

JUSTIFICATION/ANALYSIS

Project No.: 7390-00
Volume: EQ-FSV14

CQD File No.: 027095
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PDR ADOCK 05000267
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ANALYSIS & CONCLUSIONS SECTION

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1.0 OBJECTIVE

The purpose of this report is to analyze the subject safety-related equipment for the effect of normal service time/temperature aging, identify age susceptible materials used in the equipment, demonstrate operability of the safety-related equipment during and after a Design Basis Event (DBE), and establish a maintenance and surveillance program. The aging analysis will be performed per DOR Guidelines of IE Bulletin 79-01B.

2.0 REFERENCES

1. Wyle Report #57705-7, Aging analysis of Square 'D' pressure switch and temperature switch models 9012 and 9025 used in Public Service Co. of Colorado's Fort St. Vrain Nuclear Power Plant, Rev. A, dated 11/22/85.
2. Wyle Report #58084-2, steam line rupture (SLR) qualification test on pressure differential switch, part #ACW31538B9G1 Class 9012, Serial #271 for General Atomic Company (GAC), dated 8/10/76.
3. Wyle Report #57504-10, SLR qualification test on temperature switch Type BCW-42, Class 9025, Form LA16 for GAC, dated 9/14/76.
4. CQD File #022959, Rev. 00, "Fort St. Vrain 35 Year Temperature Histogram for Normal Plant Conditions".
5. CQD File #027090, "Version IV of DBE Temperature/Humidity Profiles for Reactor and Turbine Buildings" (Preliminary).
6. Southwest Research Institute Document #06-6073-TR66, dated 11/84, "Nuclear Component Qualification Test Report Square D 9012-ACW-25 Pressure Switch".
7. SWRI Document #06-6073-TR116, dated 11/84, "Nuclear Component Qualification Test Report Square D 9025-BCW-45 Temperature Switch".
8. Durez Bulletin #328.



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9. "Design Guide for Reactor Cover Gas Elastomer Seals",
Atomics International, Division of Rockwell
International, Document #AI-AEC-13145.
10. Parker O-Ring Handbook, dated 3/82.
11. PSC letter #NDG-86-0108 dated 1/23/86 transmitting
Environmental Qualification Master Equipment List.
12. Square D Company Catalog Section dated 1/82,
Class 9012.
13. Square D Company Catalog Section dated 1/81,
Class 9025.
14. Engineering Evaluation of Fort St. Vrain Component
Operating Cycles #EE-EQ-002, Rev. A, dated 8/21/85.

3.0 ASSUMPTIONS

1. Metals are insensitive to environmental effects and
therefore due to their high heat resistance
properties are not age sensitive.
2. No internal heat rise above the ambient due to switch
operation is expected ($\Delta t = 0$).

4.0 EQUIPMENT DESCRIPTION

The subject of this analysis is Square D temperature and
pressure switches. The following is the list of switch
models and tag numbers taken from Reference 11:

| Tag No. | Item Description | Manufacturer/Model # | Location |
|---------|------------------|----------------------|----------|
| PS-8208 | Pressure Switch | Square D/9012-ACW-25 | TB2 |
| PS-8214 | " | " 9012-ACW-25 | TB2 |
| PS-8221 | " | " 9012-ACW-28 | TB2 |
| PS-8222 | " | " 9012-ACW-28 | TB2 |
| PS-8247 | " | " 9012-ACW-25 | TB2 |
| PS-8248 | " | " 9012-ACW-28 | TB2 |



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| Tag No. | Item Description | Manufacturer/Model # | Location |
|---------|--------------------|----------------------|----------|
| TS-8208 | Temperature Switch | Square D/9025-BCW-42 | TB2 |
| TS-8214 | " | " 9025-BCW-42 | TB2 |
| TS-8218 | Temperature Switch | Square D/9025-BCW-64 | TB2 |
| TS-8219 | " | " 9025-BCW-64 | TB2 |
| TS-8236 | " | " 9025-BCW-43 | TB2 |
| TS-8237 | " | " 9025-BCW-43 | TB2 |
| TS-8245 | " | " 9025-BCW-43 | TB2 |
| TS-8246 | " | " 9025-BCW-42 | TB2 |

5.0 PERFORMANCE REQUIREMENTS/ACCEPTANCE CRITERIA

A pre-operational test, operational test during the DBE test, and post-operational test were performed per GAC Specification 93-I-530 to monitor the performance requirements. The tests were conducted as described in References 2 & 3, Page 2. The test specimen operated at all times per GAC Specification 93-I-530 (References 2&3, Pages 3 & 4). Setpoint deviations during the test are evaluated later in Tab C.

