TU ELECTRIC REACTOR ENGINEERING
CALCULATION COVER SHEET

Calculation No. RXE-TA-CP1/6-027 Revision No. 1

Subject UV/UF Reactor Trip Setpoints

☒ Nuclear Safety Related

☐ Computer Output Listing(s) attached

No. of Sheets 16

Originator Walter J Bookmyer Jr Date 2/10/92

Reviewer Hui-Hang Lo Date 2/10/92

Approval Stephen M. Maier Date 2/13/92

Attachments ATT. 1. 3 pg
ATT. 2. 2 pg
ATT. 3. 2 pg

Abstract:

The nominal setpoint, allowable value, the "S" and "Z" terms and the total allowance for use in Table 2.2-1 of the CPSES-1 Technical Specifications for the underfrequency and undervoltage reactor trip setpoints were calculated. The following values are used in the 5 column Technical Specification format shown in Tech Spec Table 2.2-1. Unless otherwise noted, all values are in units of percent of instrument span.

	Undervoltage Reactor Trip	Underfrequency Reactor Trip
TA	7.7	4.4
Z	1.2	0.0
S	0.0	0.0
Nominal Trip Setpoint	4830V	57.2 Hz
Allowable Value	4753V	57.1 Hz

Also provided in this calculation package is an alternate calculation of the UF reactor trip setpoint and associated input for the CPSES-1 Technical Specifications. This alternate calculation (Contained in Section VI.) will supersede the calculation contained in Section III. when LDCR TS 92-010 is approved by the NRC. LDCR TS 92-010 is a Tech Spec change implementing the results of the alternate calculation for the UF reactor trip setpoint and incorporating the change to the "Z" term for the UV reactor trip setpoint. Until LDCR 92-010 is approved by the NRC, the alternate UF calculation merely forms the basis for the LDCR submittal.

REV 3/89

TU ELECTRIC REACTOR ENGINEERING REVISION SHEET

Calculation No. RXE-TA-CP1/0-027 Rev. No. 1

Description:

Revision 1 of this calculation provides an alternate calculation of the UF reactor trip setpoint and associated input for the CPSES-1 Technical Specifications. This alternate calculation (Contained in Section VI.) will supersede the calculation contained in Section III. for the UF reactor trip setpoint when LDCR TS 92-010 is approved by the NRC. LDCR TS 92-010 is a Tech Spec change implementing the results of the alternate calculation for the UF reactor trip setpoint and incorporating the change to the "Z" term for the UV reactor trip setpoint. Until LDCR 92-010 is approved by the NRC, the alternate UF calculation merely forms the basis for the LDCR submittal.

Revision 1 is reissued in its entirety; thus, Revision 0 is superseded.

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Subject UV/UF Reactor Trip Setpoints

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Sheet 1

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I. Purpose

One Form FX 91-1658 [3] describes a condition wherein the allowable calibration tolerances specified in the E1-2400 document were inconsistent with the tolerances used in the calculation of the Undervoltage (UV) and Underfrequency (UF) reactor trip setpoints for CPSES-1 [2]. Further, an additional uncertainty has been identified which was not originally included in the setpoint calculation. The purpose of this calculation is to calculate revised setpoints for CPSES-1 for inclusion into the plant Technical Specifications, and to establish new calibration tolerances for the UV and UF relays within the confines of the current CPSES-1 Technical Specifications.

Also provided in this calculation package is an alternate calculation of the UF reactor trip setpoint and associated input for the CPSES-1 Technical Specifications. This alternate calculation (Contained in Section VI.) will supersede the calculation contained in Section III. when LDCR TS 92-010 is approved by the NRC. LDCR TS 92-010 is a Tech Spec change implementing the results of the alternate calculation for the UF reactor trip setpoint and incorporating the change to the "Z" term for the UV reactor trip setpoint. Until LDCR 92-010 is approved by the NRC, the alternate UF calculation merely forms the basis for the LDCR submittal.

