
REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 191-8210
SRP Section: 14.02 – Initial Plant Test Program – Design Certification and New License Applicants
Application Section:
Date of RAI Issue: 09/01/2015

Question No. 14.02-12

REQUIREMENTS

GDC 17 requires that onsite and offsite power systems provide sufficient capacity and capability and GDC 18 requires the testing of electrical power systems

ISSUE AND INFORMATION NEEDED

DCD Tier 2 Section 14.2.12.1.86 discusses the EDG mechanical system test.

- A) Discuss whether this test verifies that EDG diesel generator and auxiliary system alarms, interlocks, and control functions perform as designed and if so, how.
- B) Section 8.3.1.1.3.2, “Starting Mechanism and System” provides the mechanical and electrical trips to protect the EDGs. However 3.2 in the EDG mechanical system test does not include low temperature in the cooling water system, low level in fuel oil day tank, and low level in the cooling water system. Please explain why the aforementioned trips are not demonstrated as operable and function as described in Section 8.3.1. In addition, please explain how the electrical trips, as listed in 8.3.1.3.3, “Tripping Devices” are demonstrated.
- C) Please discuss how this test demonstrates that EDG instrumentation operates over the design range using actual or simulated signals.
- D) Please discuss how this test demonstrates that EDG alarms and interlocks occur as designed.
- E) Please discuss how this test demonstrates that the EDG instrumentation responds as designed to actual or simulated limiting malfunctions or failures.

- F) Please discuss how this test demonstrate that the EDG instrumentation response meets the accident analysis assumptions, such as time response, accuracy, and control stability.
- G) Please confirm that part 3.5 (demonstrating capability for 35 consecutive starts) is 35 consecutive starts, without failures.

Response

KHNP has reviewed the subject question and understands the staff's request. KHNP is in the process of upgrading the test plans presented in Section 14.2 of the DCD. This effort is focused on adding additional SSCs that are important to safety and risk significant as well as increasing the level of detail described in the DCD for test prerequisites, test methods and acceptance criteria for the various tests. It has been determined that the actions to be taken as a result of this question is within the scope of the upgrade effort. Therefore, KHNP will address the noted items in the upgrade effort, which is scheduled to be completed by February 1, 2016. A revised response to this question that incorporates the results of the upgrade effort will be submitted to the NRC after completion.

Response – (Rev. 1)

- A) To verify that EDG diesel generator system alarms, interlocks, and control functions perform as designed, Items 1.1, 1.2, 3.2, 3.3, 4.1, 4.3, 4.5, 5.2, 5.3, 5.4, and 5.5 will be provided, as shown in the attachment to this response.
- B) To verify how the mechanical and electrical trips, as listed in Subsection 8.3.1.1.3.3, "Tripping Devices" are demonstrated, Items 1.2, 3.3, 4.3, 4.5, and 5.4 will be provided, as shown in the attachment to this response.
- C) For performing this test, "Prerequisites" Items 2.2 and 2.3 must be completed to verify that EDG instrumentation operates over the design range, as shown in the attachment to this response.
- D) To verify that alarms and interlocks perform as designed, Items 1.2, 3.3, 4.3, 4.5, 5.4, and 5.5 will be provided, as shown in the attachment to this response.

To verify that the EDG alarm occurs as designed, a simulated signal for each alarm is used during the testing.

To verify that interlocks occur as designed, a simulated trip signal is used during the testing. To test the operation of the interlock upon a normal trip signal, the following procedure is performed.

- a) simulate the normal trip signal,
- b) start the EDG,
- c) verify that the EDG does not start.

To test the operation of the interlock upon an emergency start signal, the following procedure is performed.

- a) simulate the emergency trip signal,
- b) attempt to stop the EDG when the EDG is operating, then verify that the EDG does not stop,
- c) simulate the normal trip signal, then verify that the EDG does not stop.

Detailed procedures will be described in the detailed design phase.