6.0 SERVICE CONDITIONS

The subject pressure and temperature switches are located in environmental zone TB2. The time/temperature histogram per Reference 4 for the normal service conditions of Zone TB2 is provided below:

| Temperature (°F) | Duration (days) |
|------------------|-----------------|
| 105 | 2723 Period I |
| 95 | 2756 Period I |
| 105 | 5040 Period II |
| 95 | 2160 Period II |



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7.0 METHOD OF QUALIFICATION

The Square D pressure and temperature switches are qualified to 79-01B requirements. Therefore, the qualification for thermal aging is done by analysis. The DBE qualification is performed by a combination of type testing and analysis.

7.1 Service Life Evaluation

1. All non-metallics that are subject to temperature aging were identified.
2. Utilizing the minimum activation energy value (eV), the amount of required aging at a 105°F reference temperature was calculated based upon the 35 year plant requirements (Reference 4).
3. The life consumed for the entire 30 day DBE/post-DBE period is calculated based on the 105°F reference temperature and added to the results obtained in Step 2 above.
4. Utilizing aging test data (References 6 & 7) the qualified life is calculated at a 105°F reference temperature and compared to the results obtained in Step 3 above.

7.2 DBE/Post-DBE Evaluation

1. High temperature peaks postulated for the plant DBE are enveloped by the test with significant margin.
2. Operability for the duration of the SLR test was demonstrated by successful functional testing during the DBE simulation and post-DBE functional testing.
3. Qualification after the termination of the SLR test is demonstrated by analysis of the materials and their specific properties relative to their contribution to switch operation.

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4. The thermal stress induced during the entire DBE at a reference temperature of 105°F is calculated in Appendix I to verify that the total thermal stress induced during the entire DBE/post-DBE is a fraction of the qualified life.

8.0 DBE CONDITIONS

Per Reference 5, the following are the DBE conditions (combined line break profile) for the Square D temperature and pressure switches:

| Temperature (°F) | Duration (minutes) |
|------------------|--------------------|
| 100-200 | 0.03 |
| 200-300 | 0.07 |
| 300-330 | 0.05 |
| 360-360 | 0.10 |
| 330-300 | 0.05 |
| 300-160 | 0.70 |
| 160-170 | 0.50 |
| 170-170 | 1.40 |
| 170-185 | 4.60 |
| 185-195 | 9.50 |
| 195-170 | 53.0 |
| 170-150 | 50.0 |
| 150-120 | 380.0 |
| 120-120 | 42700.0 |

W. H. H. H. H.

Total 30 days

9.0 SIMILARITY ANALYSIS

Square D temperature switch Model 9025 and pressure switch Model 9012 (which were DBE tested) are similar to the Square D temperature and pressure switches installed at the Fort St. Vrain Plant, since the tested and installed switches are the same model with the same materials of construction. Furthermore, the materials application for both the Square D temperature and pressure switches is the same even though the model numbers are different. The following are the non-metallic materials in the Model 9025 Square D temperature switch and the Model 9012 pressure switch:

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Snap switch insulator - Phenolic
Gasket - Silicone Rubber

The remaining parts of the temperature and pressure switches are metallic and, therefore, are not age sensitive.

10.0 DBE/POST-DBE QUALIFICATION

10.1 DBE

The test specimen was subjected to a 30 minute DBE test. Qualification for the DBE will be justified by performing a comparison of the tested and plant profiles. The plant and tested DBE profiles are shown in Figures 1 & 2. The test specimens were subjected to SLR testing, per Reference 2, Figure 2, Page 17 and References 3, Figure 2, Page 16 as follows:

1. Test Profile for Pressure Switch Model 9012 (Reference 2, Page 17)

| <u>Temperature (°F)</u> | <u>Duration (Minutes)</u> |
|-------------------------|---------------------------|
| 110-440 | 1 |
| 440-504 | 1 |
| 504-515 | 1 |
| 515-504 | 1 |
| 504-311 | 1 |
| 311-310 | 8 |
| 310-264 | 7 |
| 264-252 | 10 |