II. Background

The calculations of the nominal and allowable values of the setpoints, and of the "S" and "Z" terms included in the Technical Specifications, will be performed using the same methodology used by Westinghouse to calculate the Unit 1 setpoints [1, 2]. This methodology, the assumptions, and the bases for those assumptions are provided in Reference 1. The actual Unit 1 calculations are provided in Reference 2.

III. Calculations

A. Trip Functions

As described on pages 55 and 56 of Reference 1, the RCP undervoltage reactor trip function provides a primary reactor trip for the complete loss of RCS flow event. This trip function monitors the bus voltage for the RCPs. A loss of voltage results in tripping the undervoltage relays prior to a reactor trip due to low RCS coolant flow. Below the P-7 interlock, this function is automatically blocked, and is automatically enabled above P-7.

As described in page 56 of Reference 1, the RCP underfrequency reactor trip function provides a backup function for the undervoltage for the complete loss of RCS flow. The frequency of the RCP busses is monitored downstream of the RCP breakers. A reduction in the frequency is an indication of a significant reduction in the bus voltage. Below the P-7 interlock, this function is automatically blocked, and is automatically enabled above P-7.

B. Operating Environment

As described on Page 56 of Reference 1, the accidents upon which the UV/UF trip functions are relied do not result in adverse containment environments; therefore, no adverse environment effects must be considered.

C. Safety Analysis Limits

As noted in Reference 4, there is no explicit accident analysis limit assumed for the undervoltage reactor trip. Therefore, for consistency with the Unit 1 Technical Specifications, a safety analysis limit of 68% of the nominal voltage of 6.9kV is assumed. This limit, derived from the nominal value and total allowance values of the Unit 1 Technical Specifications [5], corresponds to 4692 V. As noted in Reference 4, the safety analysis limit for the UF event is 57.0 Hz.

D. Instrumentation

The Undervoltage and Underfrequency relay model numbers, nominal settings and tolerance settings are described in Attachment 1. This information was provided to Westinghouse as the basis for the Unit 1 setpoint study [2]. From conversations with various CPSES personnel, it is highly desireable to relax the tolerance settings. Because this calculation package forms the basis for the tolerance settings, new tolerances will be developed and used in this calculation. The new tolerances, including allowances will be provided in Section IV.

As described in Attachment 1, the detection of the undervoltage condition is provided by G.E. Model #12NGV13A11A relays. These relays have a dropout range of 70-100V. The potential transformer ratio is 7200/120. As shown in Attachment 2, there is an uncertainty of $\pm$0.3% associated with this ratio. As described in Attachment 1, the underfrequency relays are Westinghouse type KF underfrequency relays, Style #671B287A17. These relays have a frequency range of 55 to 59.5 Hz.

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E. Nominal Setpoints

The nominal setpoints are based on considerations other than this statistical setpoint study. The relay setting tolerances are based on the such considerations as this setpoint study and the ease of calibration. For the purposes of this calculation, the tolerances are developed, based on verbal input from CPSES personnel. The incorporation of these tolerances into the appropriate plant documents is outside the scope of this calculation (see Section IV.)

As described in Attachment 1, the nominal undervoltage relay setting is 80.5V. Note that this voltage is reduced from the actual bus voltage by the potential transformer by a factor of 60 (the P.T. ratio).

As described in Attachme:t 1, the underfrequency relay setting is 57.2 Hz.

F. Channel Statistical Allowance

As defined in Section 4.2 of Reference 1, the channel statistical allowance is expressed as:

$$CSA = \{(PMA)^2 + (PEA)^2 + (SCA + SMTE + SD)^2 + (SPE)^2 + (STE)^2 + (RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2} + EA$$

where the relevant acronyms will be defined below.

