Advanced Passive 1000 (AP1000)
Generic Technical Specification Traveler (GTST)

Title: Changes related to Section 3.8.3, Inverters - Operating

I. Technical Specifications Task Force (TSTF) Travelers, Approved Since Revision 2 of STS NUREG-1431, and Used to Develop this GTST

TSTF Number and Title:

TSTF-425, Rev. 3, Relocate Surveillance Frequencies to Licensee Control - RITSTF Initiative 5b

STS NUREGs Affected:

TSTF-425, Rev. 3: NUREG-1430, -1431, -1432, -1433, -1434

NRC Approval Date:

TSTF-425, Rev. 3: 18-Mar-2009

TSTF Classification:

TSTF-425, Rev. 3: Technical Change

II. Reference Combined License (RCOL) Standard Departures (Std. Dep.), RCOL COL Items, and RCOL Plant-Specific Technical Specifications (PTS) Changes Used to Develop this GTST

RCOL Std. Dep. Number and Title:

None

RCOL COL Item Number and Title:

None

RCOL PTS Change Number and Title:

VEGP LAR DOC D13:	LCO Statement in TS 3.8.3, Inverters - Operating, is revised deleting details.

III. Comments on Relations Among TSTFs, RCOL Std. Dep., RCOL COL Items, and RCOL PTS Changes

This section discusses the considered changes that are: (1) applicable to operating reactor designs, but not to the AP1000 design; (2) already incorporated in the GTS; or (3) superseded by another change.

TSTF-432, Rev. 1, Changes to Technical Specification End States, is based on Topical Report, WCAP-16294. WCAP-16294 did not consider AP1000 design and is therefore not applicable for AP1000 STS without further analyses. TSTF-432 was not considered.

TSTF-425 is deferred for future consideration.

Rev. 0 version of this GTST included a number of changes replacing “bus[es]” with “electric power distribution system(s)” or “division.” Based on APOG comments, it is recognized that the use of the term is appropriate in many locations and previous changes were withdrawn/corrected. However, some additional editorial changes are included, as presented in Section VI of this GTST, under heading “Description of additional changes proposed by NRC staff/preparer of GTST.” The changes also ensure use of “electrical power system, as opposed to “electric power system.”

IV. Additional Changes Proposed as Part of this GTST (modifications proposed by NRC staff and/or clear editorial changes or deviations identified by preparer of GTST)

Clarification of nomenclature used for Class 1E electric power distribution subsystems, consistent with VEGP LAR DOC A112.

Clarifying editorial changes were made in the Specifications and in the “Applicable Safety Analyses,” “LCO,” and “Actions” sections of the Bases.

APOG Recommended Changes to Improve the Bases

Throughout the Bases, references to Sections and Chapters of the FSAR do not include the “FSAR” clarifier. Since these Section and Chapter references are to an external document, it is appropriate to include the “FSAR” modifier. (DOC A003)

Revise LCO 3.8.3 Note 1 reference to “constant voltage source transformer” with “voltage regulating transformer.”

Revise TS 3.8.3 Bases for Required Action A.1 for consistency with TS 3.8.3 Condition A Note and TS 3.8.5 Action A Completion Time.

Remove the additional clarification of nomenclature changes proposed by the NRC staff. Since the AP1000 Owner's Group desires to maintain consistency across the fleet, a presentation difference between the STS NUREG and issued GTS / COLs is not warranted. (Considering the issue raised by APOG, nomenclature changes are adjusted. The use of the term “bus” is retained as appropriate. Also “electrical power distribution” is used instead of “electric power distribution.”