2. Test Profile for Temperature Switch Model #9025 (Reference 3, Page 16)



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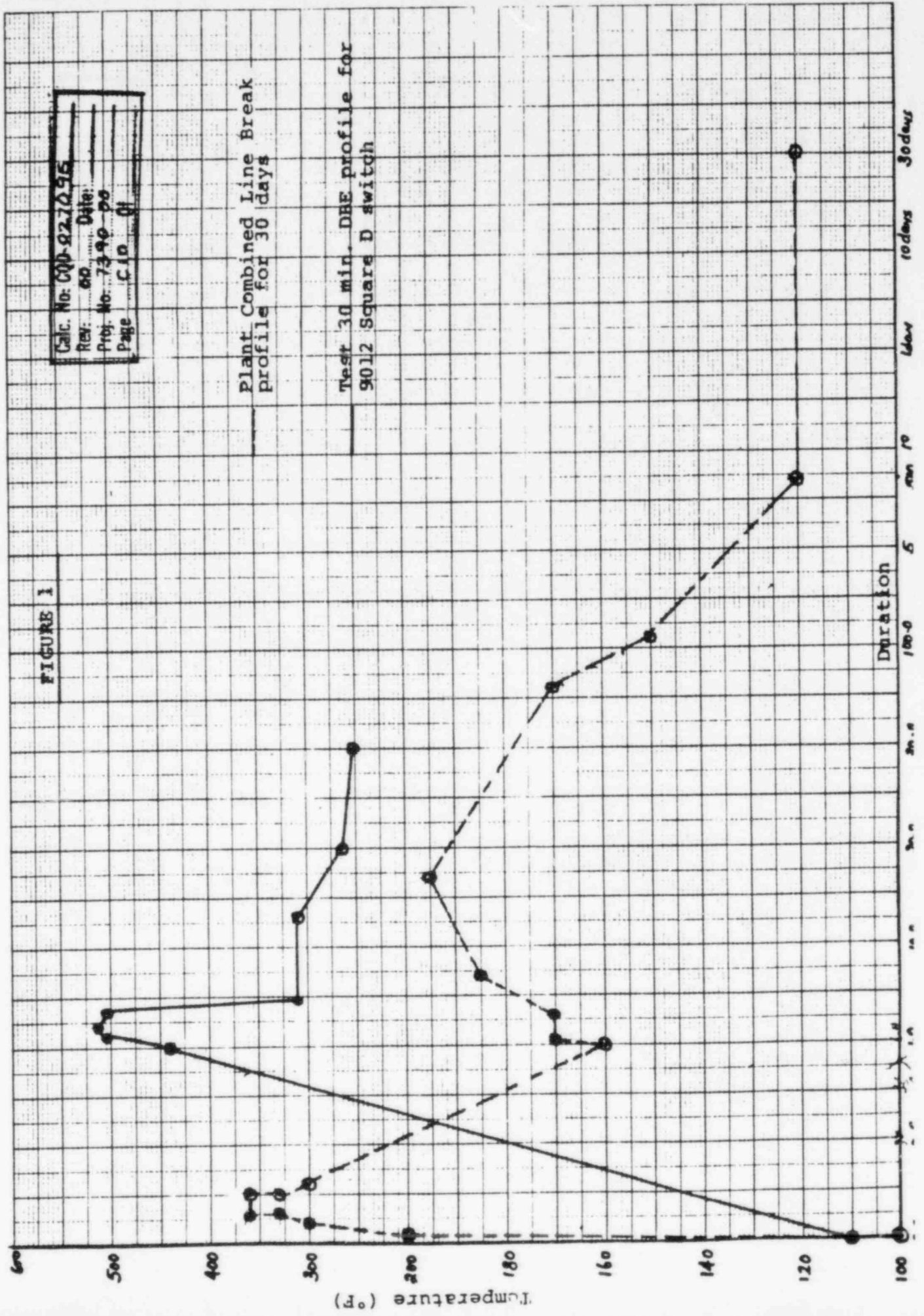
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| Temperature (°F) | Duration (Minutes) |
|------------------|--------------------|
| 185-470 | 1 |
| 470-516 | 1 |
| 516-526 | 1 |
| 526-504 | 1 |
| 504-330 | 1 |
| 330-328 | 1 |
| 328-328 | 4 |
| 328-316 | 2 |
| 316-304 | 2 |
| 304-284 | 2 |
| 284-270 | 4 |
| 270-240 | 10 |

Referring to Figures 1 & 2 which graphically depict both the tested and the plant DBE profiles it can be seen that for the first 30 minutes the tested peak temperature (approx. 520°F) envelopes the plant peak temperature of (approx. 360°F) with significant margin. The tested peak temperature duration at 520°F also envelopes the plant peak temperature duration at 360°F. Although a mismatch in rise times exists between the plant and tested profiles for the initial transient, which can be attributed to test facility limitations, this mismatch can be considered negligible based on the following justification:

1. The tested switches were wrapped with 3 inches of insulation. The plant switches are required to be wrapped with 3 inches of insulation per Tab E.
2. Switch internals that are housed in a NEMA type 13 enclosure, wrapped in 3 inches of insulation, cannot be significantly affected by the short duration accident peak temperature.
3. The switch internal temperature rise would be higher due to a 44 second temperature rise to 520°F (tested) than a 9 second rise to 360°F (plant).

