6, for approximately 2 seconds at Panel 1-SR-1 (Ref. PS-1-92053).

mm
EPDM
CV

2335

- 4.1.6 Check the DG1AB output breakers opened to initiate the load rejection. [CMS 7844]

- a. T11A11, Emer Incoming Feed from Diesel Generator 1AB (DG1AB Out Bkr to Bus T11A) OPEN
- b. T11B4, Emer Incoming Feed from Diesel Generator 1AB (DG1AB Out Bkr to Bus T11B) OPEN

mm
mm

- 4.1.7 DG1AB continued running (e.g., did not trip).

Circle One: YES NO

mm

- 4.1.8 Check Buses T11A and T11B remain energized.

mm

- 4.1.9 Stop the recorder(s).

mm

- 4.1.10 Perform the following (Acceptance Criteria, Step 5.8, includes test equipment inaccuracy of ± 55 Volts):

- a. Record the maximum voltage indicated on recorder.

5079 Volts *mm*

- b. Check maintained voltage is ≤ 5295 V.

mm

- 4.1.11 IF desired, THEN perform Attachment 22, DG1AB Disabled Trip Testing.

mm 10-7-14
wh 10-7-14


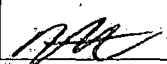
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NOTE:

The SI/Blackout interlock is sealed in until the Emergency Diesel Generator is stopped or reset by performing the following step. The SI/Blackout interlock seals in the Trips Disable circuit.

4.1.12 **IF** required for additional testing **THEN**:

- a. Restore SI/Blackout interlock by momentary lead lifting, as follows:


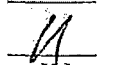
Tech 1 - Locate lead 1 on relay 1-1X-DGAB at Rear Instrument/Relay Rack 1-SR-2.		
Tech 2 - Verify lead 1 on relay 1-1X-DGAB at Rear Instrument/Relay Rack 1-SR-2 is identified.		
Tech 1 - Momentary lift lead 1 on relay 1-1X-DGAB.		
Relay 1-1X-DGAB at Rear Instrument/Relay Rack 1-SR-2. (Ref. PS-1-92053)	Tech 2 Initials	Tech 1 Initials
Momentary lift lead 1 on relay 1-1X-DGAB.		

- b. Check the following:

- Relay 1-1X-DGAB has de-energized
- IF** available, **THEN** check Annunciator #119 Drop 53, DG1AB TRIPS DISABLED, has cleared

4.1.13 Restore the following equipment that could be affected when actuating relay 1-5X6-T11A:

- a. **IF** opened, **THEN** close 1-SA-TS6-7, Defeats Trip of South Plant Lighting Xfmr Supply Breaker 1-11A4 During Load Shed/Conservation.



IV

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DG1AB Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 184 - 194	

4.2 IF performing a 600 KW load rejection, THEN:

NOTE:

Steps 4.2.1a through 4.2.1c may be repeated as necessary to achieve desired results. DG1AB load should be as close to 600 kW as reasonably achievable.

4.2.1 Verify DG1AB loaded to support 600 kW load rejection testing:

- Verify AB EDG loaded to ≥ 600 kW – ≤ 750 kW. mw
- Perform Data Sheet 3, Calculating Power Factor (PF), of 1-OHP-4030-132-027AB, AB Diesel Generator Operability Test (Train B), to establish the power factor. (SR 3.8.1.11) mw
- Verify power factor less than or equal to .86. mw
- Record the following information:
 - DG1AB load: 700 kW mw
 - DG1AB power factor: 0.85 mw
- Verify DG1AB output breakers – CLOSED:
 - T11A11, Emer Incoming Feed from Diesel Generator 1AB (DG1AB Out Bkr to Bus T11A) mw
 - T11B4, Emer Incoming Feed from Diesel Generator 1AB (DG1AB Out Bkr to Bus T11B) mw

4.2.2 Verify that the proper precautions have been taken to prevent damage to the following equipment when actuating relay 1-5X5-T11B (affected equipment with the post test positions listed below or action to be taken):

- IF 1-11BD, 600V Bus 11B to 600V Bus 11D Tie, is closed, THEN open 1-SA-TS8-1, Defeats Trip of 1-11BD During Load Shed from Bus 1-T11B.

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12-7-14
↓
IV

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NOTE:

A load rejection ≥ 600 kW will be initiated by manual actions in the next several steps.

4.2.3 Verify this step number is documented on Data Sheet 9, Recorder Data File Log, for the recorder(s) used.

mw

4.2.4 Start the recorder(s) to measure maximum voltage.

mw

4.2.5 Manually actuate relay 1-5X5-T11B, 4KV Bus T11B Master Load Shedding Relay #5, for approximately 2 seconds.

EPDM
CV

4.2.6 Check the DG1AB output breakers opened to initiate the load rejection. [CMS 7844]

a. T11A11, Emer Incoming Feed from Diesel Generator 1AB (DG1AB Out Bkr to Bus T11A) OPEN

mw

b. T11B4, Emer Incoming Feed from Diesel Generator 1AB (DG1AB Out Bkr to Bus T11B) OPEN

mw

4.2.7 DG1AB continued running (e.g., did not trip).

Circle One:

YES

NO

mw

4.2.8 Check Buses T11A and T11B remain energized.

mw

4.2.9 Stop the recorder(s).

mw

0014

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4.2.10 Performed the following (Acceptance Criteria, Step 5.7)

a. Record the voltage and frequency indicated on recorder:

4203.5 - 4215.2 Voltage range
60.016 - 60.14 Hz range
60.712 Maximum Hz mw

b. Check Tech Spec SR 3.8.1.10 requirements are satisfied:

Within 2 seconds following load rejection, voltage is ≥ 3965 V
and ≤ 4345 Volts.

{Based upon test equipment inaccuracy of ± 55 Volts}

Circle One:

YES

NO

mw

Within 2 seconds following load rejection, frequency is ≥ 59.5
and ≤ 60.4 Hz.

{Based upon test equipment inaccuracy of ± 0.1 Hz}

Circle One:

YES

NO

mw

Following load rejection, frequency is ≤ 64.3 Hz.

{Based upon test equipment inaccuracy of ± 0.1 Hz}

Circle One:

YES

NO

mw

4.2.11 IF desired, THEN perform Attachment 22, DG1AB Disabled Trip Testing.

mw
10-7-14

423 min 4203.5
max 4215.2

min 60.016
max 60.14

60.712 Hz

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DG1AB Load Sequencing & ESF Testing			
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NOTE:

The SI/Blackout interlock is sealed in until the Emergency Diesel Generator is stopped or reset by performing the following step. The SI/Blackout interlock seals in the Trips Disable circuit.

4.2.12 **IF** required for addition testing **THEN** :

- a. Restore SI/Blackout interlock by momentary lead lifting, as follows:

Tech 1 - Locate lead 1 on relay 1-1X-DGAB at Rear Instrument/Relay Rack 1-SR-2.		
Tech 2 - Verify lead 1 on relay 1-1X-DGAB at Rear Instrument/Relay Rack 1-SR-2 is identified.		
Tech 1 - Momentary lift lead 1 on relay 1-1X-DGAB.		
Relay 1-1X-DGAB at Rear Instrument/Relay Rack 1-SR-2. (Ref. PS-1-92053)	Tech 2 Initials	Tech 1 Initials
Momentary lift lead 1 on relay 1-1X-DGAB.	N/A	N/A

- b. Check the following:

- Relay 1-1X-DGAB has de-energized
- IF** available, **THEN** check Annunciator #119 Drop 53, DG1AB TRIPS DISABLED, has cleared

4.2.13 Restore the following equipment that could be affected when actuating relay 1-5X5-T11B:

- a. **IF** opened, **THEN** close 1-SA-TS8-1, Defeats Trip of 1-11BD During Load Shed from Bus 1-T11B.