V. Applicability

Affected Generic Technical Specifications and Bases:

Section 3.8.3, Inverters – Operating

Changes to the Generic Technical Specifications and Bases:

LCO 3.8.3 is revised deleting “(Divisions A and D, one each and Divisions B and C two each; six total).” (DOC D13)

LCO 3.8.3 Note 1 was revised replacing “constant voltage source transformer” with “voltage regulating transformer.” (APOG comment)

LCO and Required Action A.1 Note were revised inserting “AC” before “instrument and control bus.” (NRC staff comment)

The Bases discussion for various sections were revised to provide clarifications and to ensure use of “electrical power distribution” as opposed to “electric power distribution.” (NRC staff comment)

The acronym “FSAR” is added to modify “Section” and “Chapter” in references to the FSAR throughout the Bases. (DOC A003)

VI. Traveler Information

Description of TSTF changes:

NA

Rationale for TSTF changes:

NA

Description of changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

RCOL PTS Change VEGP LAR DOC D13:

The change deletes descriptive information from the LCO statement. Specifically, it deletes "(Divisions A and D, one each and Divisions B and C two each; six total)" from the LCO statement. This description is added in the LCO Section of the Bases. Specifically, in the second sentence, second paragraph of LCO in the Bases, following "The six inverters," the deletion from the LCO statement is added.

Rationale for changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

As described in TSTF-GG-05-01, subsection 4.1.4.a, the LCO is intended to describe, as simply as possible, the lowest functional capability or performance levels of equipment required for the safe operation of the facility. It is acceptable to generically refer to the system, subsystem, component, or parameter that is the subject of the LCO and provide the specific scope/boundaries in the Bases. In addition, TSTF-GG-05-01, subsection 3.3.1.g, recommends avoiding the overuse of parenthetical type statements within sentences, as they generally make the sentence longer, more complicated, and more difficult to understand. The proposed change to the LCO simplifies the LCO statement, is consistent with the intent of the current wording, and remains consistent with the wording of the Actions entry conditions.

The removal of these design details from the TS is acceptable because this type of information is not necessary to be included in the TS to provide adequate protection of public health and safety. TS 3.8.3 still retains a requirement for the Division A, B, C, and D inverters to be Operable. Also, this change is acceptable because these types of design details are adequately controlled in the TS Bases. Changes to the Class 1E inverter design are controlled in accordance with 10 CFR 50.59 and 10 CFR 52, Appendix D, Section VIII. Changes to the Bases are controlled by the TS Bases Control Program. This program provides for the evaluation of changes to ensure the Bases are properly controlled. This change is designated as a less restrictive removal of detail change because design details for meeting TS requirements are currently in the TS Bases.

Description of additional changes proposed by NRC staff/preparer of GTST:

LCO 3.8.3 Note 1 was revised replacing “constant voltage source transformer” with “voltage regulating transformer.”

The Bases discussions are improved adding clarifications and ensuring use of “electrical power distribution,” not “electric power distribution.”

The acronym “FSAR” is added to modify “Section” and “Chapter” in references to the FSAR throughout the Bases. (DOC A003)

In the “Actions” section of the Bases, under heading “A.1,” second paragraph, the word “applicable” was inserted before “Conditions and Required Actions of LCO 3.8.5” for consistency with TS 3.8.5 Action A Completion Time.

Clarifying changes made in the Specifications and the Bases are as follows:

- Insert “AC” before “instrument” of LCO Note 1.

- Revise Required Action A.1 Note as follows:

  Enter applicable Conditions and Required Actions of LCO 3.8.5 “Distribution Systems - Operating” ~~**for any division**~~ with ~~any~~ any **AC** instrument and control bus de-energized.

- In the “Applicable Safety Analyses” section of the Bases, make the following changes:

  In the first paragraph, revise the first sentence by inserting “and” before “transient” to match Subsection 3.8.4 Bases.

  Revise second paragraph, second sentence, as follows:

  . . This includes maintaining ~~at least three of the four Divisions of~~ **all Class 1E** AC instrument and control buses OPERABLE **in at least three of the four** ~~Divisions~~ **electrical power distribution system divisions** during accident conditions in the event of: . . .

- In the “LCO” section of the Bases, revise the third paragraph, as follows:

  An inverter is OPERABLE **when it powers its associated** ~~inverters require that the~~ Class 1E AC instrument and control **bus** ~~**electric power distribution subsystems** bus be powered by the inverter~~ with output voltage and frequency within tolerances, and the **associated 250 VDC station battery provides the inverter’s** power input ~~to the inverter from a 250 VDC station battery~~ **by way of the associated Class 1E DC electrical power distribution subsystem bus**.