FIGURE 1



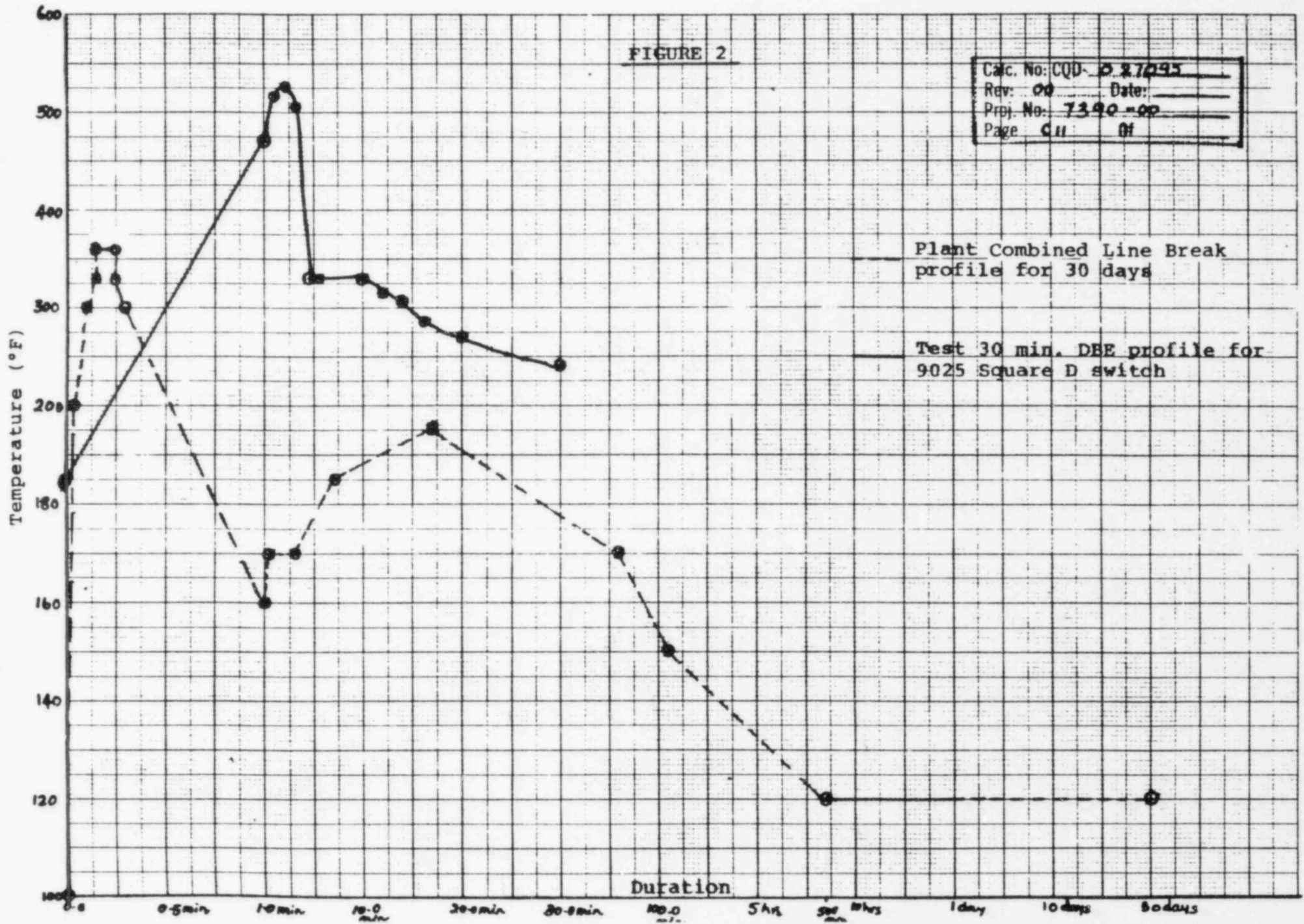
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Plant Combined Line Break
profile for 30 days

Test 30 min. DBE profile for
9012 Square D switch

FIGURE 2

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- The switch internal temperature would rise more due to the test duration at 520°F than the 6 second plant duration at 360°F.

Considering the construction of the temperature and pressure switches, the non-metallic internals, i.e. phenolic and silicone rubber that are housed in a NEMA type 13 enclosure, the thermal conditions imposed by the tested profile are more severe than those that would be imposed by the plant profile.