For the trip functions under consideration, the relays can be considered as part of the rack. As described on page 192 of Reference 1, for simple channels that have only a power supply, the inclusion of an RCA term is not necessary. However, an allowance for the settings of the relays will be included. Only the rack terms and the uncertainty associated with the P.T. ratio are included in the calculation of the CSA. Therefore, the definition of CSA relevant to the UV/UF reactor trip functions is:

$$CSA = \{(PEA)^2 + (RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2}$$

WHERE, for the UNDERVOLTAGE trip function:

PEA = Primary Element Accuracy

As noted in Attachment 3, the uncertainty associated with the potential transformer is ±0.3%. Thus, the P.T. ratio may vary from (0.997*60 =) 59.82 to (1.003*60 =) 60.18. The nominal bus voltage is 6900 V; however, to conservatively maximize the effect of the ratio uncertainty, a bus voltage of 7200V is assumed. Therefore, the relay voltage can vary from (7200V/59.82 =) 120.36V to (7200V/60.18 =) 119.64V about the nominal value of 120V. This uncertainty can be expressed as ±0.36V. Given the voltage span of 30V, the uncertainty becomes ±1.2% span.

Note that this uncertainty could be expressed as a "process measurement accuracy" term; however, during a telephone conversation on 1/15/92, C. R. Tuley of Westinghouse indicated that it was W practice to represent this uncertainty as a PEA. The effect on the final calculated results is the same, regardless of how the uncertainty is expressed.

RCA = rack calibration accuracy = ±2.25% span

The relay calibration is confirmed as an integral part of the rack. From Reference 1, the rack calibration tolerance is defined as the accuracy to which the relay can be set. As alluded to earlier, conversations with CPSES personnel indicated that a calibration accuracy of ~±2% span would be considered acceptable. A calibration accuracy of ±2.25% span is selected in order to maximize the allowable calibration tolerance, while ensure the RMTE allowance can be incorporated into the rack uncertainty total which form the basis for the current plant Technical Specifications. For the UV relay, the lower setpoint tolerance would become:

±2.25% = (Nominal setting - lowest tolerance)/span * 100%

±2.25% = (80.5V - xV)/30V *100%

x = 79.83 V

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RMTE = rack measuring and test equipment allowance

It is assumed that the measuring and test equipment is sufficiently accurate to ensure that the RCA : RMTE ratio is at least 4:1. Hence, the allowance for the RMTE is ±0.56% span. However, in order to keep the allowable value (to be calculated later) the same as in the current plant Technical Specifications, the RMTE allowance will be increased to ±0.61% span.

RCSA = rack comparator setting accuracy = ±0.0% span

Because there is no separate bistable in this channel, no RCSA allowance is required.

RD = rack drift

An allowance for rack drift over the surveillance intervals required by the plant Technical Specifications will be made which corresponds to the original rack drift allowance made by Westinghouse in Reference 2, i.e., 1.43% span. (The value reported in Reference 2 is 1.4% span, rounded from the rigorous calculation of RD using Attachment 1, i.e., RD = RCA = (80.5V - 80.07V)/30V * 100% = 1.43% span).

RTE = rack temperature effects = ±0.0% of span

As noted on page 201 of Reference 1, the effect of voltage and frequency shifts are negligible. Because this channel consists of only a relay, and no additional circuitry is involved, there is no need for the RTE allowance. This approach is consistent with the original calculation performed by W for Unit 1 [2].

Therefore, for the UNDERVOLTAGE reactor trip function,

$$CSA = \{(PEA)^2 + (RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2}$$

$$= \{(1.2)^2 + (2.25 + 0.61 + 0.0 + 1.43)^2 + (0.0)^2\}^{1/2}$$

$$= 4.45\%\ \text{span}$$

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For the UNDERFREQUENCY trip function:

RCA = rack calibration accuracy = 1.0% span

The relay calibration is confirmed as an integral part of the rack. Similar to the calculation performed for the the Undervoltage relay, a Rack Calibration Accuracy of ±1.0% span is provided. This allowance corresponds to a calibration tolerance of:

RCA = (Nominal setting - lowest tolerance)/span * 100%
1.0% = (57.2Hz - xHz)/4.5Hz *100%
x = 57.155 Hz

RMTE = rack measuring and test equipment allowance

It is assumed that the measuring and test equipment is sufficiently accurate to ensure that the RCA : RMTE ratio is at least 4:1. Hence, the allowance for the RMTE is 0.25% span. However, in order to preserve the allowable value reported in the current CPSES-1 Technical Specifications, the RMTE allowance will be increased to 0.34% span.