- E) EDG instrumentation calibration is a prerequisites condition for testing of the EDG. Therefore, it is included as prerequisite condition Item 2.3.
- F) Prerequisite condition item 2.3 ensures that EDG instrumentation response meets the accident analysis assumptions, such as time response, accuracy, and control stability.
- G) To demonstrate an acceptable level of reliability of the EDG starting, reliability tests are performed by ensuring 25 consecutive tests without failures in accordance with IEEE 387, "Standard for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations." The ability of the EDG to reliably start is verified through items 1.2, 3.3, 4.2, and 5.6 as shown in the attachment.

Impact on DCD

The upgraded DCD Tier 2, Section 14.2.12.1.86 submitted by KHNP in letter MKD/NW-16-0156L, dated February 24, 2016 will be revised as indicated in the attachment associated with this response.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

APR1400 DCD TIER 214.2.12.1.86 Emergency Diesel Generator Mechanical System Test1.0 ~~OBJECTIVE~~ OBJECTIVES

1.1 To demonstrate the emergency diesel generator (EDG) mechanical system operates reliably

2.0 PREREQUISITES

2.1 Construction activities on the diesel generator system have been completed.

2.2 EDG system instrumentation has been calibrated.

2.3 Support systems required for operation of the EDG system are complete and operational.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Demonstrate that each EDG can be started from the control room and its local panel in automatic and manual.

3.2 Demonstrate that the following mechanical and electrical trips are operable and function as described in Subsection 8.3.1 (includes protective trips bypass tests).

3.2.1 Engine overspeed

3.2.2 Generator differential protection

3.2.3 Low-low lube oil pressure

3.2.4 Generator voltage-controlled overcurrent

Replacement A

14.2.12.1.86 Emergency Diesel Generator Mechanical System Test

1.0 OBJECTIVES

- 1.1 To demonstrate performance characteristics of the emergency diesel generators (EDGs) and associated auxiliaries, and verify that each diesel reaches rated speed within the required time.
- 1.2 To verify the operational capability of control circuits associated with the EDG and diesel auxiliaries, including the control circuit response to safety signals.
- 1.3 To demonstrate the reliability of each diesel generator by means of 25 consecutive valid tests.
- 1.4 To demonstrate the capability of each air storage tank to provide five diesel cranking cycles without being recharged.
- 1.5 To demonstrate the continuous operation of each diesel generator for 24 hours of full power, 2 hours at load equivalent to the short time rating, and 22 hours at load equivalent to the continuous rating.
- 1.6 To demonstrate the fuel oil consumption of the EDG while operating at the continuous load rating.

2.0 PREREQUISITES

- 2.1 Construction activities on the diesel generator system have been completed.
- 2.2 Required electrical power supplies and control circuits are operational.
- 2.3 EDG system instrumentation has been calibrated.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 The component cooling water system is available to supply cooling water to the diesel engine heat exchanger.
- 2.6 The fuel oil system, cooling water system, starting air system, lubrication system, and combustion air intake and exhaust system are available.

3.0 TEST METHOD

- 3.1 Start the EDGs and record the time required to reach rated speed.
- 3.2 Evaluate performance characteristics of the EDGs and associated auxiliaries.
- 3.3 Evaluate the operational capability of all control circuits associated with the EDG including the control circuit response to safety signals.
- 3.4 Evaluate the ability of each diesel generator by means of 25 consecutive valid tests.
- 3.5 Evaluate the ability of each air storage tank to provide five diesel cranking cycles without being recharged.

Replacement A (Con't)

- 3.6 Evaluate the fuel oil consumption is monitored with EDG operating at the continuous load rating.
- 3.7 Evaluate the continuous operation of each diesel generator for 24 hours of full power, 2 hours at load equivalent to the short time rating, and 22 hours at load equivalent to the continuous rating.