Therefore, based on the above discussion, it is concluded that the thermal stress experienced by the tested switches is more severe than the thermal stress the switches would see during the initial plant transient despite the mismatch in rise times. This is documented in Sargent & Lundy CQD File #027843 and is available for audit purposes.

Discussion of the post-DBE including material analysis follows:

10.2 POST-DBE QUALIFICATION

Per the manufacturers' published data (References 12 & 13), the switches are designed for a continuous ambient temperature of 185°F. The maximum post-DBE temperature (decaying to ambient) postulated for the plant is 185°F. Furthermore, the Square D pressure and temperature switches have successfully performed their safety function at the 5, 15 and 25 minute intervals during the DBE and post-DBE (References 2 & 3). Operability after the DBE is demonstrated by the post-DBE functional test. In addition, research of the phenolics listed in the EPRI material data base has revealed a minimum continuous threshold temperature of 143°C (289°F), irrespective of the phenolic's failure mode (Reference 8). The phenolic material which is used as an insulator in the Square D switches has a corresponding failure mode attributed to a loss of flexural strength for its specific application. Thirty (30) minutes into the DBE, the phenolics are not thermally stressed since the maximum temperature after 30 minutes into the DBE is 190°F which is significantly less than the 289°F minimum continuous threshold temperature stated above. Since it has been demonstrated that the



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properties of phenolics do not change at 289°F or below, which envelopes the post-DBE requirements of the plant, it is concluded that the phenolics will maintain their physical properties during the entire 30 day DBE/post-DBE.

In an application, similar to that for the switches, the silicone rubber maintained its 90% compression set even after exposure to a temperature of 505°F (Reference 9). Further evidence of silicone rubber's ability to retain its retention property as a static seal is provided by Parker Seal Company. This material resists 700°F temperatures for short periods and would maintain the desired material property (compression set) for 1,000 hours at 450°F (Reference 10, Page A3-36). Therefore, based upon the above and the knowledge that the silicone rubber is held in compression, it is also concluded that the silicone rubber will maintain its physical properties during the entire 30 day DBE/post-DBE.

Demonstration of the switches capability to perform their intended safety function for the post-DBE is supported by References 6 & 7. In these references both the Square D temperature and pressure switches were aged at 125°C (257°F) for 108 continuous days. After this thermal aging period, operability was verified. This more than adequately envelopes the plant post-DBE requirements (time and temperature).

Based upon the above discussion, it is concluded that during the 30 day DBE/post-DBE period, the change in physical properties for the non-metallics is negligible. The switches are capable of performing the intended safety function during the entire 30 day DBE/post-DBE period.

11.0 THERMAL AGING ANALYSIS

The Arrhenius model is utilized in the evaluation of the switch's service life. The service temperature during normal operation of the plant varies between 95°F and 105°F in the turbine building. The Arrhenius parameters provided in Table 1, Page 7, Reference 1 will be used to

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determine the qualified life of the non-metallic materials of the Square D temperature and pressure switches. Arrhenius parameters used for the following non-metallic materials in the subject switches are:

- | | | |
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| 1. Phenolic ($\phi = 0.64$ eV) (Snap Switch Insulator) | S = 7396.48 I = -8.96 | S = Slope I = Intercept |
| 2. Silicone Rubber ($\phi = 0.86$ eV) (gasket) | S = 9987.54 I = -18.39 | ϕ = Activation Energy (eV) |

Utilizing of the Arrhenius equation in the following form:

$$t_{AG} = t_{SER} \exp \left[\frac{\phi}{k} \left(\frac{1}{T_{AG}} - \frac{1}{T_{SER}} \right) \right]$$

Where:

- t_{AG} = time of aging in hours
- t_{SER} = time of service in hours
- T_{AG} = Temperature of aging in degrees Kelvin
- T_{SER} = Service temperature in degrees Kelvin.
- ϕ = Activation Energy (eV)
- k = Boltzmann's constant = 8.617×10^{-5} eV/ $^{\circ}$ K

Therefore, the qualified life can now be determined for the phenolic in the subject switches. If the qualified life of the phenolic is greater than 35 years in the TB2 zone, then the silicone rubber is likewise qualified for at least that period since the phenolic is the weak link material, i.e., lowest eV value.