RCSA = rack comparator setting accuracy = ±0.0% span

Because there is no separate bistable in this channel, no RCSA allowance is required.

RD = rack drift

An allowance for rack drift over the surveillance intervals required by the plant Technical Specifications will be made which corresponds to value used by W in the original setpoint calculations. This value is 0.67% span. (The value reported in Reference 2 is 0.7% span, rounded from the rigorous calculation of RD using Attachment 1, i.e., RD = RCA = (57.2Hz - 57.17Hz)/4.5Hz * 100% = 0.67% span).

RTE = rack temperature effects = ±0.0% of span

As noted on page 201 of Reference 1, the effect of voltage and frequency shifts are negligible. Because this channel consists of only a relay, and no additional circuitry is involved, there is no need for the RTE allowance. This approach is consistent with Unit 1 [2].

Therefore, for the UNDERFREQUENCY reactor trip function,

$$CSA = \{(RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2}$$

$$= \{(1.00 + 0.34 + 0.0 + 0.67)^2 + (0.0^2)\}^{1/2}$$

$$= 2.01\% \text{ span}$$

G. "A"

The "A" term will be used in the evaluation of the allowable value of the setpoint. The allowable value will be specified in the plant Technical Specifications.

As noted on page 29 of Reference 1,

$$A = (PMA1)^2 + (PMA2)^2 + (PEA)^2 + (SPE)^2 + (STE)^2 + (RTE)^2$$

= 1.44% span for the UV trip function. (PEA is only non-zero term)

= 0.0% span for the UF trip function.

H. "Z"

"Z" is used with the variables "S" and "R" in the Tech Specs when actual measured data is available for the racks or transmitters.

From Page 29 of Reference 1,

$$Z = A^{1/2} + EA$$

= 1.2% span for the UV trip function.

= 0.0% span for the UF trip function.

I. "S"

"S" represents the transmitter terms in the determination of the channel operability per the Tech Specs.

From Page 30 of Reference 1,

$$S = SCA + SMTE + SD$$

= 0.0% for both the UV and UF trip functions

J. Total Allowance

The Total Allowance (TA) represents the difference between the nominal setpoint and the safety analysis limit in terms of % span. As inferred from Page 26 of Reference 1, the total allowance is:

TA = ABS[(SAL - nominal setpoint)]/span * 100%

For the UNDERVOLTAGE trip function, the safety analysis limit setpoint is converted to relay voltage by using the nominal P.T. ratio of 60. Hence, the safety analysis limit is:

4692V / 60V/V = 78.2V.

The TA then becomes:

= ABS[(78.2V - 80.5V)]/30V * 100% span

= 7.67% span, rounded to 7.7% span

For the UNDERFREQUENCY trip function, the safety analysis limit setpoint 57.0 Hz. The TA then becomes:

= ABS[(57.2Hz - 57.0Hz)]/4.5Hz * 100% span

= 4.44% span, rounded to 4.4% span

K. T1

T1 is a trigger used to develop the allowable value developed in Section M. From Page 33 of Reference 1,

T1 = RCA + RMTE + RCSA + RD

For the UNDERVOLTAGE trip function,

T1 = 2.25 + 0.61 + 0.0 + 1.43

= 4.29% span

For the UNDERFREQUENCY trip function,

T1 = 1.00 + 0.34 + 0.0 + 0.67

= 2.01% span

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L. T2 is a trigger used to develop the allowable value developed in Section M. From page 33 of Reference 1,

$$T2 = TA - [\{A + S^2\}^{1/2} + EA]$$

For the the UV trip function

$$T2 = 7.7 - [\{1.44 + 0.0^2\}^{1/2} + 0.0]$$

$$= 6.5\% \text{ span}$$

For the UF trip function T2 = TA = 4.4% span

M. Allowable Value

The allowable value is used in the Tech Specs as a trigger to indicate when a protection loop is inoperable. The allowable value is the based on the lesser of T1 or T2, or T. From Section 4.7 of Reference 1,

Allowable Value (AV) = Nominal Setpoint ± T (depending upon the application)

For the UNDERVOLTAGE trip function,

AV = 80.5V - [4.29% span * 30V/100% span]

= 79.213V (relay voltage)

= 4753V (bus voltage)

For the UNDERFREQUENCY trip function,

AV = 57.2Hz - [2.01% span * 4.5Hz/100% span]
= 57.1Hz

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N. Summary

The following values are used in the 5 column Technical Specification format shown in Tech Spec Table 2.2-1. Unless otherwise noted, all values are in units of percent of instrument span.

