




## ENGINEERING AND RESEARCH INC.

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## Table of Contents

| <u>Section</u>                                      | <u>Page</u> |
|---|-------------|
| 1.0 Purpose .....                                   | 2           |
| 2.0 Procedure .....                                 | 2           |
| 3.0 References .....                                | 2           |
| 4.0 System Description .....                        | 3           |
| 5.0 Analysis - PORV Block Valve (HCV-150/151) ..... | 4           |
| 5.1 Normal Operations .....                         | 5           |
| 5.2 Abnormal Operations .....                       | 7           |
| 5.3 Design Basis Accident Conditions .....          | 9           |
| 5.4 Surveillance/Test .....                         | 10          |
| 5.5 Emergency Operating Procedures .....            | 12          |
| 6.0 Summary of Results .....                        | 14          |

|      |     |         |         |         |  |                       |
|------|-----|---------|---------|---------|--|-----------------------|
|      |     |         |         |         | JOB No. 159-90-05  | PAGE<br>1<br>OF<br>15 |
|      |     |         |         |         | CALC No. 159-90-05.01  |                       |
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| REV. | BY  | DATE    | CHECKED | DATE    |  |                       |

## 1.0 Purpose

The purpose of this calculation is to document the design bases for operation of motor-operated valves (MOV) MOV-150/151, the Power Operated Relief Valve (PORV) block valves. These MOVs are contained in the Reactor Coolant System (RCS) and are included in the Fort Calhoun Nuclear Station Generic Letter No. 89-10 MOV Program. The design basis review involves the compilation of the design bases for operation of each MOV including maximum expected differential pressure (MEDP), maximum line pressure ( $P_{max}$ ), maximum flow rate (Q), and maximum fluid temperature (T).

## 2.0 Procedure

The procedure for performing the design basis review consists of defining the MOV functions from the appropriate elementaries/schematics, operating procedures, the USAR and other design basis documents. Based on the function definitions, operating scenarios are developed for which the maximum expected pressure and differential pressure are calculated. Scenarios from each applicable mode of operation including normal operations, abnormal operations, design basis accident conditions, surveillance/test, and Emergency Operating Procedures will be developed and the corresponding design basis flowrate and temperature will be documented.

## 3.0 References

1. ABB/CE Calculation 602512-MPS-5CALC-001, Rev. 03
2. ABB/CE Calculation 602512-MPS-5CALC-003, Rev. 02
3. ABB/CE Calculation 602977-MPS-5EFPR-002, Rev. 0
4. OPPD Schematic No. 11405-E51, Sh 3, Rev. 21
5. FCS Technical Specifications, Amendment No. 136
6. Design Basis Document SDBD-RC-128, Rev. 0
7. Abnormal Operating Procedure AOP-22, Rev. 6
8. Surveillance Test Procedure OP-ST-RC-3002, Rev. 1
9. Emergency Operating Procedure EOP-03, Loss of Coolant Accident, Rev. 15
10. Emergency Operating Procedure EOP-00, Standard Post Trip Actions, Rev. 5
11. Emergency Operating Procedure EOP-06, Loss of All Feedwater, Rev. 9
12. Emergency Operating Procedure EOP-20, Functional Recovery Procedure, Rev. 13
13. Operating Instruction OI-RC-3, Rev. 7
14. Operating Instruction OI-RC-6, Rev. 0
15. CRANE, FLOW OF FLUIDS THROUGH VALVES, FITTINGS, AND PIPE, 1969; including Appendix A

|      |     |         |         |          |  |      |
|------|-----|---------|---------|----------|--|------|
|      |     |         |         | JOB No.  | 159-90-05                                    | PAGE |
|      |     |         |         | CALC No. | 159-90-05.01                                 | 2    |
|      |     |         |         |          |  | OF   |
| D    | OTS | 9-17-91 | W       | 9-17-91  | <b>ERAI</b><br>ENGINEERING AND RESEARCH INC. | 15   |
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## Steam Tables