11.1 Required Aging at 105 $^{\circ}$ F Reference Temperature for the 35 Year Plant Life (Reference 4)

As indicated in Section 6.0 of Tab C, the TB2 environmental zone has the following time/temperature histogram during the plant 35 year service life:

| <u>Temperature ($^{\circ}$F)</u> | <u>Total Duration (days)</u> |
|---|------------------------------|
| 105 | 7,763 |
| 95 | 4,916 |

For the phenolic, the required equivalent aging at 105 $^{\circ}$ F for satisfying the plants' 35 year histogram is as follows:

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The equivalent duration for the Phase I period (i.e., from January 1, 1974 to December 31, 1988 at 105°F is given by:

$$2723 + \frac{2756 \times \exp\left(\frac{0.64 \times 10^5}{8.617} \left(\frac{1}{313.555} - \frac{1}{308}\right)\right)}{365.25}$$

= 12.38 years at 105°F

Similarly, the equivalent duration for the Phase II period (i.e., from January 1 1989 to September 17, 2008) at 105°F is given by:

$$5040 + \frac{2160 \times \exp\left(\frac{0.64 \times 10^5}{8.617} \left(\frac{1}{313.555} - \frac{1}{308}\right)\right)}{365.25}$$

= 17.66 years at 105°F

Therefore, the total required aging of the phenolic is:

12.38 + 17.66 = 30.04 years at 105°F

11.2 Equivalent Time Demonstrated by Thermal Aging

Per References 6 & 7, a Square D pressure and temperature switch were each aged at 125°C (257°F) for 108 days. Shown below is the equivalency of this aging period at 105°F using the Arrhenius methodology:

Phenolic - (Life Consumed in 30 day DBE/post-DBE = 0.16 years at 105°F per Appendix I)

$$\text{Actual Aging} = \frac{108 \times \exp\left[\frac{0.64 \times 10^5}{8.617} \left(\frac{1}{313.555} - \frac{1}{398}\right)\right]}{365.25}$$

= 45.03 years at 105°F

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The 35 year plant life (TB2 zone) plus the 30 day DBE/post-DBE consume a total of 30.04 years + 0.16 years = 30.20 years at 105°F. Since the thermal aging temperature of 125°C for 108 days equates to 45.03 years at 105°F, the combined plant normal service conditions plus 30 day DBE/post-DBE period aging requirements are enveloped.

12.0 CYCLIC AGING

Per Reference 14, the maximum cyclic requirements for both 9012 and 9025 switches is 2191 during the 35 year service life. A total of 6210 cycles of operation under inductive loading conditions was performed on both the 9012 and 9025 switches. The test items functioned normally at the conclusion of the operational aging (References 6 & 7). Therefore the tested conditions envelope the plant requirements.

13.0 ACCURACY CALCULATIONS

1. 9012 Pressure Switch (Reference 2, Page 13)
 The set point pressure for "open" position was = 5.6 psi. The maximum deviation during DBE and post-test operation check was - 0.4 psi.

So the percentage deviation for "open" position for DBE was = $\frac{-0.4}{5.6} \times 100 = -7.24\%$

Similarly for "close" position the percentage deviation for the DBE was = $\frac{-0.3}{5.0} \times 100 = -6\%$

So the deviations in the setting pressure during the DBE are as follows:

- Open + 0
- 7.14%
- Close + 0
- 6%

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2. 9025 Temperature Switch (See Reference 3, Page 13)
 The set point temperature for "open" position was =
 206.67°F (average). The maximum deviation during
 DBE and post-test operation check was + 10.33°F and
 - 6.0°F.

So the percentage deviation for "open" position for
 DBE was

$$= + \frac{10.33 \times 100}{206.67} \text{ and } - \frac{6 \times 100}{206.67} \text{ i.e. } + 5\% \text{ and } - 3\%$$

The set point temperature for "close" position was
 177.33°F (average). Similarly for "close" position
 the percentage deviation for the DBE was
 $+ \frac{0.66 \times 100}{177.33}$ and $- \frac{2.66 \times 100}{177.33}$ i.e. +0.5% and -1.5%

So the deviations in the setting temperature during
 the DBE are as follows:

- Open + 5%
- 3%

- Close = + 0.5%
- 1.5%

The above deviations during DBE shall be incorporated into
 the normal calibration procedures for Fort St. Vrain. See
 Tab E.

14.0 RADIATION AGING ANALYSIS

The process fluid (steam or feedwater) is not contami-
 nated, and therefore, no radiological concerns are
 directly associated with the DBE. Design Basis Accident
 No. 1, "Permanent Loss of Forced Circulation", discussed
 in the Appendix D of the FSAR, provides the worst case
 radiological conditions, but the overall radiological
 concerns are minimal, and accumulated doses (less than
 1000 rads, TID) would have no operational effect on the
 equipment.