	Undervoltage Reactor Trip	Underfrequency Reactor Trip
TA	7.7	4.4
Z	1.2	0.0
S	0.0	0.0
Nominal Trip Setpoint	4830V	57.2 Hz
Allowable Value	4753V	57.1 Hz

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IV. Assumptions (to be transmitted with results of this calculation)

** Note that these assumptions will be affected by the implementation of LDCR 92-010, as described in Sections I and VI.

1. An allowance for a RCA:RMTE ratio of 4:1 is included in the uncertainty calculations.

2. Allowances for Rack Drift for the Undervoltage and Underfrequency trip functions are 1.43% span and 0.67% span, respectively.

3. Allowances for the following nominal relay setting and tolerances (low end only) have been included in the setpoint study:

   UV Reactor Trip Function: (nominal - 80.5V; minimum - 79.83V)

   UF Reactor Trip Function: (nominal - 57.2Hz; minimum - 57.155Hz)

V. References

1. "Bases Document for Westinghouse Setpoint Methodology for Comanche Peak Protection Systems", WCAP 12485, March, 1990.

2. "Westinghouse Setpoint Methodology for Protection Systems, Comanche Peak Unit 1, Revision 1,", WCAP 12123, Revision 2, April 1990.

3. ONE Form FX-91-1658, initiated 12/9/91.

4. "Accident Analysis Assumptions Checklists", WCAP-12368, Revision 1, August 1990.

5. CPSES-1 Technical Specifications, Table 2.2-1, through Amendment 7.

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VI. Alternate Calculation for the UF Reactor Trip Setpoint

This section contains an alternate calculation of the UF reactor trip setpoint. This alternate calculation provides for a relay setting tolerance of ±2% span for the UF relay. Note that in order to provide this relaxed tolerance, the "Allowable Value" term reported in the current CPSES-1 Tech Specs for the UF reactor trip setpoint must be changed. Therefore, this calculation shall not be used in CPSES-1 applications until the Tech Spec change has been approved by the NRC. Until NRC approval is attained, this alternate calculation forms the basis for the Tech Spec change submittal, LDCR TS 92-010.

A. Channel Statistical Allowance

As defined in Section 4.2 of Reference 1, the channel statistical allowance is expressed as:

$$CSA = \{(PMA)^2 + (PEA)^2 + (SCA + SMTE + SD)^2 + (SPE)^2 + (STE)^2 + (RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2} + EA$$

where the relevant acronyms will be defined below.

For the trip functions under consideration, the relays can be considered as part of the rack. As described on page 192 of Reference 1, for simple channels that have only a power supply, the inclusion of an RCA term is not necessary. However, an allowance for the settings of the relays will be included. Only the rack terms are included in the calculation of the CSA. Therefore, the definition of CSA relevant to the UF reactor trip function is:

$$CSA = \{(RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2}$$

For the UNDERFREQUENCY trip function:

RCA = rack calibration accuracy

The relay calibration is confirmed as an integral part of the rack. Similar to the calculation performed for the Undervoltage relay, a Rack Calibration Accuracy of ±2.0% span is provided. This allowance corresponds to a calibration tolerance of:

RCA = (Nominal setting - lowest tolerance)/span * 100%
2.0% = (57.2Hz - xHz)/4.5Hz *100%
x = 57.11 Hz

RMTE = rack measuring and test equipment allowance

It is assumed that the measuring and test equipment is sufficiently accurate to ensure that the RCA : RMTE ratio is at least 4:1. Hence, the allowance for the RMTE is 0.50% span.

RCSA = rack comparator setting accuracy = ±0.0% span

Because there is no separate bistable in this channel, no RCSA allowance is required.