N/A 10-8-14
10-7-14
N/A 10-8-14
10-7-14
N/A 10-8-14
10-7-14
IV

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Comments:

REF WOT 55453089-01 Start 2723

Verified Complete By: [Signature] / Date: 10/8/14

Reviewed By: [Signature] Date: 10/8/14

Supervisor/Manager Signature

C

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AB Diesel Generator Operability Test (Train B)			
Data Sheet 3	Calculating Power Factor (PF)	Pages: 180 - 182	

1 PREREQUISITES

1.1 None

2 PRECAUTIONS AND LIMITATIONS

2.1 None

3 DETAILS

INIT

NOTE:

- Power Factor Limits: The acceptable operation region is developed based on running EDG at ≥ 3150 kW and ≤ 3500 kW load. Using the monitored EDG power, current and voltage, and applying these values in Eq.1 (i.e. $\text{Power [kW]} = (1.73 * \text{Voltage [volts *35]} * \text{Current [amperes]} * \text{Power Factor [unit less]}) / 1000$ [watts per kW])
- Rearranging, $\text{Power Factor} = \text{Power [kW]} / (1.73 * \text{Voltage [volts *35]} * \text{Current [amperes]} / 1000$ [watts per kW]) (Eq. 2).
- $\text{Power Factor} = (\text{Power [kW]} * 16.5) / (\text{Voltage [volts as read]} * \text{Current [amperes]})$ (Eq. 3) [Ref. 8.2.1g]

3.1 Perform the following to calculate Power factor (PF):

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Data Sheet 3	Calculating Power Factor (PF)	Pages: 180 - 182	

NOTE:

Voltage: The voltage values are the metered voltage values, or the values as read on the secondary of the PT with a ratio of 35 . The expected steady state voltage range is 3910 to 4400 volts, which corresponds to 111.7 to 125.7 volts secondary, respectively. The voltage used in the formula should be the average of the individual phases.

Current: The maximum EDG current established is 600 amps, which is based on EDG nameplate rating. The current used in the formula should be the average of the individual phases.

3.1.1 Calculate the average of the three phases voltage.

Phase 1 119 Volts

Phase 2 120 Volts

Phase 3 119 Volts

Average Voltage 119.33 Volts

$$\frac{23}{\mu V} \\ IV$$

3.1.2 Calculate the average of the three phases current.

Phase 1 120 Amps

Phase 2 100 Amps

Phase 3 120 Amps

Average Current 113.33 Amps

$$\frac{23}{\mu V} \\ IV$$

3.1.3 Record current desired load.

Load 700 kW

700

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3.1.4 Calculate Power Factor:
(Power [kW] * 16.5)/(Voltage [volts as read] * Current
[amperes]) = Power Factor
(700 kW * 16.5)/(119.33 volts * 113.33 amperes)
Desired Load Average Average
(Step 3.1.3) (Step 3.1.1) (Step 3.1.2)
= 0.85
Power Factor

0.3
mm
IV

CAUTION: Do not exceed 600 amperes on any phase. When making changes with the auto voltage regulator monitor current closely as it is most sensitive to adjustments with the auto voltage regulator.

3.1.5 IF not at desired Power Factor, THEN:

- Adjust auto voltage regulator as necessary to obtain desired Power Factor.
- Repeat Steps 3.1.1 to 3.1.4, to determine Power Factor.

N/A
10-8-14
10-8-14

4 FINAL CONDITIONS

Comments:

Verified Complete By: [Signature] Date: 10/7/14

Reviewed By: [Signature] Date: 10/7/14
Supervisor

REVIEWED OCT 10 2014

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DG1CD Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 195	

1 PURPOSE AND SCOPE

- 1.1 This attachment provides instructions to test DG1CD Emergency Diesel Generator response to load rejection (relay 1-5X-CD actuation).

2 PREREQUISITES

INIT

- 2.1 The working copy of this procedure is the current revision. *JM*
- 2.2 A pre-test briefing has been conducted with the Shift Manager (SM), Unit Supervisor (US), or WCC-SRO in accordance with PMP-4010-JOB-001, Pre Job Briefs and Post Job Reviews. *JM*
- 2.3 PMP-4030-EXE-001, Conduct of Surveillance Testing, Section 3.2, General Expectations for Test Prerequisite Activity, has been reviewed. *JM*
- 2.4 DG1CD Emergency Diesel Generator is in service. *JM*
- 2.5 DG1CD Emergency Diesel Generator is not loaded to the test bank. *JM*
- 2.6 Recorder(s) installed per Attachment 13. *JM*

3 PRECAUTIONS AND LIMITATIONS

- 3.1 None.

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CONTROLLED DOCUMENT

OCT 1 2014 *JM*

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Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 195	

NOTE

References: OP-1-98035, OP-1-98044, OP-1-98047, OP-1-98223, & OP-1-982851.

4 DETAILS

INIT

NOTE:

Step 4.1 tests the Emergency Diesel for the response to a full load rejection. Step 4.2 tests the Emergency Diesel for the response to a 600 kW load rejection.

Steps 4.1 or 4.2 may be performed in any order.

Annunciator #120 Drop 53, DG1CD TRIPS DISABLED, will actuate when relays are actuated during the load rejection(s).

4.1 IF performing full load rejection, THEN:

NOTE:

Steps 4.1.1a through 4.1.1d may be repeated as necessary to achieve desired results.

4.1.1 Verify DG1CD EDG loaded to support full load rejection testing:

- a. Verify DG1CD EDG loaded to ≥ 3150 kW and ≤ 3500 kW. *JSM*

NOTE:

One of the following steps (4.1.1b or 4.1.1c) is performed. It is preferred to raise EDG load to 3400 kW and use Figure 3 to verify the power factor is in the correct range.

If load is raised to another value in the ≥ 3150 kW and ≤ 3500 kW range, a manual calculation must be used to determine power factor.

- b. IF loading the EDG to 3400 kW AND using Figure 3 to verify the power factor, THEN:

1. Raise the DG1CD load to 3400 kW indicated. *JJA*

DG2CD Load: 3400 kW. *JJA*

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NOTE:

In adjusting voltage to perform the EDG run at less than or equal to a 0.86 power factor, the current on all three phases should be within 80 amps of each other.

Figure 3 can be utilized at an EDG load of 3400 kW ONLY. [Ref. 8.2.1g]

2. Establish power factor: (SR 3.8.1.11)

a) Calculate the average of the three phases voltage:

Phase 1 120 Volts

Phase 2 121 Volts

Phase 3 120 Volts

Average Voltage 120.3 Volts

b) Adjust the EDG Auto Voltage Regulator to maintain diesel output within the operating region as indicated on Figure 3, EDG Power Factor at 3400 kW.

-OR-

c. IF loading the EDG to a value other than 3400 kW, THEN:

1. Raise the DG1CD load ≥ 3150 kW and ≤ 3500 kW indicated.

DG1CD Load: _____ kW.

2. Perform Data Sheet 3, Calculating Power Factor (PF), of 1-OHP-4030-132-027CD, CD Diesel Generator Operability Test (Train A), to establish the power factor. (SR 3.8.1.11)

d. Verify power factor is less than or equal to .86.

JSM

JM

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AS 10/11/14
JSM

N/A

10-14-14
JSM

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e. Record the following information:

1. DGC1D load: 3420 kW.

Jim

2. DG1CD Power Factor: .825 (.8 to .86)

Jim

f. Verify the DG1CD output breakers - CLOSED:

1. T11C3, Emer Incoming Feed from Diesel Generator
1CD (DG1CD Out Bkr to Bus T11C)

Jim

2. T11D8, Emer Incoming Feed from Diesel Generator
1CD (DG1CD Out Bkr to Bus T11D)

Jim

4.1.2 Verify that the proper precautions have been taken to prevent damage to the following equipment when actuating relay 1-5X4-T11D (affected equipment with the post test positions listed below or action to be taken):

a. 1-11D13, North CRDMG Set Motor Supply Bkr- PTLO.