4.0 DATA REQUIRED

- 4.1 EDG and associated auxiliaries operating parameters
- 4.2 EDG engine consecutive starts data
- 4.3 Set points of EDG trips
- 4.4 EDG governor operating data
- 4.5 Set points at which alarms and interlocks occur
- 4.6 EDG starting air volume parameters after consecutive starts

5.0 ACCEPTANCE CRITERIA

- 5.1 The required time for each EDG to reach rated speed is in accordance with Subsection 8.3.1.1.2.4.
- 5.2 Performance characteristics of the EDGs and associated auxiliaries are within design requirements.
- 5.3 Each EDG starts automatically on receipt of a safety injection actuation signal, containment spray actuation signal, auxiliary feedwater actuation signal, or 4.16 kV bus under-voltage signal.
- 5.4 Each EDG trips automatically on receipt of signals for automatic trip conditions described in Subsection 8.3.1.1.3.
- 5.5 The alarm, interlocks, controls, and operation of the EDG and associated auxiliaries are as described in Subsection 8.3.1.1.3, 9.5.5, 9.5.6, 9.5.7, and 9.5.8.
- 5.6 Each diesel generator completes 25 consecutive valid tests.
- 5.7 Each air storage tank is capable of providing five diesel cranking cycles without being recharged.
- 5.8 The EDG engine cooling water system operates as described in Subsection 9.5.5.
- 5.9 The EDG engine starting air system operates as described in Subsection 9.5.6.
- 5.10 The EDG engine lubrication system operates as described in Subsection 9.5.7.
- 5.11 The EDG engine combustion air and exhaust system operates as described in Subsection 9.5.8.

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~~3.2.5 Low-pressure lube oil~~

~~3.2.6 High-pressure crankcase~~

~~3.2.7 High-temperature bearings~~

~~3.2.8 High-temperature lube oil out~~

~~3.2.9 High-high temperature jacket water~~

~~3.2.10 High vibration~~

~~3.3 Demonstrate that the following parameters are correctly monitored in the control room and at the local panel:~~

~~3.3.1 Lube oil temperature and pressures~~

~~3.3.2 Bearing temperatures~~

~~3.3.3 Cooling water temperatures and pressures~~

~~3.3.4 Speed~~

~~3.3.5 Starting air pressure~~

~~3.4 Demonstrate the operation of the following status indications:~~

~~3.4.1 Cooling water not available~~

~~3.4.2 Emergency diesel generator breaker racked out~~

~~3.4.3 Emergency diesel generator overspeed~~

~~3.4.4 Loss of control power~~

APR1400 DCD TIER 2~~3.4.5 Generator fault~~~~3.4.6 Low air and oil pressure~~~~3.4.7 Maintenance mode~~~~3.5 Demonstrate the capability for ~~35~~25 consecutive starts.~~~~3.6 Demonstrate full load capability.~~~~3.7 Demonstrate EDG speed control.~~~~4.0 DATA REQUIRED~~~~4.1 EDG engine operating parameters~~~~4.2 EDG engine consecutive starts data~~~~4.3 Setpoints of EDG trips~~~~4.4 EDG governor operating data~~~~4.5 Setpoints at which alarms and interlocks occur~~~~5.0 ACCEPTANCE CRITERIA~~~~5.1 The EDG mechanical system performs its designed functions as described in Subsection ~~8.3.1.1.3~~.~~14.2.12.1.87 Emergency Diesel Generator Electrical System Test1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To verify the emergency diesel generators (EDGs) can supply power at the rated load, voltage, and frequency under all design conditions

REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 191-8210

SRP Section: 14.02 – Initial Plant Test Program – Design Certification and New License Applicants

Application Section:

Date of RAI Issue: 09/01/2015

Question No. 14.02-13

REQUIREMENTS

GDC 17 requires that onsite and offsite power systems provide sufficient capacity and capability and

GDC 18 requires the testing of electrical power systems

ISSUE AND INFORMATION NEEDED

DCD Tier 2 Section 14.2.12.1.87 discusses the EDG electrical system test.

- A) Discuss whether this test verifies that EDG alarms, interlocks, and control functions perform as designed and if so, how.
- B) Adequate ventilation is necessary for the operation of EDGs. Discuss how adequate ventilation is verified before performing tests on the EDG.