Form 00.308.1 Rev. 2



Calc. For Environmental Qualification of
 Square D Pressure & Temp. Switches

| | | | |
|---|----------------|--|--------------------|
| X | Safety-Related | | Non-Safety-Related |
|---|----------------|--|--------------------|

| | |
|-----------|------------|
| Calc. No. | CQD-027095 |
| Rev. | 00 |
| Date | |
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| | |
|------------|--------------------------------|
| Client | Public Service Co. of Colorado |
| Project | Fort St. Vrain |
| Proj. No. | 7390-00 |
| Equip. No. | See Tab D |

| | | | |
|-------------|--|------|--|
| Prepared by | | Date | |
| Reviewed by | | Date | |
| Approved by | | Date | |

15.0 SUBMERGENCE

All switches are above the turbine building Flood level. Therefore submergence is not applicable.

16.0 SYNERGISM

No synergistic effects are presently known to exist for the non-metallic materials of construction of the Square D temperature and pressure switches.

17.0 HUMIDITY

During the DBE, the humidity level can reach 100%. In order to maintain the qualification of the switches, a qualified seal at the conduit entrance is required. See Tab E.

18.0 CHEMICAL SPRAY

Chemical spray is not utilized at Fort St. Vrain.

19.0 DISPOSITION OF ANOMALIES

1. Per Reference 2, the chamber pressure was monitored during the test and was found to be within + 0.5 psi limits. This was considered satisfactory and was waived by GAC personnel as a continuing system requirement.
2. Per Reference 3, the following deviations were identified:
 - a) During the visual inspection, it was noted that the specimen part number was BCW42, Class 9025, Form LA16 instead of BCW43 as listed in Paragraph 5.1 of GAC Specification 93-I-530.

Both the part number BCW42 and BCW43 are similar, having the same materials of construction and therefore this deviation is insignificant.
 - b) The deviation mentioned on Page 22 of Reference 3 concerning the wrapping of the specimen with 3 inches of fiber glass insulation is considered a test set-up anomaly. The probe capillary tubing and specimen was wrapped with 3 inches of fiber



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| Calc. For Environmental Qualification of | | Calc. No. CQD-027095 |
| Square D Pressure & Temp. Switches | | Rev. 00 Date |
| X | Safety-Related | Non-Safety-Related |
| | | Page C19 of |

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| Client Public Service Co. of Colorado | Prepared by | Date |
| Project Fort St. Vrain | Reviewed by | Date |
| Proj. No. 7390-00 Equip No. See Tab D | Approved by | Date |

glass insulation due to the short distance (6 inches) between the specimen and the stream-line rupture simulation entrance.

The Square D switches will be exposed only to a peak temperature of 360°F for 6 seconds during the DBE whereas the test specimen was exposed to temperatures above 500°F during the DBE simulation. The 9012 Square D pressure switch (9012 and 9025 Square D have the same materials) which had no such wrapping has successfully operated even after exposure to accident temperatures above 500°F. Since the plant peak accident temperature is significantly less severe than the tested peak DBE temperature, this anomaly is judged not to impact the qualification of the 9025 Square D temperature switches.

20.0 RESPONSE TO IE BULLETINS/NOTICES

Not applicable, since no IE Bulletins have been issued for either the Square D temperature or pressure switches to date.

21.0 MAINTENANCE/SURVEILLANCE REQUIREMENTS

1. The set point deviations that occurred during the DBE test must be incorporated in to the normal plant calibration procedures. See Tab E.
2. All the Square D switches must be sealed with a qualified seal at the conduit entrance. See Tab E.
3. The 9012 pressure switches and 9025 temperature switches must be wrapped with 3 inches of fiber glass insulation and sealed with fiber glass resin.

22.0 CONCLUSIONS

The subject Square D temperature and pressure switches (Models 9012 and 9025) installed at PSC's Fort St. Vrain Nuclear Power Plant are qualified to DOR Guidelines of IE Bulletin 79-01B requirements for 35 years plus DBE/post-DBE provided the maintenance and surveillance requirements in Tab "E" are implemented.

Form GO 308 1 Rev. 2



Calcs. For Environmental Qualification of

Calc. No. CQD-027095

Square D Pressure & Temp. Switches

Rev. 00 Date

Safety-Related

Non-Safety-Related

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Client Public Service Co. of Colorado

Prepared by

Date

Project Fort St. Vrain

Reviewed by

Date

Proj. No. 7390-00 Equip No. See Tab D

Approved by

Date

APPENDIX I



Calcs. For Environmental Qualification of
 Square D Pressure & Temp. Switches

| | | |
|---|----------------|--------------------|
| X | Safety-Related | Non-Safety-Related |
|---|----------------|--------------------|

Calc. No. CQD-027095
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Client Public Service Co. of Colorado
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 Proj. No. 7390-00 Equip. No. See Tab D

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| Prepared by | Date |
| Reviewed by | Date |
| Approved by | Date |

PURPOSE:

The purpose of this appendix is to calculate the equivalent durations at the normal operating conditions for different materials for the entire 30 day DBE/post-DBE.