Jim

b. 1-T11D4, East CTS Pump 1-PP-9E - PTLO.

Jim

c. IF 1-11D3, Containment Lighting Transformer 1-TR-LTG-10, is closed, THEN open 1-SA-TS20-2, Defeats Trip of Containment Ltg Xfmr Supply Breaker 1-11D3 During Load Shed/Conservation.

Jim

IV

d. IF 1-11D10, North Plant Lighting Transformer 1-TR-LTG-9N, is closed, THEN open 1-SA-TS20-4, Defeats Trip of N Plant Lighting Xfmr Supply Bkr 1-11D10 During Load Shed/Conservation.

Jim

IV

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Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 195	

NOTE:

A load rejection ≥ 3150 kW and ≤ 3500 kW will be initiated by manual actions in the next several steps.

4.1.3 Verify this step number is documented on Data Sheet 9, Recorder Data File Log, for the recorder(s) used.

JSM

4.1.4 Start the recorder(s) to measure maximum voltage.

JSM

4.1.5 Manually actuate relay 1-5X4-T11D, 4KV Bus T11D Master Load Shedding Relay #4, for approximately 2 seconds.

MA
EPDM

JSM
CV

4.1.6 Check the DG1CD output breakers opened to initiate the load rejection. [CMS 7844]

a. T11C3, Emer Incoming Feed from Diesel Generator
1CD (DG1CD Out Bkr to Bus T11C) OPEN

JSM

b. T11D8, Emer Incoming Feed from Diesel Generator
1CD (DG1CD Out Bkr to Bus T11D) OPEN

JSM

4.1.7 DG1CD continued running (e.g., did not trip)

Circle One: YES NO

JSM

4.1.8 Check Buses T11C and T11D remain energized.

JSM

4.1.9 Stop the recorder(s).

JSM

4.1.10 Perform the following (Acceptance Criteria, Step 5.8, includes test equipment inaccuracy of ± 55 Volts).

a. Record the maximum voltage indicated on recorder:

5078 Volts

JSM

b. Check maintained voltage is ≤ 5295 V

JSM

4.1.11 IF desired, THEN perform Attachment 22, DG1CD Disabled Trip Testing.

MA

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10/14/14
JSM



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Attachment 9.	3500/600 KW Load Rejection Testing	Pages: 186 - 195	

NOTE

The SI/Blackout interlock is sealed in until the Emergency Diesel Generator is stopped or reset by performing the following step. The SI/Blackout interlock seals in the Trips Disable circuit.

4.1.12 IF required for additional testing, THEN:

- a. Restore SI/Blackout interlock by momentary lead lifting, as follows:

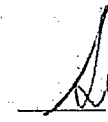
Tech 1 - Locate lead 1 on relay 1-1X-DGCD at Rear Instrument/Relay Rack 1-SR-4.		
Tech 2 - Verify lead 1 on relay 1-1X-DGCD at Rear Instrument/Relay Rack 1-SR-4 is identified.		
Tech 1 - Momentary lift lead 1 on relay 1-1X-DGCD.		
Relay 1-1X-DGCD at Rear Instrument/Relay Rack 1-SR-4. (Ref. PS-1-92054)	Tech 2 Initials	Tech 1 Initials
Momentary lift lead 1 on relay 1-1X-DGCD.		

- b. Check the following:

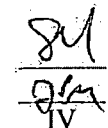
- Relay 1-1X-DGCD has de-energized
- IF available, THEN check Annunciator #120 Drop 53, DG1CD TRIPS DISABLED, has cleared.

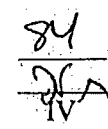
4.1.13 Restore the following equipment that could be affected when actuating relay 1-5X4-T11D:

- a. IF opened in Step 4.1.2c, THEN close 1-SA-TS20-2, Defeats Trip of Containment Ltg Xfmr Supply Breaker 1-11D3 During Load Shed/Conservation.
- b. IF opened in Step 4.1.2d, THEN close 1-SA-TS20-4, Defeats Trip of N Plant Lighting Xfmr Supply Bkr 1-11D10 During Load Shed/Conservation.









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DG1CD Load Sequencing & ESF Testing			
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4.2 IF performing a 600 kW load rejection, THEN:

NOTE:

Steps 4.2.1a through 4.2.1c may be repeated as necessary to achieve desired results. DG1CD load should be as close to 600kW as reasonably achievable.

4.2.1 Verify DG1CD EDG loaded to support 600 kW load rejection testing:

- a. Verify DG1CD EDG loaded to ≥ 600 kW - ≤ 750 kW. JSM
- b. Perform Data Sheet 3, Calculating Power Factor (PF), of 1-OHP-4030-132-027CD, CD Diesel Generator Operability Test (Train A), to establish the power factor. (SR 3.8.1.11) JSM
- c. Verify power factor is less than or equal to .86. JSM
- d. Record the following information:
 1. DG1CD load: 700 kW. JSM
 2. DG1CD Power Factor: .87. JSM
- e. Verify the DG1CD output breakers - CLOSED:
 1. T11C3, Emer Incoming Feed from Diesel Generator 1CD (DG1CD Out Bkr to Bus T11C) JSM
 2. T11D8, Emer Incoming Feed from Diesel Generator 1CD (DG1CD Out Bkr to Bus T11D) JSM

NOTE:

A load rejection ≥ 600 kW will be initiated by manual actions in the next several steps.

4.2.2 Verify this step number is documented on Data Sheet 9, Recorder Data File Log, for the recorder(s) used. JSM

4.2.3 Start the recorder(s) to measure frequency AND voltage. JSM

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- 4.2.4 Manually actuate relay 1-5X6-T11C, 4KV Bus T11C Master Load Shedding Relay #6, for approximately 2 seconds.

EPDM

CV

- 4.2.5 Check the DG1CD output breakers opened to initiate the load rejection. [CMS 7844]

- a. T11C3, Emer Incoming Feed from Diesel Generator
1CD (DG1CD Out Bkr to Bus T11C) OPEN
- b. T11D8, Emer Incoming Feed from Diesel Generator
1CD (DG1CD Out Bkr to Bus T11D) OPEN

JM

JM

- 4.2.6 DG1CD continued running (e.g., did not trip)

Circle One: YES NO

JM

- 4.2.7 Check Buses T11C and T11D remain energized.

JM

- 4.2.8 Stop the recorder(s).

JM

- 4.2.9 Perform the following (Acceptance Criteria, Step 5.7):

- a. Record the voltage and frequency indicated on recorder:

4211 - 4229 Voltage range
60.02 - 60.29 Hz range
60.77 Maximum Hz

JM

- b. Check Tech Spec SR 3.8.1.10 requirements are satisfied:

Within 2 seconds following load rejection, voltage is ≥ 3965 V
and ≤ 4345 Volts.

{Based upon test equipment inaccuracy of ± 55 Volts}

Circle One: YES NO

JM

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Within 2 seconds following load rejection, frequency is ≥ 59.5 and ≤ 60.4 Hz.

{Based upon test equipment inaccuracy of ± 0.1 Hz}

Circle One: YES NO

JS

Following load rejection, frequency is ≤ 64.3 Hz.

{Based upon test equipment inaccuracy of ± 0.1 Hz}

Circle One: YES NO

JS

4.2.10 IF desired, THEN perform Attachment 22, DG1CD Disabled Trip Testing.

JS

NOTE: The SI/Blackout interlock is sealed in until the Emergency Diesel Generator is stopped or reset by performing the following step. The SI/Blackout interlock seals in the Trips Disable circuit.