RD = rack drift

An allowance for rack drift over the surveillance intervals required by the plant Technical Specifications will be made which corresponds to value used by W in the original setpoint calculations. This value is 0.67% span. (The value reported in Reference 2 is 0.7% span, rounded from the rigorous calculation of RD using Attachment 1, i.e., RD = RCA = (57.2Hz - 57.17Hz)/4.5Hz * 100% = 0.67% span).

RTE = rack temperature effects = ±0.0% of span

As noted on page 201 of Reference 1, the effect of voltage and frequency shifts are negligible. Because this channel consists of only a relay, and no additional circuitry is involved, there is no need for the RTE allowance. This approach is consistent with the original setpoint calculation performed for Unit 1 [2].

Therefore, for the UNDERFREQUENCY reactor trip function,

$$CSA = \{(RCA + RMTE + RCSA + RD)^2 + (RTE)^2\}^{1/2}$$

$$= \{(2.00 + 0.50 + 0.0 + 0.67)^2 + (0.0^2)\}^{1/2}$$

$$= 3.17\% \text{ span}$$

B. "A"

The "A" term will be used in the evaluation of the allowable value of the setpoint. The allowable value will be specified in the plant Technical Specifications.

As noted on page 29 of Reference 1,

$$A = (PMA1)^2 + (PMA2)^2 + (PEA)^2 + (SPE)^2 + (STE)^2 + (RTE)^2$$

$$= 0.0\% \text{ span for the UF trip function.}$$

C. "Z"

"Z" is used with the variables "S" and "R" in the Tech Specs when actual measured data is ava''able for the racks or transmitters.

From Page 29 of Reference 1,

$$Z = A^{1/2} + EA$$

$$= 0.0\% \text{ span for the UF trip function.}$$

D. "S"

"S" represents the transmitter terms in the determination of the channel operability per the Tech Specs.

From Page 30 of Reference 1,

$$S = SCA + SMTE + SD$$

$$= 0.0\% \text{ span for the UF trip functions}$$

E. Total Allowance

The Total Allowance (TA) represents the difference between the nominal setpoint and the safety analysis limit in terms of % span. As inferred from Page 26 of Reference 1, the total allowance is:

TA = ABS[(SAL - nominal setpoint)]/span * 100%

For the UNDERFREQUENCY trip function, the safety analysis limit setpoint 57.0 Hz. The TA then becomes:

= ABS[(57.2Hz - 57.0Hz)]/4.5Hz * 100% span

= 4.44% span, rounded to 4.4% span

F. T1

T1 is a trigger used to develop the allowable value developed in Section M. From Page 33 of Reference 1,

T1 = RCA + RMTE + RCSA + RD

For the UNDERFREQUENCY trip function,

T1 = 2.00 + 0.50 + 0.0 + 0.67

= 3.17% span

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G. T2 is a trigger used to develop the allowable value developed in Section M. From page 33 of Reference 1,

$$T2 = TA - [(A + S^2)^{1/2} + EA]$$

For the UF trip function T2 = TA = 4.4% span

H. Allowable Value

The allowable value is used in the Tech Specs as a trigger to indicate when a protection loop is inoperable. The allowable value is the based on the lesser of T1 or T2, or T. From Section 4.7 of Reference 1,

Allowable Value (AV) = Nominal Setpoint $\pm$ T (depending upon the application)

For the UNDERFREQUENCY trip function,

AV = 57.2Hz - [3.17% span * 4.5Hz/100% span]
= 57.06Hz

I. Alternate Calculation Summary

The following values are used in the 5 column Technical Specification format shown in Tech Spec Table 2.2-1. Unless otherwise noted, all values are in units of percent of instrument span.

