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.:	**529-8711**
SRP Section:	**14.02 – Initial Plant Test Program**
Application Section:	**8.4**
Date of RAI Issue:	**11/14/2016**

Question No. 14.02-71

REQUIREMENTS

10 CFR Part 50, Appendix A, GDC 17 requires that onsite and offsite power systems provide sufficient capacity and capability and 10 CFR Part 50, Appendix A, GDC 18 requires the testing of electrical power systems.

ISSUE AND INFORMATION NEEDED

In response to RAI 191-8210, Question 14.02-11, dated October 5, 2016 (ML16279A510), the applicant provided revised DCD Tier 2 Sections 14.2.12.1.89, “Alternate AC Source System Test (Mechanical),” and 14.2.12.1.90, “Alternate AC Source System Test (Electrical).” Furthermore, in response to RAI 191-8210, Question 14.02-11, the applicant added a new section, DCD Tier 2 Section 8.4.1.3.1, “AAC Instrumentation and Control.”

In its response to RAI 165-8192, Question 08.04-6(b), dated November 18, 2015 (ML15322A404) and in its response to follow-up RAI 412-8525, Question 08.04-13(b) and RAI 412-8525, Question 08.04-15(b), dated May 2, 2016 (ML16123A384), the applicant stated that the MCR and RSR contain all of the control and/or monitoring provision for the operator to manually actuate the components of the systems necessary to cope with an SBO condition. In revised DCD Tier 2 Section 14.2.12.1.89, item 3.1 states “demonstrate that the GTG and its supporting systems can be started in automatic and manual modes using Main Control Room (MCR) and local control station.” Please discuss how the initial test program in DCD Tier 2 Section 14.2.12.1.89, demonstrates that the AAC Gas Turbine Generator (GTG) and its supporting systems can be started, controlled and monitored from the RSR to cope with an SBO.

The new section, DCD Tier 2 Section 8.4.1.3.1, discusses parameters for monitoring in the MCR and local control panel. The applicant further discusses status indications in the local control panel. The applicant stated, as discussed above, that the RSR contains all of the control and/or

monitoring provision for the operator to cope with an SBO condition. Please discuss how parameters for monitoring and status indications in the RSR are addressed in DCD Tier 2 Section 8.4.1.3.1.

In response to RAI 165-8192, Question 08.04-7(b), dated November 18, 2015 (ML15322A404), the applicant stated that the performance of the AAC power source (voltage, current, frequency, volt-ampere reactive, watts, watt-hour, and power factor) and status of circuit breaker position will be monitored from the control room. This information is on performance monitoring of the AAC, and DCD Tier 2 Section 8.4.1.3.1 discusses various monitoring and control devices to provide the operator with control and operational status information for the AAC system. Please discuss why the above information on monitoring the performance of the AAC source is not included in the new DCD Section 8.4.1.3.1, or add the information to the new DCD Section 8.4.1.3.1.

Response

Since the AAC Gas Turbine Generator (GTG) and its supporting systems can be started, controlled and monitored from the Remote Shutdown Room (RSR), the testing to demonstrate this capability will be added to the test plan detailed in Section 14.2.12.1.89, Alternate AC Source System Test (Mechanical) and Section 14.2.12.1.90, Alternate AC Source System Test (Electrical).

As stated in the response to RAI 412-8525, Question 08.04-15(b) all of the performance monitoring parameters listed in the response to RAI 8192, Question 08.04-7(b) for the AAC power source compliance to Criterion D are available in both the Main Control Room (MCR) and the RSR. Therefore, DCD Tier 2, Subsection 8.4.1.3.1 will be revised to include the RSR.

Also, DCD Tier 2, Subsection 8.4.1.3.1 will be revised to include the parameters for the performance of the AAC power source (voltage, current, frequency, volt-amperes reactive, watts, watt-hours, and power factor) and the status of circuit breaker position that are available in both the MCR and RSR.

Impact on DCD

DCD Tier 2 Subsections 8.4.1.3.1, 14.2.12.1.89 and 14.2.12.1.90 will be revised as indicated in the attachment.

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.