4.2.11 IF required for addition testing THEN:

a. Restore SI/Blackout interlock by momentary lead lifting, as follows:

Tech 1 - Locate lead 1 on relay 1-1X-DGCD at Rear Instrument/Relay Rack 1-SR-4.		
Tech 2 - Verify lead 1 on relay 1-1X-DGCD at Rear Instrument/Relay Rack 1-SR-4 is identified.		
Tech 1 - Momentary lift lead 1 on relay 1-1X-DGCD.		
Relay 1-1X-DGCD at Rear Instrument/Relay Rack 1-SR-4. (Ref. PS-1-92054)	Tech 2 Initials	Tech 1 Initials
Momentary lift lead 1 on relay 1-1X-DGCD.		

b. Check the following:

- Relay 1-1X-DGCD has de-energized
- IF available, THEN check Annunciator #120 Drop 53, DG1CD TRIPS DISABLED, has cleared.

NIA *JS* 10-14-14
10/15/14

JS

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Attachment 9	3500/600 KW Load Rejection Testing		Pages: 186 - 195

Comments:

1205

Verified Complete By: _____

Date: 10/15/14

Reviewed By: _____

Date: 10/15/14 y

Supervisor/Manager Signature

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CD Diesel Generator Operability Test (Train A)			
Data Sheet 3	Calculating Power Factor (PF)	Pages: 178 - 180	

1 PREREQUISITES

1.1 None

OPERATIONS DEPARTMENT
CONTROLLED DOCUMENT

OCT 14 2014

2 PRECAUTIONS AND LIMITATIONS

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2.1 None

3 DETAILS

INIT

NOTE:

- Power Factor Limits: The acceptable operation region is developed based on running EDG at ≥ 3150 kW and ≤ 3500 kW load. Using the monitored EDG power, current and voltage, and applying these values in Eq.1 (i.e. $\text{Power [kW]} = (1.73 * \text{Voltage [volts *35]} * \text{Current [amperes]} * \text{Power Factor [unit less]}) / 1000$ [watts per kW])
- Rearranging, $\text{Power Factor} = \text{Power [kW]} / (1.73 * \text{Voltage [volts *35]} * \text{Current [amperes]} / 1000$ [watts per kW]) (Eq. 2).
- $\text{Power Factor} = (\text{Power [kW]} * 16.5) / (\text{Voltage [volts as read]} * \text{Current [amperes]})$ (Eq. 3)

3.1 Perform the following to calculate Power factor (PF):

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CD Diesel Generator Operability Test (Train A)			
Data Sheet 3	Calculating Power Factor (PF)	Pages: 178 - 180	

<p>NOTE:</p> <ul style="list-style-type: none"> • Voltage: The voltage values are the metered voltage values, or the values as read on the secondary of the PT with a ratio of 35. The expected steady state voltage range is 3910 to 4400 volts, which corresponds to 111.7 to 125.7 volts secondary, respectively. The voltage used in the formula should be the average of the individual phases. • Current: The <u>maximum</u> EDG current established is 600 amps, which is based on EDG nameplate rating. The current used in the formula should be the average of the individual phases.
--

3.1.1 Calculate the average of the three phases voltage.

Phase 1 120 Volts

Phase 2 121 Volts

Phase 3 120 Volts

Average Voltage 120.3 Volts

120.3
IV

3.1.2 Calculate the average of the three phases current.

Phase 1 130 Amps

Phase 2 100 Amps

Phase 3 120 Amps

Average Current 116.7 Amps

116.7
IV

3.1.3 Record current desired load.

Load 700 kW

700

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CD Diesel Generator Operability Test (Train A)			
Data Sheet 3	Calculating Power Factor (PF)	Pages: 178 - 180	

3.1.4 Calculate Power Factor:
(Power [kW] * 16.5)/(Voltage [volts as read] * Current [amperes]) = Power Factor
(700 kW * 16.5) / (120.3 volts * 116.7 amperes)
Desired Load Average Average
(Step 3.1.3) (Step 3.1.1) (Step 3.1.2)
= .82
Power Factor

25
G
IV

CAUTION: Do not exceed 600 amperes on any phase. When making changes with the auto voltage regulator monitor current closely as it is most sensitive to adjustments with the auto voltage regulator.

3.1.5 IF not at desired Power Factor, THEN:

- Adjust auto voltage regulator as necessary to obtain desired Power Factor.
- Repeat Steps 3.1.1 to 3.1.4, to determine Power Factor.

SM 10/14/14
10-14-14
MA
JN
↓

4 FINAL CONDITIONS

Comments:

Verified Complete By: [Signature] Date: 10/14/14

Reviewed By: [Signature] Date: 10/15/14
Supervisor/Manager Signature

[Signature]
REVIEWED OCT 20 2014

(Good)

4-4

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DG2AB Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 196	

1 PURPOSE AND SCOPE

- 1.1 This attachment provides instructions to test DG2AB Emergency Diesel Generator response to full (3500 kW) and/or 600 kW load rejection (relay 2-5X-AB actuation).

2 PREREQUISITES

INIT

- 2.1 The working copy of this procedure is the current revision. 03
- 2.2 A pre-test briefing has been conducted with the Shift Manager (SM), Unit Supervisor (US), or WCC-SRO in accordance with PMP-4010-JOB-001, Pre-Job Briefs and Post-Job Reviews. 03
- 2.3 PMP-4030-EXE-001, Conduct of Surveillance Testing, Section 3.2, General Expectations for Test Prerequisite Activity, has been reviewed. 03
- 2.4 DG2AB Emergency Diesel Generator is in service. 03
- 2.5 DG2AB Emergency Diesel Generator is not loaded to the test bank. 03
- 2.6 Recorder(s) installed per Attachment 13. 03

3 PRECAUTIONS AND LIMITATIONS

- 3.1 None.

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APR 03 2015

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APR 04 2015

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DG2AB Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing		Pages: 186 - 196

NOTE: References: OP-2-98034, OP-2-98043, OP-2-98045, OP-2-98111, OP-2-98222 & OP-2-98285.

4 DETAILS

INIT

NOTE: Step 4.1 tests the Emergency Diesel for the response to a full load rejection. Step 4.2 tests the Emergency Diesel for the response to a 600 kW load rejection.

Steps 4.1 or 4.2 may be performed in any order.

Annunciator #219 Drop 53, DG2AB TRIPS DISABLED, will actuate when relays are acutated during the load rejection(s).

4.1 IF performing full load rejection, THEN:

NOTE: Steps 4.1.1a through 4.1.1d may be repeated as necessary to achieve desired results.

4.1.1 Verify DG2AB loaded to support full load rejection testing:

- a. Verify DG2AB loaded to ≥ 3150 kW and ≤ 3500 kW. AB

NOTE: One of the following steps (4.1.1b or 4.1.1c) is performed. It is preferred to raise EDG load to 3400 kW and use Figure 3 to verify the power factor is in the correct range.

If load is raised to another value in the ≥ 3150 kW and ≤ 3500 kW range, a manual calculation must be used to determine power factor.

- b. IF loading the EDG to 3400 kW AND using Figure 3 to verify the power factor, THEN:

1. Raise the DG2AB load to 3400 kW indicated. AB

DG2AB Load: 3400 kW. AB

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DG2AB Load Sequencing & ESF Testing			
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NOTE: In adjusting voltage to perform the EDG run at less than or equal to a 0.86 power factor, the current on all three phases should be within 80 amps of each other.

Figure 3 can be utilized at an EDG load of 3400 kW ONLY. [Ref. 8.2.1g]

2. Establish power factor: (SR 3.8.1.11)

a) Calculate the average of the three phases voltage:

Phase 1 119 Volts

Phase 2 119 Volts

Phase 3 118.5 Volts

Average Voltage 118.83 Volts

03

b) Adjust the EDG Auto Voltage Regulator to maintain diesel output within the operating region as indicated on Figure 3, EDG Power Factor at 3400 kW.