	Underfrequency Reactor Trip (Alternate Calculation)
TA	4.4
Z	0.0
S	0.0
Nominal Trip Setpoint	57.2 Hz
Allowable Value	57.06 Hz

ATTACHMENT 1

SWEC Letter SWW-0207

dated July 27, 1988

RXE-TA-CP1/0-027 Rev 1

B 41.2

STONE & WEBSTER ENGINEERING CORPORATION

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Mr. J. L. Vota, Project Manager
Westinghouse Nuclear Energy Systems
P.O. Box 355
Pittsburgh, PA 15230

July 27, 1988
J.O.No. 18051
SWW-0207
No Response Required

STATISTICAL SETPOINT STUDY INFORMATION REQUEST
COMANCHE PEAK STEAM ELECTRIC STATION - UNIT 1
TU ELECTRIC

Westinghouse Electric Corporation (WEC) Letter WPT-9570, dated January 12, 1988, requested statistical setpoint study information for various instrument channels. The major concerns were to verify that the original transmitters shipped were installed and to identify any uncertainties associated with the performance of calorimetrics (flow and power) and the accuracies associated with the equipment used to calibrate the transmitters and racks.

Stone & Webster Engineering Corporation (SWEC) has identified the tag nos. associated with the instrument channels from Attachment II of WPT-9570. Attached are the completed Instrument Channel Input data sheets for your use.

For calibrating equipment accuracies a 1 to 1 ratio (accuracy of calibrating equipment to accuracy of instrument being calibrated) is being used to calibrate the transmitters and rack mounted cards at the Comanche Peak site.

If you have any questions, please contact Mr. R. L. Poltrino at (617) 589-8894.

J. B. Carty
Project Engineer

Enclosures

MGH:vrc

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SWW-0207

*4.19 Undervoltage relays and time delay relays for reactor trip.

4.19.1 Undervoltage relays, devices 27-1/1A1, 27-1/1A2, 27-1/1A3, 27-1/1A4, 27-1/2A1, 27-1/2A2, 27-1/2A3, 27-1/2A4

G.E. Model #12NGV13A11A.
Rated 120V, 60 Hz, dropout range 70-100V
One single phase relay per bus
P. T. Ratio 7200/120

Setting of Relays:
Dropout voltage = 80.3V (80.07V to 84.53V)

4.19.2 Time delay relays, devices 27-1T/1A1, 27-1T/1A2, 27-1T/1A3, 27-1T/1A4, 27-1T/2A1, 27-1T/2A2, 27-1T/2A3, 27-1T/2A4

Syracuse, Model #PTR00300, 0.1-1.0 sec., 115 V.A.C.

Setting of Relays:
Time setting = 0.5 sec. (0.4 sec. to 0.6 sec.)

*4.20 Underfrequency relays and time delay relays for reactor trip.

4.20.1 Underfrequency relays, devices 81/1A1, 81/1A2, 81/1A3, 81/1A4, 81/2A1, 81/2A2, 81/2A3, 81/2A4

Westinghouse type KF underfrequency relay, Style #671B287A17 without time delay.
Rated 120V at 60 Hz.
Frequency range 55 to 59.5 Hz

Setting of Relays:
Frequency setting - 57.2 Hz (57.17 Hz to 58.0 Hz)

4.20.2 Time delay relays, devices 81T/1A1, 81T/1A2, 81T/1A3, 81T/1A4, 81T/2A1, 81T/2A2, 81T/2A3, 81T/2A4

Syracuse Model #PTR00300, 0.1-1.0 sec., 115 V.A.C.

Setting of Relays:
Time setting - 0.1 sec. (0.09 sec. to 0.11 sec.)

* See Tech. Specs. Section 4.3.1.1 and 4.3.1.2 for surveillance requirements.

Attachment 2

Excerpt from Specification 2323-ES-5

Potential Transforme Metering Accuracy Class

APPENDIX-4
(TECH. DATA SHEETS)

RXE-TA-CP/0-027 Rev 1
B A2.2

Gibbs & Hill, Inc.
Specification No. 2323-ES-5
Revision 1
Sheet 6 of 9

DATE 1/13/75

NAME OF SELLER ITE Imperial Corporation Rev

Performance Data (Continued)

4. Potential Transformers

a.	Ratio	7200-120V
b.	Type	JMV-5
c.	Manufacturer	G.E.
d.	Insulation	Butyl-Molded
e.	Thermal Rating	1000VA with 55°C ambient
f.	Impulse level - full wave	95KV
g.	Accuracy Class	W,X,Y,Z = 0.3