Response

KHNP has reviewed the subject question and understands the staff's request. KHNP is in the process of upgrading the test plans presented in Section 14.2 of the DCD. This effort is focused on adding additional SSCs that are important to safety and risk significant as well as increasing the level of detail described in the DCD for test prerequisites, test methods and acceptance criteria for the various tests. It has been determined that the actions to be taken as a result of this question is within the scope of the upgrade effort. Therefore, KHNP will address the noted items in the upgrade effort, which is scheduled to be completed by February 1, 2016. A revised response to this question that incorporates the results of the upgrade effort will be submitted to the NRC after completion.

Response – (Rev. 1)

- A) The testing for EDG alarms, interlocks, and control functions is performed in accordance with Subsection 14.2.12.1.86, "Emergency Diesel Generator Mechanical System Test." The testing of Subsection 14.2.12.1.87, "Emergency Diesel Generator Electrical System Test" is performed when the EDG mechanical system test in Subsection 14.2.12.1.86 is completed as stated in 2.0 "Prerequisites of Subsection 14.2.12.1.87." Attachment 2 to this response contains the revised Subsection 14.2.12.1.86 (Related items are: 1.1, 1.2, 3.2, 3.3, 4.1, 4.3, 4.5, 5.2, 5.3, 5.4, and 5.5 of Attachment 2).
 - B) The testing for EDG area HVAC is provided in Subsection 14.2.12.1.97, "Emergency Diesel Generator Area HVAC System Test."
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Impact on DCD

The upgraded DCD Tier 2, Section 14.2.12.1.87 submitted by KHNP in letter MKD/NW-16-0156L, dated February 24, 2016 will be revised as indicated in Attachment 1 to this response.

The upgraded DCD Tier 2, Section 14.2.12.1.86 submitted by KHNP in letter MKD/NW-16-0156L, dated February 24, 2016 will be revised as indicated in Attachment 2.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

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3.4.5 Generator fault

3.4.6 Low air and oil pressure

3.4.7 Maintenance mode

3.5 Demonstrate the capability for ~~35~~25 consecutive starts.

3.6 Demonstrate full load capability.

3.7 Demonstrate EDG speed control.

4.0 DATA REQUIRED

4.1 EDG engine operating parameters

4.2 EDG engine consecutive starts data

4.3 Setpoints of EDG trips

4.4 EDG governor operating data

4.5 Setpoints at which alarms and interlocks occur

5.0 ACCEPTANCE CRITERIA

Replace with A (next page)

5.1 The EDG mechanical system performs its designed functions as described in Subsection 8.3.1.1.3.

~~14.2.12.1.87~~ Emergency Diesel Generator Electrical System Test

~~1.0~~ ~~OBJECTIVE~~ OBJECTIVES

~~1.1~~ ~~To verify the emergency diesel generators (EDGs) can supply power at the rated load, voltage, and frequency under all design conditions~~

Replacement A

14.2.12.1.87 Emergency Diesel Generator Electrical System Test

1.0 OBJECTIVES

- 1.1 To demonstrate the ability of each EDG to carry the continuous rated load, the short-time rated load, and design rate load.
- 1.2 To demonstrate the ability of each EDG to attain and stabilize frequency and voltage within the rated limits and time.
- 1.3 To demonstrate that each EDG starts automatically on an engineered safety feature actuation signal (ESFAS) and/or 4.16 kV bus loss of voltage, and that the associated EDG feeder breaker closes when, on an under-voltage signal received from the respective 4.16 kV bus, the EDG rated voltage and frequency has been attained.
- 1.4 To demonstrate the capability of each EDG to withstand a maximum rate load rejection without exceeding speeds or voltages that cause tripping or damage.
- 1.5 To demonstrate the operability of each diesel generator feeder breaker and associated interlocks.