03

-OR-

c. IF loading the EDG to a value other than 3400 kW, THEN:

1. Raise the DG2AB load ≥ 3150 kW and ≤ 3500 kW indicated.

DG2AB Load: _____ kW.

2. Perform Data Sheet 3, Calculating Power Factor (PF), of 2-OHP-4030-232-027AB, AB Diesel Generator Operability Test (Train B), to establish the power factor. (SR 3.8.1.11)

N/A ⁰³ 4/4/15
8m
4-4-15

d. Verify power factor less than or equal to .86.

03

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DG2AB Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 196	

e. Record the following information:

1. DG2AB load: 3400 kW 03
2. DG2AB Power Factor: 0.85 (.8 to .86) 03

f. Verify DG2AB output breakers - CLOSED:

1. T21A11, Emer Incoming Feed from Diesel Generator 2AB (DG2AB Out Bkr to Bus T21A) 03
2. T21B4, Emer Incoming Feed from Diesel Generator 2AB (DG2AB Out Bkr to Bus T21B) 03

4.1.2 Verify that the proper precautions have been taken to prevent damage to the following equipment when actuating relay 2-5X4-T21A (affected equipment with the post test positions listed below or action to be taken):

- a. 2-21A10, West Turbine Auxiliary Cooling Water Pump 2-PP-14W - TRIP. 03
- b. 2-21A1, South Rod Control Drive MG Set 2-CRDMG-2S - TRIP. 03
- c. Verify 2-T21A3, West Containment Spray Pump 2-PP-9W - PTLO. 03
- d. IF 2-21AC, 600V Bus 21A to 600V Bus 21B Bus Tie, is closed, THEN open 2-SA1-TS-45, ACB 21AC TRIP. 03
IV

~~NOTE:~~

A load rejection ≥ 3150 kW and ≤ 3500 kW will be initiated by manual actions in the next several steps.

4.1.3 Verify this step number is documented on Data Sheet 9, Recorder Data File Log, for the recorder(s) used. 03

4.1.4 Start the recorder(s) to measure maximum voltage. 03

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DG2AB Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 196	

- 4.1.5 Manually actuate relay 2-5X4-T21A, 4KV Bus T21A Master Load Shedding Relay #4, for approximately 2 seconds.

ML
EPDM

CV

- 4.1.6 Check the DG2AB output breakers opened to initiate the load rejection. [CMS 7844]

- a. T21A11, Emer Incoming Feed from Diesel Generator 2AB (DG2AB Out Bkr to Bus T21A)

OPEN

03

- b. T21B4, Emer Incoming Feed from Diesel Generator 2AB (DG2AB Out Bkr to Bus T21B)

OPEN

03

- 4.1.7 DG2AB continued running (e.g., did not trip).

Circle One:

YES

NO

03

- 4.1.8 Check Buses T21A & T21B remain energized.

03

- 4.1.9 Stop the recorder(s).

03

- 4.1.10 Perform the following (Acceptance Criteria, Step 5.8, includes test equipment inaccuracy of ± 55 Volts):

- a. Record the maximum voltage indicated on recorder

4754

Volts

03

- b. Check maintained voltage is ≤ 5295 V.

03

- 4.1.11 IF desired, THEN perform Attachment 22, DG2AB Disabled Trip Testing.

N/A *03* *4/4/15* *SM* *4-4-15*

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DG2AB Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 196	

4.2 IF performing a 600 KW load rejection, THEN:

NOTE: Steps 4.2.1a through 4.2.1c may be repeated as necessary to achieve desired results. DG2AB load should be as close to 600 kW as reasonably achievable.

4.2.1 Verify DG2AB loaded to support 600 kW load rejection testing:

- a. Verify AB EDG loaded to ≥ 600 kW and ≤ 750 kW. mm
- b. Perform Data Sheet 3, Calculating Power Factor (PF), of 2-OHP-4030-232-027AB, AB Diesel Generator Operability Test (Train B), to establish the power factor. (SR 3.8.1.11) 0.83
- c. Verify power factor is less than or equal to .86. 0.85 0.83
- d. Record the following information:
 1. DG2AB load: 600 kW 0.83
 2. DG2AB power factor: 0.83 0.83
- e. Verify DG2AB output breakers – CLOSED:
 1. T21A11, Emer Incoming Feed from Diesel Generator 2AB (DG2AB Out Bkr to Bus T21A) 0.83
 2. T21B4, Emer Incoming Feed from Diesel Generator 2AB (DG2AB Out Bkr to Bus T21B) 0.83

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DG2AB Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 196	

4.2.2 Verify that the proper precautions have been taken to prevent damage to the following equipment when actuating relay 2-5X4-T21B (affected equipment with the post test positions listed below or action to be taken):

- a. 2-21B6, East Turbine Auxiliary Cooling Water Pump
2-PP-14E - TRIP.
- b. IF 2-21B13, Turb Bldg Misc Power Supply Xfmr
2-TR-TBMP-591-2, is closed, THEN open 2-SA1-TS-19,
ACB 21B13 TRIP.
- c. Open 2-SA1-TS-24, ACB 21B12 ~~TRIP~~ (prevents South
NESW Pump start).

BS

BS
C
IV

BS
6
IV

CLOSE 4-4-15
2m atm
BS 4/4/15
2 4/4/15
(SKO)

~~NOTE:~~

A load rejection ≥ 600 kW will be initiated by manual actions in the next several steps.

- 4.2.3 Verify this step number is documented on Data Sheet 9, Recorder Data File Log, for the recorder(s) used.
- 4.2.4 Start the recorder(s) to measure maximum voltage.
- 4.2.5 Manually actuate relay 2-5X4-T21B, 4KV Bus T21B Master Load Shedding Relay #4, for approximately 2 seconds.

BS

BS

MM
EPDM
BS

* SEE COMMENTS

Email sent to E. Hicks on 4/4/15 ALL 4/4/15

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DG2AB Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 196	

4.2.6 Check the DG2AB output breakers opened to initiate the load rejection. [CMS 7844]

- a. T21A11, Emer Incoming Feed from Diesel Generator 2AB (DG2AB Out Bkr to Bus T21A) OPEN 03
- b. T21B4, Emer Incoming Feed from Diesel Generator 2AB (DG2AB Out Bkr to Bus T21B) OPEN 03

4.2.7 DG2AB continued running (e.g., did not trip).

Circle One: YES NO 03

4.2.8 Check Buses T21A & T21B remain energized. 03

4.2.9 Stop the recorder(s). 03

4.2.10 Perform the following (Acceptance Criteria, Step 5.7):

- a. Record the voltage and frequency indicated on recorder:
- | | | |
|----------------------|---------------|-----------|
| <u>4164-4300</u> | Voltage range | <u>03</u> |
| <u>60.258-59.887</u> | Hz range | |
| <u>00.8</u> | Maximum Hz | |

- b. Check Tech Spec SR 3.8.1.10 requirements are satisfied:

Within 2 seconds following load rejection, voltage is ≥ 3965 V and ≤ 4345 Volts.
{Based upon test equipment inaccuracy of ± 55 Volts}

Circle One: YES NO 03

Within 2 seconds following load rejection, frequency is ≥ 59.5 and ≤ 60.4 Hz.
{Based upon test equipment inaccuracy of ± 0.1 Hz}

Circle One: YES NO 03

Following load rejection, frequency is ≤ 64.3 Hz.
{Based upon test equipment inaccuracy of ± 0.1 Hz}

Circle One: YES NO 03



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DG2AB Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 186 - 196	

- 4.2.11 IF desired, THEN perform Attachment 22, DG2AB Disabled Trip Testing. C3

NOTE: The SI/Blackout interlock is sealed in until the Emergency Diesel Generator is stopped or reset by performing the following step. The SI/Blackout interlock seals in the Trips Disable circuit.