- Revise the “Actions” section of the Bases, under the heading “B.1 and B.2,” as follows:

  If the inoperable **inverter** ~~DC electrical power subsystem~~ cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to MODE 5 where the probability and consequences ~~on~~ **of** an event are minimized. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems.

Rationale for additional changes proposed by NRC staff/preparer of GTST:

Use of “voltage regulating transformer” is consistent with the naming convention used in AP1000 DCD and other TS Bases in AP1000.

Since Bases references to FSAR Sections and Chapters are to an external document, it is appropriate to include the “FSAR” modifier.

The changes made are acceptable because they provide clarity and consistency in the use of terminology within and across the TS sections. These changes are considered editorial in nature.

VII. GTST Safety Evaluation

Technical Analysis:

The deletion of details from the LCO statement is acceptable for AP1000 STS because such details are not necessary and can contribute to distractions. Without the details, the requirements are adequately defined and are consistent with other requirements and can be implemented without difficulty. The changes made are consistent with the current Writer's Guide.

The use of “voltage regulating transformer” as opposed to “constant voltage source transformer” makes the Specification consistent with the Bases discussion where “voltage regulating transformer” is used. This avoids confusion and is acceptable.

The inclusion of details in the Bases provides explanation as needed and can be evaluated and controlled for changes under the TS Bases Control Program. The TS Bases Control Program provides for the evaluation of changes to ensure that the Bases are properly controlled. These changes simplify the LCO statement making it easier to implement while maintaining the details in the Bases. The changes are acceptable for AP1000 STS.

The remaining changes are editorial, clarifying, grammatical, or otherwise considered administrative. These changes do not affect the technical content, but improve the readability, implementation, and understanding of the requirements, and are therefore acceptable.

Having found that this GTST’s proposed changes to the GTS and Bases are acceptable, the NRC staff concludes that AP1000 STS Subsection 3.8.3 is an acceptable model Specification for the AP1000 standard reactor design.

References to Previous NRC Safety Evaluation Reports (SERs):

None

VIII. Review Information

Evaluator Comments:

None

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Review Information:

Availability for public review and comment on Revision 0 of this traveler approved by NRC staff on 5/22/2014.

APOG Comments (Ref. 7) and Resolutions

(Internal #3) Throughout the Bases, references to Sections and Chapters of the FSAR do not include the “FSAR” modifier. Since these Section and Chapter references are to an external document, it is appropriate to include the “FSAR” modifier. This is resolved by adding the “FSAR” modifier as appropriate.

(Internal #457) 3.8.03, Pg. 04, APOG requested removal of additional clarifications of nomenclature proposed by the NRC staff. Replacement of “bus[es]” with “electric power distribution system(s)” or “division(s)” was corrected. However, other clarifications in the Bases discussion were added and proper use of the term “electrical power distribution” was ensured.

(Internal #458) 3.8.03, Pg. 26, the discussion in the “Actions A.1” section of the Bases were modified inserting “applicable” before “Conditions and Required Actions of LCO 3.8.5.”

(Internal #464) 3.8.03, Pg. 21, LCO 3.8.3 Note 1 reference to “constant voltage source transformer” was revised to “voltage regulating transformer.”

NRC Final Approval Date: 12/10/2015

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IX. Evaluator Comments for Consideration in Finalizing Technical Specifications and Bases

None

X. References Used in GTST

1. AP1000 DCD, Revision 19, Section 16, “Technical Specifications,” June 2011 (ML11171A500).

2. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Unit 3 and 4, Technical Specifications Upgrade License Amendment Request, February 24, 2011 (ML12065A057).

3. TSTF-GG-05-01, Technical Specification Task Force (TSTF) Writer's Guide for Plant-Specific Improved Technical Specifications, Revision 1.

4. RAI Letter No. 01 Related to License Amendment Request (LAR) 12-002 for the Vogtle Electric Generating Plant Units 3 and 4 Combined Licenses, September 7, 2012 (ML12251A355).

5. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Units 3 and 4, Response to Request for Additional Information Letter No. 01 Related to License Amendment Request LAR-12-002, ND-12-2015, October 04, 2012 (ML12286A363 and ML12286A360).