8.4.1.3.1 AAC Instrumentation and Control

Various monitoring and control devices are provided to provide the operator with control and operational status information for the AAC system. The COL applicant is to specify the specific parameters for monitoring, alarms, mechanical and electrical trip for testing, and emergency trips. (COL 8.4(4)). Generally, parameters described in this Subsection are used.

The following mechanical trips are provided to protect the AAC GTG during testing:

a. Low lube oil pressure

b. Low lube oil level in lube oil tank or sump

c. High pressure in crank case

d. High high lube oil temperature

e. low fuel oil pressure

These mechanical trips are bypassed during the operation of the AAC GTG in the emergency mode.

The following electrical trips are provided to protect the AAC GTG during testing:

a. Generator electrical protection

b. Electronic governor failure

All signals of the protective relay trip, except the trip signals listed below, are bypassed during the operation of the AAC GTG in the emergency mode.

a. Engine over speed

b. Generator differential protection , RSR,

c. Manual trip

The following parameters are monitored in the MCR and local control panel.

a. Lube oil temperature and pressure

b. Engine bearing temperatures

c. Engine speed

d. Air pressure (if air is used for starting)

The following status indication are provided in local control panel.

a. Engine over speed

b. Low oil pressures

c. Low air pressure (if air is used for starting)

d. GTG output breaker position

e. Loss of control power

f. Generator fault

Insert A on the next page

Insert A

The status of each Class 1E 4.16 kV breaker position is indicated in the MCR, RSR, and the circuit breaker cubicle. The instrumentation for the AAC GTG provides the following indicators in the MCR and RSR:

a. Output voltage

b. Output frequency

c. Output ampere

d. Output watts

e. Output vars

f. Power factor

g. Output watt-hours

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Replacement A

14.2.12.1.89 Alternate AC Source System Test (Mechanical)

1.0 OBJECTIVES

1.1 To demonstrate that the Alternate AC Source (Gas Turbine Generator – GTG) set operates reliably.

1.2 To demonstrate the operation of the GTG supporting systems, namely, fuel oil storage & transfer system, starting system, lubrication system, combustion intake air and exhaust system, and ventilation system for GTG enclosure.

1.3 To demonstrate the capability of the starting system to provide five (5) GTG cycles (for starting), without being charged.

1.4 To determine that the fuel oil consumption of GTG while operating at continued load rating condition.

2.0 PRE-REQUESITES

2.1 The required construction activities is completed for the Gas Turbine Generator and its supporting systems

2.2 The GTG supporting systems, namely, fuel oil storage & transfer system, starting system, lubrication system, combustion intake air and exhaust system, and ventilation system for GTG enclosure are available and operational

2.3 GTG and its supporting system instrumentation is available, functional and calibrated for its operation / tests

2.4 Test instrumentation is available and calibrated

3.0 TEST METHOD

, Remote Shutdown Room (RSR),

3.1 Demonstrate that the GTG and its supporting systems can be started in automatic and manual modes using Main Control Room (MCR) and local control station.

3.2 Demonstrate that the following mechanical trips are functional:

3.2.1 Engine over speed

3.2.2 Low lube oil pressure

3.2.3 Low lube oil level in lube oil tank or sump

3.2.4 High pressure in crank case

3.2.5 High-high lube oil temperature

3.2.6 Low fuel oil pressure

Replacement A (Con't)

3.3 Demonstrate that the following parameters are monitored in the MCR, RSR, and local control panel:

3.3.1 Lube oil temperature and pressure

3.3.2 Engine bearing temperatures

3.3.3 Engine speed

3.3.4 Air pressure (if air is used for starting)

3.4 Demonstrate the operation of following status indication:

3.4.1 Engine Over speed

3.4.2 Low oil pressures

3.4.3 Low air pressure (if air is used for starting)

3.5 Evaluate the ability of the starting system to allow cranking a cold GTG five (5) times, without re-charging the receiver / motor.

3.6 Verify that the system alarms, instrumentation, interlocks and controls

3.7 Fuel oil is transferred from the fuel oil storage tank to the fuel oil day tanks by means of transfer pumps; record the appropriate flow parameter.