2.0 PREREQUISITES

- 2.1 Construction activities on the diesel generator system have been completed.
- 2.2 EDG mechanical system test is completed.
- 2.3 EDG system instrumentation has been calibrated.
- 2.4 The component cooling water system is available to supply cooling water to the diesel engine heat exchanger.
- 2.5 The fuel oil system, cooling water system, starting air system, lubrication system, and combustion air intake and exhaust system are available.
- 2.6 Electrical testing is complete as needed to allow the buses to be energized.
- 2.7 EDG electrical voltage tests are complete.
- 2.8 Engineered safety features loads are available to be loaded onto the bus.

3.0 TEST METHOD

- 3.1 Demonstrate the continuous rated load, short-time rated load and design rate load test.
- 3.2 Evaluate the ability of each EDG to attain and stabilize frequency and voltage within the rated time.
- 3.3 Evaluate the ability of each EDG to start automatically on an ESFAS and/or 4.16 kV bus loss of voltage. Evaluate the ability of the associated breaker to close on an under-voltage signal received from the respective 4.16 kV bus when the EDG

Replacement A (Con't)

rated voltage and frequency has been attained.

- 3.4 Evaluate the ability of each EDG to withstand a maximum rated load rejection without exceeding speeds or voltages.
- 3.5 Evaluate the operability of each EDG feeder breaker and associated interlocks.

4.0 DATA REQUIRED

- 4.1 Starting and loading sequence timing
- 4.2 Test data traces for starting, stopping, and load shedding
- 4.3 Running data for the parameters monitored during each of the required testing sequences
- 4.4 Verification of field performance data versus shop data

5.0 Acceptance criteria

- 5.1 The continuous rated load, short-time rated load, and design rated load tests are in accordance with Section 8.3.1.1.2.4.
- 5.2 Each EDG can attain and stabilize frequency and voltage within specifications.
- 5.3 Each EDG starts automatically on an ESFAS and/or 4.16 kV bus loss of voltage and the feeder breaker and the associated breakers close on receipt of an under-voltage signal from the respective 4.16 kV bus when the EDG has attained its rated voltage and frequency.
- 5.4 Each EDG is capable of withstanding the maximum rated load rejection without exceeding frequency or voltage design limits.
- 5.5 The controls and interlocks associated with the EDG feeder breakers operate in accordance with system design.

APR1400 DCD TIER 2**2.0 PREREQUISITES**

- 2.1 ~~Construction activities on the EDG system have been~~are completed.
- 2.2 ~~EDG mechanical system test is completed.~~
- 2.3 ~~EDG system instrumentation has been calibrated.~~
- 2.4 ~~Support systems required for operation of the EDG system are complete and operational.~~
- 2.5 ~~Test instrumentation is available and calibrated.~~
- 2.6 ~~Electrical testing is complete as needed to allow the buses to be energized.~~
- 2.7 ~~DG electrical voltage tests are complete.~~
- 2.8 ~~Engineered safety features (ESF) loads are available to be loaded onto the bus.~~

3.0 TEST METHOD

- 3.1 ~~Demonstrate all control logic and controls including the EDG sequencer and response to ESF actuation signals.~~
- 3.2 ~~Demonstrate the continuous rating of the EDG for an interval of not less than 1 hour and until temperature equilibrium has been attained.~~
- 3.3 ~~Demonstrate that the EDG unit starts from standby conditions, reaches required voltage and frequency within acceptable limits and time as defined in the plant Technical Specifications.~~
- 3.4 ~~Demonstrate by simulating a loss of offsite power that:~~

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- a. ~~The emergency buses are de-energized and the loads are shed from the emergency buses.~~
 - b. ~~The EDG starts on the auto-start signal from its standby conditions, attains the required voltage and frequency within acceptable limits and time, and energizes the auto-connected shutdown loads through the load sequencer.~~
- 3.5 ~~Demonstrate that on a safety injection actuation signal (SIAS), the EDG starts on the autostart signal from its standby conditions, and attains the required voltage and frequency within acceptable limits and time.~~
- 3.6 ~~Demonstrate the EDG's capability to reject a loss of the largest single load, and verify that the voltage and frequency requirements are met and that the EDG unit does not trip on overspeed.~~
- 3.7 ~~EDG endurance and margin test: demonstrate full-load carrying capability for an interval of not less than 24 hours. Verify that voltage and frequency requirements are maintained. Verify that mechanical systems such as fuel, lubrication, and cooling function within design limits.~~
- 3.8 ~~Demonstrate hot restart functional capability at full load temperature conditions (after it has operated for 2 hours at full load) by verifying that the EDG starts on a manual or autostart signal, and attains the required voltage and frequency within acceptable limits and time. This testing is to occur immediately after the full load carrying capability demonstration.~~
- 3.9 ~~Demonstrate the ability to:~~
- a. ~~Synchronize the diesel generator unit with offsite power while the unit is connected to the emergency load~~
 - b. ~~Transfer this load to the offsite power~~