6. NRC Safety Evaluation (SE) for Amendment No. 13 to Combined License (COL) No. NPF-91 for Vogtle Electric Generating Plant (VEGP) Unit 3, and Amendment No. 13 to COL No. NPF-92 for VEGP Unit 4, September 9, 2013 (ADAMS Package Accession No. ML13238A337), which contains:

ML13238A355,	Cover Letter - Issuance of License Amendment No. 13 for Vogtle Units 3 and 4 (LAR 12-002).
ML13238A359,	Enclosure 1 - Amendment No. 13 to COL No. NPF-91
ML13239A256,	Enclosure 2 - Amendment No. 13 to COL No. NPF-92
ML13239A284,	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13)
ML13239A287,	Enclosure 4 - Safety Evaluation (SE), and Attachment 1 - Acronyms
ML13239A288,	SE Attachment 2 - Table A - Administrative Changes
ML13239A319,	SE Attachment 3 - Table M - More Restrictive Changes
ML13239A333,	SE Attachment 4 - Table R - Relocated Specifications
ML13239A331,	SE Attachment 5 - Table D - Detail Removed Changes
ML13239A316,	SE Attachment 6 - Table L - Less Restrictive Changes

   The following documents were subsequently issued to correct an administrative error in Enclosure 3:

ML13277A616,	Letter - Correction To The Attachment (Replacement Pages) - Vogtle Electric Generating Plant Units 3 and 4- Issuance of Amendment Re: Technical Specifications Upgrade (LAR 12-002) (TAC No. RP9402)
ML13277A637,	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13) (corrected)

7. APOG-2014-008, APOG (AP1000 Utilities) Comments on AP1000 Standardized Technical Specifications (STS) Generic Technical Specification Travelers (GTSTs), Docket ID NRC-2014-0147, September 22, 2014 (ML 14265A493).

XI. MARKUP of the Applicable GTS Subsection for Preparation of the STS NUREG

The entire section of the Specifications and the Bases associated with this GTST is presented next.

Changes to the Specifications and Bases are denoted as follows: Deleted portions are marked in strikethrough red font, and inserted portions in bold blue font.

3.8 ELECTRICAL POWER SYSTEMS

3.8.3 Inverters – Operating

LCO 3.8.3 The Division A, B, C, and D inverters ~~(Divisions A and D, one each and Divisions B and C two each; six total)~~ shall be OPERABLE.

----------NOTES----------
One inverter may be disconnected from its associated DC bus for ≤ 72 hours to perform an equalizing charge on its associated battery, providing:

1. The associated **AC** instrument and control bus is energized from its Class 1E **voltage regulating transformer**~~constant voltage source transformer~~; and

2. All other AC instrument and control buses are energized from their associated OPERABLE inverters.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One inverter inoperable.	A.1 ----------NOTE---------- Enter applicable Conditions and Required Actions of LCO 3.8.5 “Distribution Systems - Operating” with any **AC** instrument and control bus de-energized. ---------- Restore inverter to OPERABLE status.	24 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.3.1	Verify correct inverter voltage, frequency, and alignment to required AC instrument and control buses.	7 days

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Inverters – Operating

BASES

BACKGROUND

The inverters are the preferred source of power for the Class 1E AC instrument and control buses because of the stability and reliability they achieve. Divisions A and D, each consist of one Class 1E inverter. Divisions B and C, each consist of two inverters. The function of the inverter is to convert Class 1E DC electrical power to AC electrical power, thus providing an uninterruptible power source for the instrumentation and controls for the Protection and Safety Monitoring System (PMS). The inverters are powered from the Class 1E 250 V battery sources (Ref. 1).

Under normal operation, a Class 1E inverter supplies power to the Class 1E AC instrument and control bus. If the inverter is inoperable or the Class 1E 250 VDC input to the inverter is unavailable, the Class 1E AC instrument and control bus is powered from the backup source associated with the same division via a static transfer switch featuring a make-before-break contact arrangement. In addition, a manual mechanical bypass switch is used to provide a backup power source to the Class 1E AC instrument and control bus when the inverter is removed from service. The backup source is a Class 1E regulating 480-208/120 volt transformer providing a regulated output to the Class 1E AC instrument and control bus through a static transfer switch and a manual bypass switch.