- 4.2.12 IF required for addition testing THEN :

- a. Restore SI/Blackout interlock by momentary lead lifting, as follows:

Tech 1 - Locate lead 1 on relay 2-1X-DGAB at Rear Instrument/Relay Rack 2-SR-1.		
Tech 2 - Verify lead 1 on relay 2-1X-DGAB at Rear Instrument/Relay Rack 2-SR-1 is identified.		
Tech 1 - Momentary lift lead 1 on relay 2-1X-DGAB.		
Relay 2-1X-DGAB at Rear Instrument/Relay Rack 2-SR-1. (Ref. PS-2-92053)	Tech 2 Initials	Tech 1 Initials
Momentary lift lead 1 on relay 2-1X-DGAB.		

- b. Check the following:

- Relay 2-1X-DGAB has de-energized C3
- Check Annunciator #219 Drop 53, DG2AB TRIPS DISABLED, has cleared C3

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4.2.13 Restore the following equipment that could be affected when actuating relay 2-5X4-T21B:

- a. IF required for current plant conditions, THEN close 2-21B6, East Turbine Auxiliary Cooling Water Pump 2-PP-14E.
- b. IF 2-SA1-TS-19, ACB 21B13 TRIP, was opened in Step 4.2.2b, THEN close 2-SA1-TS-19, ACB 21B13 TRIP.
- c. Close 2-SA1-TS-24, ACB 21B12 TRIP.

4.4.15
via QTR
CLOSE # SEE COMMENTS
4/4/15
2 4/4/15
(SRO)

OK
N/A
4.4.15
4/4/15

OK
mw
IV

OK
mw
IV

Comments:

* PROCEDURE LABEL INCORRECT, IS ACB 21B12 CLOSE. PREVIOUSLY IDENTIFIED AND AWARD INITIATED. CORRECTION FOR PRE-002 STEP 1.1
OK 4/4/15 via 4.4.15 QTR 2 4/4/15 (SRO)

Verified Complete By: _____

Date: 4/4/15

Reviewed By: _____

Date: 4/4/15

Supervisor/Manager Signature

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AB Diesel Generator Operability Test (Train B)			
Data Sheet 3	Calculating Power Factor (PF)	Pages: 173 - 175	

3-21

1 PREREQUISITES

~~1.1~~ None

2 PRECAUTIONS AND LIMITATIONS

~~2.1~~ None

3 DETAILS

INIT

NOTE:

- Power Factor Limits: The acceptable operation region is developed based on running EDG at ≥ 3150 kW and ≤ 3500 kW load. Using the monitored EDG power, current and voltage, and applying these values in Eq.1 (i.e. $\text{Power [kW]} = (1.73 * \text{Voltage [volts *35]} * \text{Current [amperes]} * \text{Power Factor [unit less]}) / 1000$ [watts per kW])
- Rearranging, $\text{Power Factor} = \text{Power [kW]} / (1.73 * \text{Voltage [volts *35]} * \text{Current [amperes]} / 1000$ [watts per kW]) (Eq. 2).
- $\text{Power Factor} = (\text{Power [kW]} * 16.5) / (\text{Voltage [volts as read]} * \text{Current [amperes]})$ (Eq. 3)

3.1 Perform the following to calculate Power factor (PF):

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MAR 31 2015

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AB Diesel Generator Operability Test (Train B)			
Data Sheet 3	Calculating Power Factor (PF)		Pages: 173 - 175

NOTE:

- Voltage: The voltage values are the metered voltage values, or the values as read on the secondary of the PT with a ratio of 35. The expected steady state voltage range is 3910 to 4400 volts, which corresponds to 111.7 to 125.7 volts secondary, respectively. The voltage used in the formula should be the average of the individual phases.
- Current: The maximum EDG current established is 600 amps, which is based on EDG nameplate rating. The current used in the formula should be the average of the individual phases.

3.1.1 Calculate the average of the three phases voltage.

Phase 1 120 Volts
 Phase 2 120 Volts
 Phase 3 119 Volts
 Average Voltage 119.7 Volts

OB
ST
 IV

3.1.2 Calculate the average of the three phases current.

Phase 1 ⁸³³⁻³¹⁻⁸
170 Amps
 Phase 2 160 Amps
 Phase 3 170 Amps
 Average Current 167 Amps

OB
ST
 IV

3.1.3 Record current desired load.

Load ⁸³³⁻³¹⁻¹⁵
600 kW

OB

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AB Diesel Generator Operability Test (Train B)			
Data Sheet 3	Calculating Power Factor (PF)	Pages: 173 - 175	

3.1.4 Calculate Power Factor:

$$\begin{aligned}
 & \text{(Power [kW] * 16.5) / (Voltage [volts as read] * Current [amperes]) = Power Factor} \\
 & \text{Desired Load (Step 3.1.3)} \quad \text{Average (Step 3.1.1)} \quad \text{Average (Step 3.1.2)} \\
 & \text{9900} \quad \left(\frac{600 \text{ kW} * 16.5}{119.7 \text{ volts} * 167 \text{ amperes}} \right) \\
 & = \frac{495}{\text{Power Factor}}
 \end{aligned}$$

03
IV

CAUTION: Do not exceed 600 amperes on any phase. When making changes with the auto voltage regulator monitor current closely as it is most sensitive to adjustments with the auto voltage regulator.

3.1.5 IF not at desired Power Factor, THEN:

- Adjust auto voltage regulator, as necessary to obtain desired Power Factor.
- Repeat Steps 3.1.1 to 3.1.4, to determine Power Factor.

03-31-15
NIA
3-31-15
↓

4 FINAL CONDITIONS

Comments:

PER STEP 4.2 of 2-OHP 4030 232-217B A9 for 600V
load reject test

Verified Complete By: _____

Date: 3/31/15

Reviewed By: _____

Supervisor

Date: 3/31/15

REVIEWED APR 02 2015

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DG2CD Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 190 - 200	

4-20

1 PURPOSE AND SCOPE

- 1.1 This attachment provides instructions to test DG2CD Emergency Diesel Generator response to load rejection (relay 2-5X-CD actuation).

2 PREREQUISITES

INIT

- 2.1 The working copy of this procedure is the current revision. 02
- 2.2 A pre-test briefing has been conducted with the Shift Manager (SM), Unit Supervisor (US), or WCC-SRO in accordance with PMP-4010-JOB-001, Pre Job Briefs and Post Job Reviews. 03
- 2.3 PMP-4030-EXE-001, Conduct of Surveillance Testing, Section 3.2, General Expectations for Test Prerequisite Activity, has been reviewed. 03
- 2.4 DG2CD Emergency Diesel Generator is in service. 03
- 2.5 DG2CD Emergency Diesel Generator is not loaded to the test bank. 02
- 2.6 Recorder(s) installed per Attachment 13. 02

3 PRECAUTIONS AND LIMITATIONS

- 3.1 None.

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APR 20 2015
02/20/15
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APR 19 2015
02/20/15
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DG2CD Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 190 - 200	

NOTE: References: OP-2-98035, OP-2-98044, OP-2-98045, OP-2-98046, OP-2-98047, OP-2-98111, OP-2-98281 & OP-2-98402.

4 DETAILS

INIT

NOTE: Step 4.1 tests the Emergency Diesel for the response to a full load rejection. Step 4.2 tests the Emergency Diesel for the response to a 600 kW load rejection.

Steps 4.1 or 4.2 may be performed in any order.

Annunciator #220 Drop 53, DG2CD TRIPS DISABLED, will actuate when relays are acutated during the load rejection(s).

4.1 IF performing full load rejection, THEN:

NOTE: Steps 4.1.1a through 4.1.1d may be repeated as necessary to achieve desired results.