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e. Isolate the diesel generator unit

d. Restore it to standby status

3.10 Demonstrate that with the EDG operating in a test mode while connected to its bus, a simulated SIAS overrides the test mode by:

a. Returning the EDG to standby operation

b. Automatically energizing the emergency loads from offsite power

3.11 Demonstrate that, by starting and running both redundant EDG units simultaneously, potential common failure modes that may be undetected in single EDG unit tests do not occur.

4.0 DATA REQUIRED

4.1 Starting and loading sequence timing

4.2 Test data traces for starting, stopping, and load shedding

4.3 Running data for the parameters monitored during each of the required testing sequences

4.4 Verification of field performance data versus shop data

5.0 ACCEPTANCE CRITERIA

5.1 The EDG electrical system performs its designed functions as described in Subsection 8.3.1.1.3.

APR1400 DCD TIER 214.2.12.1.86 Emergency Diesel Generator Mechanical System Test1.0 ~~OBJECTIVE~~ OBJECTIVES

1.1 To demonstrate the emergency diesel generator (EDG) mechanical system operates reliably

2.0 PREREQUISITES

2.1 Construction activities on the diesel generator system have been completed.

2.2 EDG system instrumentation has been calibrated.

2.3 Support systems required for operation of the EDG system are complete and operational.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Demonstrate that each EDG can be started from the control room and its local panel in automatic and manual.

3.2 Demonstrate that the following mechanical and electrical trips are operable and function as described in Subsection 8.3.1 (includes protective trips bypass tests).

3.2.1 Engine overspeed

3.2.2 Generator differential protection

3.2.3 Low-low lube oil pressure

3.2.4 Generator voltage-controlled overcurrent

Replacement A

14.2.12.1.86 Emergency Diesel Generator Mechanical System Test

1.0 OBJECTIVES

- 1.1 To demonstrate performance characteristics of the emergency diesel generators (EDGs) and associated auxiliaries, and verify that each diesel reaches rated speed within the required time.
- 1.2 To verify the operational capability of control circuits associated with the EDG and diesel auxiliaries, including the control circuit response to safety signals.
- 1.3 To demonstrate the reliability of each diesel generator by means of 25 consecutive valid tests.
- 1.4 To demonstrate the capability of each air storage tank to provide five diesel cranking cycles without being recharged.
- 1.5 To demonstrate the continuous operation of each diesel generator for 24 hours of full power, 2 hours at load equivalent to the short time rating, and 22 hours at load equivalent to the continuous rating.
- 1.6 To demonstrate the fuel oil consumption of the EDG while operating at the continuous load rating.

2.0 PREREQUISITES

- 2.1 Construction activities on the diesel generator system have been completed.
- 2.2 Required electrical power supplies and control circuits are operational.
- 2.3 EDG system instrumentation has been calibrated.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 The component cooling water system is available to supply cooling water to the diesel engine heat exchanger.
- 2.6 The fuel oil system, cooling water system, starting air system, lubrication system, and combustion air intake and exhaust system are available.

3.0 TEST METHOD

- 3.1 Start the EDGs and record the time required to reach rated speed.
- 3.2 Evaluate performance characteristics of the EDGs and associated auxiliaries.
- 3.3 Evaluate the operational capability of all control circuits associated with the EDG including the control circuit response to safety signals.
- 3.4 Evaluate the ability of each diesel generator by means of 25 consecutive valid tests.
- 3.5 Evaluate the ability of each air storage tank to provide five diesel cranking cycles without being recharged.