In addition to powering safety loads, the Class 1E AC power sources are used for emergency lighting in the main control room and remote shutdown workstation. When a normal AC power source for emergency lighting is lost, the loads are automatically transferred to a Class 1E AC power source. Specific details on inverters and their operating characteristics are found in **FSAR** Chapter 8 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) **and** transient analyses in **FSAR** Chapter 6 (Ref. 2) and **FSAR** Chapter 15 (Ref. 3), assume engineered safety features are OPERABLE. The inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the PMS instrumentation and controls so that the fuel, Reactor Coolant System (RCS), and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Technical Specifications 3.2

BASES

APPLICABLE SAFETY ANALYSES (continued)

(Power Distribution Limits), 3.4 (Reactor Coolant System), and 3.6 (Containment Systems).

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the unit. This includes maintaining **all Class 1E** ~~at least three of the four Divisions of~~ AC instrument and control buses OPERABLE **in at least three of the four electrical power distribution system divisions** during accident conditions in the event of:

a. An assumed loss of all offsite and onsite AC power source; and

b. A worst case single failure.

Inverters are a part of distribution systems, and as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The inverters ensure the availability of AC electrical power for the systems instrumentation required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Maintaining the required inverters OPERABLE ensures that the redundancy incorporated into the design of the PMS instrumentation and controls is maintained. The six inverters **(Divisions A and D, one each and Divisions B and C two each; six total)** ensure an uninterruptible supply of AC electrical power to the six Class 1E AC instrument and control buses even if all AC power sources are de-energized.

An inverter is OPERABLE **when it powers its associated** ~~inverters require that the~~ Class 1E AC instrument and control bus ~~be powered by the inverter~~ with output voltage and frequency within tolerances, and the **associated 250 VDC station battery provides the inverter's** power input **by the way of the associated Class 1E DC electrical power distribution subsystem bus**~~to the inverter from a 250 VDC station battery~~.

This LCO is modified by a Note that allows one inverter to be disconnected from its associated Class 1E DC bus for ≤ 72 hours, if the associated Class 1E AC instrument and control bus is powered from its Class 1E regulating transformer during the period and all other inverters

BASES

LCO (continued)

are OPERABLE. This allows an equalizing charge to be placed on one battery bank. If the inverter was not disconnected, the resulting voltage condition might damage the inverter. These provisions minimize the loss of equipment that would occur in the event of a loss of offsite power. The 72 hour time period for the allowance minimizes the time during which a loss of offsite power could result in the loss of equipment energized from the affected Class 1E AC instrument and control bus while taking into consideration the time required to perform an equalizing charge on the battery bank.

The intent of this Note is to limit the number of inverters that may be disconnected. Only the inverter associated with the single battery bank undergoing an equalizing charge may be disconnected. All other inverters must be aligned to their associated batteries.

APPLICABILITY

The inverters are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

Inverter requirements for MODES 5 and 6 are covered in the Bases for LCO 3.8.4, “Inverters Shutdown.”

ACTIONS

A.1

With a required inverter inoperable, its associated Class 1E AC instrument and control bus is automatically energized from its regulating transformer. A manual switch is also provided which can be used if the static transfer switch does not properly function.

For this reason a Note has been included **with Required Action A.1** ~~in Condition A~~ requiring ~~the~~ entry into the **applicable** Conditions and Required Actions of LCO 3.8.5, “Distribution System**s** - Operating~~.~~**,” for any division with an AC instrument and control bus de-energized.**

BASES

ACTIONS (continued)

This ensures that the **affected Class 1E AC instrument and control** bus is re-energized within **6**~~12~~ hours.