4.1.1 Verify DG2CD EDG loaded to support full load rejection testing:

- a. Verify DG2CD EDG loaded to ≥ 3150 kW and ≤ 3500 kW. OK

NOTE: One of the following steps (4.1.1b or 4.1.1c) is performed. It is preferred to raise EDG load to 3400 kW and use Figure 3 to verify the power factor is in the correct range.

If load is raised to another value in the ≥ 3150 kW and ≤ 3500 kW range, a manual calculation must be used to determine power factor.

- b. IF loading the EDG to 3400 kW AND using Figure 3 to verify the power factor, THEN:

1. Raise the DG2CD load to 3400 kW indicated. OK

DG2CD Load: 3400 kW. OK

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DG2CD Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 190 - 200	

NOTE: In adjusting voltage to perform the EDG run at less than or equal to a 0.86 power factor, the current on all three phases should be within 80 amps of each other.

Figure 3 can be utilized at an EDG load of 3400 kW ONLY. [Ref. 8.2.1g]

2. Establish power factor: (SR 3.8.1.11)

a) Calculate the average of the three phases voltage:

Phase 1 120 Volts

Phase 2 120 Volts

Phase 3 120 Volts

Average Voltage 120 Volts

02

b) Adjust the EDG Auto Voltage Regulator to maintain diesel output within the operating region as indicated on Figure 3, EDG Power Factor at 3400 kW.

02

-OR-

c. IF loading the EDG to a value other than 3400 kW, THEN:

1. Raise the DG2CD load ≥ 3150 kW and ≤ 3500 kW indicated.

DG2CD Load: _____ kW.

2. Perform Data Sheet 3, Calculating Power Factor (PF), of 2-OHP-4030-232-027CD, CD Diesel Generator Operability Test (Train A), to establish the power factor. (SR 3.8.1.11)

d. Verify power factor is less than or equal to .86.

N/A ⁰³ 4/20/15
8u 4/20/15



02

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DG2CD Load Sequencing & ESF Testing			
Attachment 9	3500/600 KW Load Rejection Testing	Pages: 190 - 200	

e. Record the following information:

1. DG2CD load: 3400 kW. OK
2. DG2CD Power Factor: 0.84 (.8 to .86) OK

f. Verify the DG2CD output breakers – CLOSED:

1. T21C3, Emer Incoming Feed from Diesel Generator 2CD (DG2CD Out Bkr to Bus T21C) OK
2. T21D8, Emer Incoming Feed from Diesel Generator 2CD (DG2CD Out Bkr to Bus T21D) OK

4.1.2 Verify that the proper precautions have been taken to prevent damage to the following equipment when actuating relay 2-5X1-T21D (affected equipment with the post test positions listed below or action to be taken):

- a. IF 2-21D9, Main and Spare XFMR Auxiliaries Emer Distribution Panel 2-TCSE, is closed, THEN open 2-SA5-TS-43, ACB 21D9 TRIP. OK
G
IV
- b. 2-T21D5, North Safety Injection Pump 2-PP-26N – PTLO. OK
- c. IF 2-21BD, 600V Bus 21B to 600V Bus 21D Bus Tie, is closed, THEN open 2-SA5-TS-39, ACB 21BD TRIP. N/A 4/20/15
↓ 2/4/2015
IV

NOTE:

A load rejection ≥ 3150 kW and ≤ 3500 kW will be initiated by manual actions in the next several steps.

4.1.3 Verify this step number is documented on Data Sheet 9, Recorder Data File Log, for the recorder(s) used. OK

4.1.4 Start the recorder(s) to measure maximum voltage. OK

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- 1533 4.1.5 Manually actuate relay 2-5X1-T21D, 4KV Bus T21D Master Load Shedding Relay #1, for approximately 2 seconds.

N/A
EPDM
CV

- 4.1.6 Check the DG2CD output breakers opened to initiate the load rejection. [CMS 7844]

- a. T21C3, Emer Incoming Feed from Diesel Generator 2CD (DG2CD Out Bkr to Bus T21C) OPEN *03*
- b. T21D8, Emer Incoming Feed from Diesel Generator 2CD (DG2CD Out Bkr to Bus T21D) OPEN *03*

- 4.1.7 DG2CD continued running (e.g., did not trip)

Circle One: ☒ YES ☐ NO *03*

- 4.1.8 Check Buses T21C & T21D remain energized. *03*

- 4.1.9 Stop the recorder(s). *07*

- 4.1.10 Perform the following (Acceptance Criteria, Step 5.8, includes test equipment inaccuracy of ± 55 Volts).

- a. Record the maximum voltage indicated on recorder: 5023 Volts *02*

- b. Check maintained voltage is ≤ 5295 V *02*

- 4.1.11 IF desired, THEN perform Attachment 22, DG2CD Disabled Trip Testing. *84 4/20/15*
N/A 03 4/20/15

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NOTE: The SI/Blackout interlock is sealed in until the Emergency Diesel Generator is stopped or reset by performing the following step. The SI/Blackout interlock seals in the Trips Disable circuit.

4.1.12 **IF** required for addition testing, **THEN:**

a. Restore SI/Blackout interlock by momentary lead lifting, as follows:

Tech 1 – Locate lead 1 on relay 2-1X-DGCD at Rear Instrument/Relay Rack 2-SR-4.		
Tech 2 – Verify lead 1 on relay 2-1X-DGCD at Rear Instrument/Relay Rack 2-SR-4 is identified.		
Tech 1 – Momentary lift lead 1 on relay 2-1X-DGCD.		
Relay 2-1X-DGCD at Rear Instrument/Relay Rack 2-SR-4. (Ref. PS-2-92054)	Tech 2 Initials	Tech 1 Initials
Momentary lift lead 1 on relay 2-1X-DGCD.	<i>MBE</i>	<i>JP</i>

b. Check the following:

- Relay 2-1X-DGCD has de-energized
- Check Annunciator #220 Drop 53, DG2CD TRIPS DISABLED, has cleared.

JP
CB

4.1.13 Restore the following equipment that could be affected when actuating relay 2-5X1-T21D:

a. **IF** 2-SA5-TS-43, ACB 21D9 TRIP, was opened in Step 4.1.2a, **THEN** close 2-SA5-TS-43, ACB 21D9 TRIP.

43
G
IV

b. **IF** 2-SA5-TS-39, ACB 21BD TRIP, was opened in Step 4.1.2c, **THEN** close 2-SA5-TS-39, ACB 21BD TRIP.

43
N/A *4/20/15*
64-20-15
IV

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4.2 IF performing a 600 kW load rejection, THEN:

NOTE: Steps 4.2.1a through 4.2.1c may be repeated as necessary to achieve desired results. DG2CD load should be as close to 600 kW as reasonably achievable.

4.2.1 Verify DG2CD EDG loaded to support 600 kW load rejection testing:

- a. Verify DG2CD EDG loaded to ≥ 600 kW and ≤ 750 kW. 03
- b. Perform Data Sheet 3, Calculating Power Factor (PF), of 2-OHP-4030-232-027CD, CD Diesel Generator Operability Test (Train A), to establish the power factor. (SR 3.8.1.11) 03
- c. Verify power factor is less than or equal to .86. 03
- d. Record the following information:
 1. DG2CD load: 600 kW. 03
 2. DG2CD Power Factor: 0.79. 03
- e. Verify the DG2CD output breakers – CLOSED:
 1. T21C3, Emer Incoming Feed from Diesel Generator 2CD (DG2CD Out Bkr to Bus T21C) 03
 2. T21D8, Emer Incoming Feed from Diesel Generator 2CD (DG2CD Out Bkr to Bus T21D) 03

4.2.2 Verify that the proper precautions have been taken to prevent damage to the following equipment when actuating relay 2-5X1-T21C (affected equipment with the post test positions listed below or action to be taken):

- a. 2-21C4, Power Supply to 2-PS-E – TRIP. 03
- b. Turbine Lube Oil Cooler temperature regulating valves – CLOSED. 03

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- c. IF 2-21AC, 600V Bus 21A to 600V Bus 21B Bus Tie, is closed, THEN open 2-SA5-TS-25, ACB 21AC TRIP.