CALCULATION AND RESULTS

The thermal calculations are based upon the Arrhenius methodology namely,

$$\frac{\phi}{K} \left(\frac{1}{T_{EQ}} - \frac{1}{T_{DBE}} \right)$$

$$t_{EQ} = t_{DBE} e^{\phi/K}$$

- where
- T_{EQ} = Reference temperature in $^{\circ}K$
 - T_{DBE} = DBE temperature in $^{\circ}K$
 - t_{EQ} = Equivalent duration
 - t_{DBE} = DBE duration
 - ϕ = Limiting activation energy (eV)
 - K = Boltzmann's Constant (8.617×10^{-5} eV/ $^{\circ}K$)

ENTER K,F, OR C FOR TEMPERATURE UNITS

>F

ENTER S,M,H,D, OR Y FOR DURATION UNITS

>M

IS IT A RAMP? (Y/N)

>Y

ENTER SPLIT-UP FACTOR (DEFAULT IS 1000)

>9999

ENTER AGING TEMPERATURE

>105

ENTER ACTIVATION ENERGY VALUE

>0.64

ENTER BEGINNING TEMP., ENDING TEMP., DURATION

ENTER END WHEN COMPLETE

>100,200,0.03

>200,300,0.07

>300,330,0.05

>330,300,0.05

>360,360,.0=<01>0=<0>`X

>360,360,0.10

>300,160,0.70

>160,170,0.50

>170,170,1.40

>170,185,4.60

>185,195,9.50

>195,170,53.00

>170,150,50.00

>150,120,380.0

>120,120,42700

>END

1. Calculation for phenolic for the entire 30-day plant DBE.
2. The equivalent number of years at 105°F for the entire 30-day plant DBE is 0.16 yrs.

EQUIVALENT DURATION AT 105.00F IS 82023.67 MINUTES

ENTER M FOR MENU PRINT-OUT OR

ENTER ACTIVITY NUMBER

>M

ENTER ACTIVITY NUMBER

1) DEFINE PROFILE TYPE 6) DEFINE ACTIVATION ENERGY

@XQT OPS#*095ABSOLUTES.AGE09524910I
 ENTER PROJECT NUMBER
 >739000
 PROJ. NO. : 739000
 PROG. NO. : 09.5.249-1.0I
 .../86

RUN ID : DAKB
 DATE : 01/14

ENTER K,F, OR C FOR TEMPERATURE UNITS
 >F
 ENTER S,M,H,D, OR Y FOR DURATION UNITS
 >M
 IS IT A RAMP? (Y/N)
 >Y
 ENTER SPLIT-UP FACTOR (DEFAULT IS 1000)
 >9999
 ENTER AGING TEMPERATURE
 >105
 ENTER ACTIVATION ENERGY VALUE
 >0.86
 ENTER BEGINNING TEMP., ENDING TEMP., DURATION
 ENTER END WHEN COMPLETE
 >100,200,0.03
 >200,300,0.07
 >300,330,0.05
 >360,360,0.10
 >330,300,0.05
 >300,160,0.70
 >160,170,0.50
 >170,170,1.40
 >170,185,4.60
 >185,195,9.50
 >195,170,53.00
 >170,150,50.00
 >150,120,380.00
 >120,120,42700
 >END
 >END

1. Calculation for silicone rubber for the entire 30-day plant DBE.
2. The equivalent number of years at 105°F for the entire 30-day plant DBE is 0.20 yrs.

EQUIVALENT DURATION AT 105.00F IS 106628.2 MINUTES

ENTER M FOR MENU PRINT-OUT OR

>195,192,13.0

>END

EQUIVALENT DURATION AT 105.00F IS 933.7639 MINUTES

Page C24

ENTER M FOR MENU PRINT-OUT OR
ENTER ACTIVITY NUMBER

>9

CURRENT AGING TEMPERATURE = 105.00F
CURRENT ACTIVATION ENERGY = .64
CURRENT SPLIT-UP FACTOR = 9999
TIME UNIT IS MINUTES

ENTER M FOR MENU PRINT-OUT OR
ENTER ACTIVITY NUMBER

10

>@@SKIP 30

>@FIN

TERMINAL INACTIVE

>@@TERM