Rev

5. Current Transformers

a.	Type	MC15-A1 & MCS-21
b.	Manufacturer	ITE
c.	Insulation	Epoxy
d.	Mechanical Limit - Amperes	same as breaker
e.	Impulse Level - Full Wave	95KV
f.	Accuracy Classification	see Table Sheet 7

TU ELECTRIC REACTOR ENGINEERING CALCULATION SHEET

Subject UV/UF Reactor Trip Setpoints | Calc. No. RXE-TA-CP1/0-027 Rev. 1
Sheet A3.1
Originator ________ Date ________
Reviewer ________ Date ________

Attachment 3

Excerpt from ANSI/IEEE 57.13 - 1978

Voltage Transformer Metering Accuracy Class

RXE-TA-CP1/0-027 Rev 1
Pg A3.2

Table 6
Standard Accuracy Class for Metering Service and Corresponding Limits of Transformer Correction Factor
(0.6 to 1.0 Percent Power Factor of Metered Load, Lagging

Metering Accuracy Class	Voltage Transformers (At 90 to 110 Percent Rated Voltage)		Current Transformers			
			At 100 Percent Rated Current[1]		At 10 Percent Rated Current	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
0.3	0.997	1.003	0.997	1.003	0.994	1.006
0.6	0.994	1.006	0.994	1.006	0.988	1.012
1.2	0.988	1.012	0.988	1.012	0.976	1.024

[1] For current transformers the 100 percent rated current limit also applies at the current corresponding to the continuous-thermal-current rating factor.

5.3 Standard Accuracy Classes. Standard accuracy classes limits of transformer correction factor in standard accuracy classes shall be as shown in Table 6.

5.4 Limiting Values of Ratio Correction Factor and Phase Angle for Standard Accuracy Classes. The limiting values of *RCF* must be the same as those for *TCF* (see 5.2). For any known value of *RCF* for a given transformer the limiting values[3] of angle derived from the expression in 5.2) are given by:

(1) For voltage transformers,
$\gamma = 2600\ (TCF - RCF)$

(2) For current transformers,
$\beta = 2600\ (RCF - TCF)$

in which *TCF* is taken as the maximum and minimum values given in Table 6 for the specified accuracy class.

These relations are conveniently shown graphically in Fig 2 for current and in Fig 3 for voltage transformers.

6. Current Transformers

6.1 Terms in Which Ratings Shall be Expressed. The rating of a current transformer shall include:

(1) Basic impulse insulation level in terms of full wave test voltage (see Tables 7 and 8)

(2) Nominal system voltage, or maximum system voltage (see Tables 7 and 8)

(3) Frequency (60 Hz)

(4) Rated primary and secondary currents (Tables 9 and 10)

(5) Accuracy classes at standard burdens (Tables 6 and 11, under 6.3 and 6.4)

(6) Continuous-thermal-current rating factor based on 30°C ambient air temperature (see 6.5)

(7) Short-time mechanical current rating and short-time thermal current rating (see 6.6)

6.2 Standard Burdens. Standard burdens for current transformers with 5 A rated secondary current shall have resistance and inductance according to Table 11.

6.3 Assignment of Accuracy Ratings for Metering Service

6.3.1 A current transformer for metering service shall be given an accuracy rating for each standard burden for which it is designed. For example, the accuracy classes assigned to a current transformer might be 0.3 B-0.1 and B-0.2, 0.6 B-0.5.

6.3.2 *Tapped Secondary or Multiple-Ratio Current Transformer Accuracy Rating.* The metering accuracy rating applies to the full secondary winding, unless otherwise specified.

6.4 Accuracy Classes for Relaying. A current transformer for relaying service shall be given an accuracy rating according to 6.4.1.

6.4.1 *Basis for Relaying Accuracy Classes.* A relaying accuracy class shall be designated by two symbols that effectively describe the steady state performance as follows:

(1) *"C" or "T" Classification.* C classification covers current transformers in which the leakage

[3] This is true of errors within the range of the standard metering accuracy classes.