N/A
↓
IV
4/20/15
8/14/20/15

NOTE: A load rejection ≥ 600 kW will be initiated by manual actions in the next several steps.

- 4.2.3 Verify this step number is documented on Data Sheet 9, Recorder Data File Log, for the recorder(s) used. CB

- 4.2.4 Start the recorder(s) to measure frequency AND voltage. CB

- 1615 4.2.5 Manually actuate relay 2-5X1-T21C, 4KV Bus T21C Master Load Shedding Relay #1, for approximately 2 seconds. MBE
EPDM
CV

- 4.2.6 Check the DG2CD output breakers opened to initiate the load rejection. [CMS 7844]

- a. T21C3, Emer Incoming Feed from Diesel Generator 2CD (DG2CD Out Bkr to Bus T21C) OPEN CB

- b. T21D8, Emer Incoming Feed from Diesel Generator 2CD (DG2CD Out Bkr to Bus T21D) OPEN CB

- 4.2.7 DG2CD continued running (e.g., did not trip)

Circle One: (YES) NO CB

- 4.2.8 Check Buses T21C & T21D remain energized. CB

- 4.2.9 Stop the recorder(s). CB

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4.2.10 Perform the following (Acceptance Criteria, Step 5.7):

a. Record the voltage and frequency indicated on recorder:

422.7 - 420.9 Voltage range

60.098 - 59.917 Hz range

60.6 Maximum Hz

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b. Check Tech Spec SR 3.8.1.10 requirements are satisfied:

Within 2 seconds following load rejection, voltage is ≥ 3965 V
and ≤ 4345 Volts.

{Based upon test equipment inaccuracy of ± 55 Volts}

Circle One: YES NO

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Within 2 seconds following load rejection, frequency is ≥ 59.5
and ≤ 60.4 Hz.

{Based upon test equipment inaccuracy of ± 0.1 Hz}

Circle One: YES NO

27

Following load rejection, frequency is ≤ 64.3 Hz.

{Based upon test equipment inaccuracy of ± 0.1 Hz}

Circle One: YES NO

27

4.2.11 IF desired, THEN perform Attachment 22, DG2CD Disabled
Trip Testing.

N/A ^{SY} 4/20/15
02/4/20/15

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NOTE:

The SI/Blackout interlock is sealed in until the Emergency Diesel Generator is stopped or reset by performing the following step. The SI/Blackout interlock seals in the Trips Disable circuit.

4.2.12 IF required for addition testing THEN:

- a. Restore SI/Blackout interlock by momentary lead lifting, as follows:

Tech 1 - Locate lead 1 on relay 2-1X-DGCD at Rear Instrument/Relay Rack 2-SR-4.		
Tech 2 - Verify lead 1 on relay 2-1X-DGCD at Rear Instrument/Relay Rack 2-SR-4 is identified.		
Tech 1 - Momentary lift lead 1 on relay 2-1X-DGCD.		
Relay 2-1X-DGCD at Rear Instrument/Relay Rack 2-SR-4. (Ref. PS-2-92054)	Tech 2 Initials	Tech 1 Initials
Momentary lift lead 1 on relay 2-1X-DGCD.	<i>MBE</i>	<i>JS</i>

- b. Check the following:

- Relay 2-1X-DGCD has de-energized
- Check Annunciator #220 Drop 53, DG2CD TRIPS DISABLED, has cleared

4.2.13 Restore the following equipment that could be affected when actuating relay 2-5X1-T21C:

- a. IF required for current plant conditions THEN close 2-21C4, Power Supply to 2-PS-E.
- b. IF required for current plant conditions, THEN restore Turbine Lube Oil Cooling per Annunciator Response 218 Drop 16, NESW to Turbine LO Cooler Locked Out.
- c. IF 2-SA5-TS-25, ACB 21AC TRIP, was opened in Step 4.2.2c, THEN close 2-SA5-TS-25, ACB 21AC TRIP.

JS

23

N/A 4/20/15 SM 4/20/15

N/A 4/20/15 SM 4/20/15

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Comments:

performed following governor tuning ref AR 2015-1589

Verified Complete By: _____

Date: 4/20/15

Reviewed By: _____

Date: 4/20/15 ✓

Supervisor/Manager Signature

h

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Data Sheet 3	Calculating Power Factor (PF)	Pages: 174 - 176	

4-20

1 PREREQUISITES

1.1 None

2 PRECAUTIONS AND LIMITATIONS

2.1 None

3 DETAILS

INIT

NOTE:

- Power Factor Limits: The acceptable operation region is developed based on running EDG at ≥ 3150 kW and ≤ 3500 kW load. Using the monitored EDG power, current and voltage, and applying these values in Eq.1 (i.e. $\text{Power [kW]} = (1.73 * \text{Voltage [volts]} * 35) * \text{Current [amperes]} * \text{Power Factor [unit less]} / 1000$ [watts per kW])
- Rearranging, $\text{Power Factor} = \text{Power [kW]} / (1.73 * \text{Voltage [volts]} * 35) * \text{Current [amperes]} / 1000$ [watts per kW]) (Eq. 2).
- $\text{Power Factor} = (\text{Power [kW]} * 16.5) / (\text{Voltage [volts as read]} * \text{Current [amperes]})$ (Eq. 3)

3.1 Perform the following to calculate Power factor (PF):

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CONTROLLED DOCUMENT

APR 20 2015

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Data Sheet 3	Calculating Power Factor (PF)	Pages: 174 - 176	

NOTE:

- Voltage: The voltage values are the metered voltage values, or the values as read on the secondary of the PT with a ratio of 35. The expected steady state voltage range is 3910 to 4400 volts, which corresponds to 111.7 to 125.7 volts secondary, respectively. The voltage used in the formula should be the average of the individual phases.
- Current: The maximum EDG current established is 600 amps, which is based on EDG nameplate rating. The current used in the formula should be the average of the individual phases.

3.1.1 Calculate the average of the three phases voltage.

Phase 1 119.5 Volts 120
Phase 2 120 Volts 120
Phase 3 119.5 Volts 120
Average Voltage 119.67 Volts 120

Q3 Q4
R R
IV

3.1.2 Calculate the average of the three phases current.

Phase 1 80 Amps 105
Phase 2 75 Amps 95
Phase 3 100 Amps 115
Average Current 85 Amps 105

Q3 Q4
R R
IV

3.1.3 Record current desired load.

Load 600 kW 600

Q3 Q4

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3.1.4 Calculate Power Factor:

(Power [kW] * 16.5)/(Voltage [volts as read] * Current [amperes]) = Power Factor
 (600 kW * 16.5) / (119.67 volts * 85 amperes)
 Desired Load Average Average
 (Step 3.1.3) (Step 3.1.1) (Step 3.1.2)

$$= \frac{0.97}{\text{Power Factor}}$$

$$\frac{(600)(16.5)}{(120)(105)} = 0.79$$

$$\frac{0.3}{R} \quad \frac{0.3}{R}$$

IV

CAUTION: Do not exceed 600 amperes on any phase. When making changes with the auto voltage regulator monitor current closely as it is most sensitive to adjustments with the auto voltage regulator.

3.1.5 IF not at desired Power Factor, THEN:

- Adjust auto voltage regulator as necessary to obtain desired Power Factor.
- Repeat Steps 3.1.1 to 3.1.4, to determine Power Factor.

4 FINAL CONDITIONS

Comments:

Verified Complete By: _____

Date: 4/20/15 4/15/15 4/20/15

Reviewed By: _____

Date: 4/20/15

Supervisor/Manager Signature

R

REVIEWED APR 21 2015