Required Action A.1 allows 24 hours to fix the inoperable inverter and return it to service. The 24 hour time limit is based upon engineering judgment, taking into consideration the time required to repair an inverter and the additional risk to which the unit is exposed because of the inverter inoperability. This has to be balanced against the risk of an immediate shutdown, along with the potential challenges to safety systems such a shutdown might entail. When ~~the~~**a Class 1E** AC instrument and control bus is powered from its regulating transformer, it is relying upon interruptible AC electrical power sources (offsite and onsite). The uninterruptible inverter source to the **Class 1E** AC instrument and control buses is the preferred source for powering instrumentation trip setpoint devices.

B.1 and B.2

If the inoperable **inverter** ~~DC electrical power subsystem~~ cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to MODE 5 where the probability and consequences of~~n~~ an event are minimized. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.8.3.1

This Surveillance verifies that the inverters are functioning properly with all required switches and circuit breakers closed and Class 1E AC instrument and control buses energized from the inverter. The verification of proper voltage and frequency output ensures that the required power is readily available for the PMS instrumentation connected to the Class 1E AC instrument and control buses. The 7 day Frequency takes into account the effectiveness of the voltage and frequency instruments, the redundant capability of the inverters, and other indications available in the control room that alert the operator to inverter malfunctions.

BASES

REFERENCES

1. **FSAR** Section 8.3.2.1.1.2, “Class 1E Uninterruptible Power Supplies.”

2. **FSAR** Chapter 6, “Engineered Safety Features.”

3. **FSAR** Chapter 15, “Accident Analyses.”

XII. Applicable STS Subsection After Incorporation of this GTST's Modifications

The entire subsection of the Specifications and the Bases associated with this GTST, following incorporation of the modifications, is presented next.

3.8 ELECTRICAL POWER SYSTEMS

3.8.3 Inverters – Operating

LCO 3.8.3 The Division A, B, C, and D inverters shall be OPERABLE.

----------NOTES----------
One inverter may be disconnected from its associated DC bus for ≤ 72 hours to perform an equalizing charge on its associated battery, providing:

1. The associated AC instrument and control bus is energized from its Class 1E voltage regulating transformer; and

2. All other AC instrument and control buses are energized from their associated OPERABLE inverters.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One inverter inoperable.	A.1 ----------NOTE---------- Enter applicable Conditions and Required Actions of LCO 3.8.5 “Distribution Systems - Operating” with any AC instrument and control bus de-energized. ---------- Restore inverter to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND	6 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.3.1	Verify correct inverter voltage, frequency, and alignment to required AC instrument and control buses.	7 days

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Inverters – Operating

BASES

BACKGROUND

The inverters are the preferred source of power for the Class 1E AC instrument and control buses because of the stability and reliability they achieve. Divisions A and D, each consist of one Class 1E inverter. Divisions B and C, each consist of two inverters. The function of the inverter is to convert Class 1E DC electrical power to AC electrical power, thus providing an uninterruptible power source for the instrumentation and controls for the Protection and Safety Monitoring System (PMS). The inverters are powered from the Class 1E 250 V battery sources (Ref. 1).

Under normal operation, a Class 1E inverter supplies power to the Class 1E AC instrument and control bus. If the inverter is inoperable or the Class 1E 250 VDC input to the inverter is unavailable, the Class 1E AC instrument and control bus is powered from the backup source associated with the same division via a static transfer switch featuring a make-before-break contact arrangement. In addition, a manual mechanical bypass switch is used to provide a backup power source to the Class 1E AC instrument and control bus when the inverter is removed from service. The backup source is a Class 1E regulating 480-208/120 volt transformer providing a regulated output to the Class 1E AC instrument and control bus through a static transfer switch and a manual bypass switch.

In addition to powering safety loads, the Class 1E AC power sources are used for emergency lighting in the main control room and remote shutdown workstation. When a normal AC power source for emergency lighting is lost, the loads are automatically transferred to a Class 1E AC power source. Specific details on inverters and their operating characteristics are found in FSAR Chapter 8 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in FSAR Chapter 6 (Ref. 2) and FSAR Chapter 15 (Ref. 3), assume engineered safety features are OPERABLE. The inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the PMS instrumentation and controls so that the fuel, Reactor Coolant System (RCS), and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Technical Specifications 3.2

BASES

APPLICABLE SAFETY ANALYSES (continued)

(Power Distribution Limits), 3.4 (Reactor Coolant System), and 3.6 (Containment Systems).