Replacement A (Con't)

- 3.6 Evaluate the fuel oil consumption is monitored with EDG operating at the continuous load rating.
- 3.7 Evaluate the continuous operation of each diesel generator for 24 hours of full power, 2 hours at load equivalent to the short time rating, and 22 hours at load equivalent to the continuous rating.

4.0 DATA REQUIRED

- 4.1 EDG and associated auxiliaries operating parameters
- 4.2 EDG engine consecutive starts data
- 4.3 Set points of EDG trips
- 4.4 EDG governor operating data
- 4.5 Set points at which alarms and interlocks occur
- 4.6 EDG starting air volume parameters after consecutive starts

5.0 ACCEPTANCE CRITERIA

- 5.1 The required time for each EDG to reach rated speed is in accordance with Subsection 8.3.1.1.2.4.
- 5.2 Performance characteristics of the EDGs and associated auxiliaries are within design requirements.
- 5.3 Each EDG starts automatically on receipt of a safety injection actuation signal, containment spray actuation signal, auxiliary feedwater actuation signal, or 4.16 kV bus under-voltage signal.
- 5.4 Each EDG trips automatically on receipt of signals for automatic trip conditions described in Subsection 8.3.1.1.3.
- 5.5 The alarm, interlocks, controls, and operation of the EDG and associated auxiliaries are as described in Subsection 8.3.1.1.3, 9.5.5, 9.5.6, 9.5.7, and 9.5.8.
- 5.6 Each diesel generator completes 25 consecutive valid tests.
- 5.7 Each air storage tank is capable of providing five diesel cranking cycles without being recharged.
- 5.8 The EDG engine cooling water system operates as described in Subsection 9.5.5.
- 5.9 The EDG engine starting air system operates as described in Subsection 9.5.6.
- 5.10 The EDG engine lubrication system operates as described in Subsection 9.5.7.
- 5.11 The EDG engine combustion air and exhaust system operates as described in Subsection 9.5.8.

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~~3.2.5 Low-pressure lube oil~~

~~3.2.6 High-pressure crankcase~~

~~3.2.7 High-temperature bearings~~

~~3.2.8 High-temperature lube oil out~~

~~3.2.9 High-high temperature jacket water~~

~~3.2.10 High vibration~~

~~3.3 Demonstrate that the following parameters are correctly monitored in the control room and at the local panel:~~

~~3.3.1 Lube oil temperature and pressures~~

~~3.3.2 Bearing temperatures~~

~~3.3.3 Cooling water temperatures and pressures~~

~~3.3.4 Speed~~

~~3.3.5 Starting air pressure~~

~~3.4 Demonstrate the operation of the following status indications:~~

~~3.4.1 Cooling water not available~~

~~3.4.2 Emergency diesel generator breaker racked out~~

~~3.4.3 Emergency diesel generator overspeed~~

~~3.4.4 Loss of control power~~

APR1400 DCD TIER 2~~3.4.5 Generator fault~~~~3.4.6 Low air and oil pressure~~~~3.4.7 Maintenance mode~~~~3.5 Demonstrate the capability for ~~35~~25 consecutive starts.~~~~3.6 Demonstrate full load capability.~~~~3.7 Demonstrate EDG speed control.~~~~4.0 DATA REQUIRED~~~~4.1 EDG engine operating parameters~~~~4.2 EDG engine consecutive starts data~~~~4.3 Setpoints of EDG trips~~~~4.4 EDG governor operating data~~~~4.5 Setpoints at which alarms and interlocks occur~~~~5.0 ACCEPTANCE CRITERIA~~~~5.1 The EDG mechanical system performs its designed functions as described in Subsection 8.3.1.1.3.~~14.2.12.1.87 Emergency Diesel Generator Electrical System Test1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To verify the emergency diesel generators (EDGs) can supply power at the rated load, voltage, and frequency under all design conditions