3.8 Verify the operability of the GTG supporting systems (namely, fuel oil storage & transfer system, starting system, lubrication system, combustion intake air and exhaust system, and ventilation system for GTG enclosure).

3.9 Fuel oil consumption is monitored at continuous load rating condition.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms and interlocks occur

4.2 AAC source system and supporting system operating parameters at designated loads

4.3 GTG consecutive start data

4.4 GTG starting air volume parameters after consecutive starts (if air is used)

4.5 Battery capacity after consecutive starts (if motor is used)

5.0 ACCEPTANCE CRITERIA

5.1 Performance requirements of GTG and associated mechanical system (starting system, lubrication system, combustion intake air & exhaust system, and ventilation system for GTG enclosure) are within the design requirements.

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Replacement B

14.2.12.1.90 Alternate AC Source System Test (Electrical)

1.0 OBJECTIVES

1.1 To demonstrate that the Alternate AC Source (Gas Turbine Generator - GTG) can reliably supply power at continuous rated load, the short-time rated load, and design rated load.

1.2 To demonstrate that the GTG starts and verify that the required voltage and frequency are attained within the required time limits.

1.3 To demonstrate the ability of the GTG starting automatically on the event of LOOP and to synchronize with the offsite power system.

1.4 To demonstrate the capability of GTG breaker and associated interlocks.

1.5 To demonstrate GTG proper operation including a test of loss of the largest single load and complete loss of load.

2.0 PRE-REQUESITES

2.1 The required construction activities are completed for the GTG and its supporting systems

2.2 The GTG mechanical system test is completed (See 14.2.12.1.89)

2.3 GTG system instrumentation is available, functional and calibrated for its operation / tests

2.4 Test instrumentation is available and calibrated

2.5 GTG Enclosure ventilation system test is completed (See 14.2.12.1.89)

2.6 Required electrical power supplies and control circuits are available.

2.7 Electrical testing is complete as needed to allow the required buses to be energized.

3.0 TEST METHOD

3.1 Demonstrate that the GTG starts from standby conditions and reaches required voltage and frequency within acceptable limits and time requirements using Main Control Room (MCR) and Remote Shutdown Room (RSR).

3.2 Demonstrate that the largest single load and complete load are shed with no tripping on over speed is verified. using MCR and RSR.

3.3 Demonstrate by simulating a SBO event that: (a) non-essential loads are shed from the bus; (b) the GTG starts on auto-start signal from its standby conditions; (c) attains the required voltage and frequency within acceptable limits and time;

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(d) energizes the respective buses; and (e) can be manually connected with the respective buses within ten minutes. using MCR and RSR.

3.4 Demonstrate the ability to synchronize the GTG with offsite power while loaded upon a simulated restoration of offsite power: (a) Parallel the SBO bus with offsite power, (b) transfer SBO GTG and open SBO GTG output circuit breaker; (c) Restore the SBO GTG to standby status. using MCR and RSR.

3.5 Evaluate the operability of GTG breaker and associated interlocks. using MCR and RSR.

3.6 Demonstrate that the following electrical trips are functional: using Local Control Panel (LCP):

3.2.1 Generator differential protection

3.2.2 Generator electrical protection

3.3.3 Electronic governor failure

3.7 Demonstrate the operation of following status indication: using LCP:

3.4.1 GTG output breaker position

3.4.2 Loss of control power

3.4.3 Generator fault

4.0 DATA REQUIRED

4.1 Test data for GTG output voltage, frequency and output circuit breaker closing data during start sequence

4.2 Running data for the parameters monitored during each of the required testing sequence

4.3 Verification of field data versus shop data

4.4 Periodic area temperature

5.0 ACCEPTANCE CRITERIA

5.1 SBO GTG electrical system meets the design requirements as described in Section 8.4

5.2 The controls, alarms, interlocks, and operation of the GTG breaker and support system are as described in Section 8.4.

5.3 GTG attains the required voltage and frequency within the required time limits

5.4 GTG starts automatically on receipt of an under-voltage signal from the 4.16 kV bus.