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the unit. This includes maintaining all Class 1E AC instrument and control buses OPERABLE in at least three of the four electrical power distribution system divisions during accident conditions in the event of:

a. An assumed loss of all offsite and onsite AC power source; and

b. A worst case single failure.

Inverters are a part of distribution systems, and as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The inverters ensure the availability of AC electrical power for the systems instrumentation required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Maintaining the required inverters OPERABLE ensures that the redundancy incorporated into the design of the PMS instrumentation and controls is maintained. The six inverters (Divisions A and D, one each and Divisions B and C two each; six total) ensure an uninterruptible supply of AC electrical power to the six Class 1E AC instrument and control buses even if all AC power sources are de-energized.

An inverter is OPERABLE when it powers its associated Class 1E AC instrument and control bus with output voltage and frequency within tolerances, and the associated 250 VDC station battery provides the inverter's power input by the way of the associated Class 1E DC electrical power distribution subsystem bus.

This LCO is modified by a Note that allows one inverter to be disconnected from its associated Class 1E DC bus for ≤ 72 hours, if the associated Class 1E AC instrument and control bus is powered from its Class 1E regulating transformer during the period and all other inverters are OPERABLE. This allows an equalizing charge to be placed on one battery bank. If the inverter was not disconnected, the resulting voltage

BASES

LCO (continued)

condition might damage the inverter. These provisions minimize the loss of equipment that would occur in the event of a loss of offsite power. The 72 hour time period for the allowance minimizes the time during which a loss of offsite power could result in the loss of equipment energized from the affected Class 1E AC instrument and control bus while taking into consideration the time required to perform an equalizing charge on the battery bank.

The intent of this Note is to limit the number of inverters that may be disconnected. Only the inverter associated with the single battery bank undergoing an equalizing charge may be disconnected. All other inverters must be aligned to their associated batteries.

APPLICABILITY

The inverters are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

Inverter requirements for MODES 5 and 6 are covered in the Bases for LCO 3.8.4, “Inverters Shutdown.”

ACTIONS

A.1

With a required inverter inoperable, its associated Class 1E AC instrument and control bus is automatically energized from its regulating transformer. A manual switch is also provided which can be used if the static transfer switch does not properly function.

For this reason a Note has been included with Required Action A.1 requiring entry into the applicable Conditions and Required Actions of LCO 3.8.5, “Distribution Systems - Operating,” for any division with an AC instrument and control bus de-energized. This ensures that the affected Class 1E AC instrument and control bus is re-energized within 6 hours.

BASES

ACTIONS (continued)

Required Action A.1 allows 24 hours to fix the inoperable inverter and return it to service. The 24 hour time limit is based upon engineering judgment, taking into consideration the time required to repair an inverter and the additional risk to which the unit is exposed because of the inverter inoperability. This has to be balanced against the risk of an immediate shutdown, along with the potential challenges to safety systems such a shutdown might entail. When a Class 1E AC instrument and control bus is powered from its regulating transformer, it is relying upon interruptible AC electrical power sources (offsite and onsite). The uninterruptible inverter source to the Class 1E AC instrument and control buses is the preferred source for powering instrumentation trip setpoint devices.

B.1 and B.2

If the inoperable inverter cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to MODE 5 where the probability and consequences of an event are minimized. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.8.3.1

This Surveillance verifies that the inverters are functioning properly with all required switches and circuit breakers closed and Class 1E AC instrument and control buses energized from the inverter. The verification of proper voltage and frequency output ensures that the required power is readily available for the PMS instrumentation connected to the Class 1E AC instrument and control buses. The 7 day Frequency takes into account the effectiveness of the voltage and frequency instruments, the redundant capability of the inverters, and other indications available in the control room that alert the operator to inverter malfunctions.

BASES

REFERENCES

1. FSAR Section 8.3.2.1.1.2, “Class 1E Uninterruptible Power Supplies.”

2. FSAR Chapter 6, “Engineered Safety Features.”

3. FSAR Chapter 15, “Accident Analyses.”