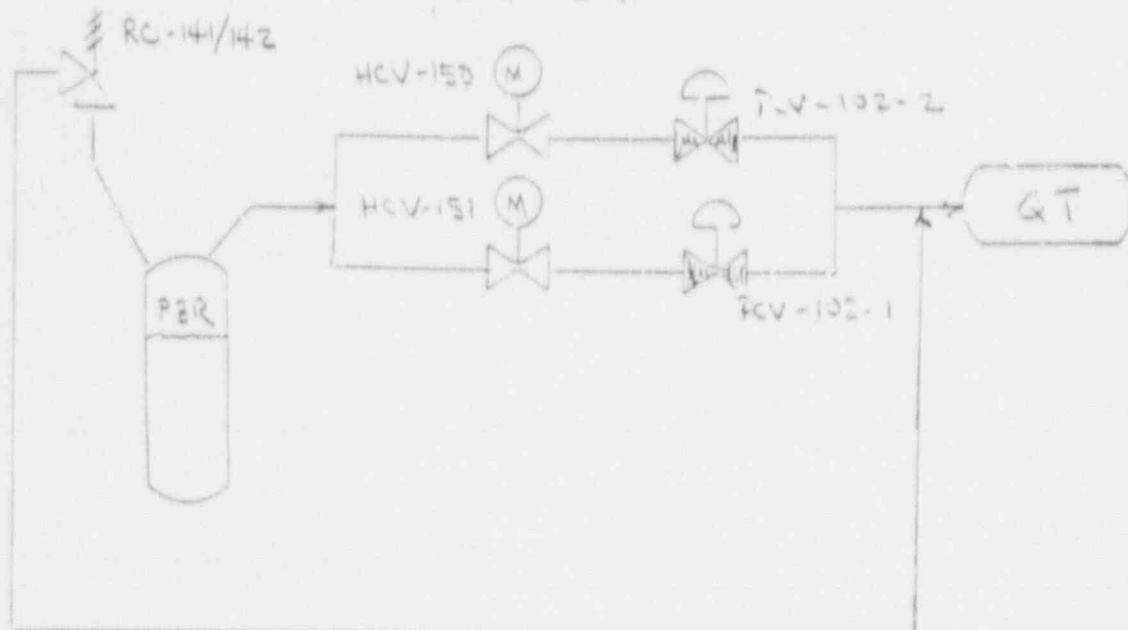
16. OPPD P&ID E-23866-210-110, Rev. 61
17. FCS Updated Safety Analysis Report, 1991 Submittal, Section 4

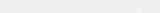
### 4.0 System Description

In addition to the pressurizer which maintains pressure at 2100 psia during normal operation, the components of interest to the design bases for operation of the PORV Block Valves within the Reactor Coolant System are the Power Operated Relief Valves, the Primary Safety Valves, and the Quench Tank. The two PORVs relieve sufficient pressurizer steam during plant transients to prevent opening of the safety valves [17]. PORVs PCV-102-1 and -2 are opened by the high primary system pressure reactor trip signal at 2385 psig (2400 psia). The set pressure of pressurizer safeties RC-141 and 142 are 2530 psig and 2485 psig respectively with a 1% tolerance. The quench tank prevents RCS discharges from being released to the containment atmosphere unless the rupture disk setpoint is exceeded [6,17].

The PORV Block Valves are normally open during normal power operations to allow the PORVs to provide for overpressure protection. The block valves must be capable of closing during any plant condition if required to isolate a leaking or stuck-open PORV and remain closed to maintain reactor coolant pressure boundary integrity [6]. Additionally, when closed, these valves may be called upon to open to provide low temperature overpressure protection, or as an alternate means of depressurization for the mitigation of steam generator tube rupture and other design basis events, or to establish once-through-cooling upon loss of all feedwater.

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|------|-----|---------|---------|---------|---|-------------------------------------|
|      |     |         |         |         | JOB No. 159-90-05   | PAGE<br><u>3</u><br>OF<br><u>15</u> |
|      |     |         |         |         | CALC No. 159-90-05.01   |                                     |
| 0    | EHS | 9-17-91 | WJL     | 9-17-91 |  <b>ENGINEERING AND RESEARCH INC</b> |                                     |
| REV. | BY  | DATE    | CHECKED | DATE    |   |                                     |

## 5.0 Analysis - PORV Block Valve (HCV-150/151)

### Description:

Crane Model 797-U 2 1/4" 2500 pound, pressure sealed bonnet, stainless steel, solid wedge gate valve; Crane drawing H-30321, Rev. C. SMR-00-7 1/2 Limitorque valve operator, Order No. 349404A, Serial Nos. 126240 and 126241.

Manual operation from the Control Room only; no automatic interlocks or permissives [4,16].

Valves HCV-150/151 are considered position changeable [2].

### Functions:

The design basis function of the PORV Block Valve is to close to isolate the PORVs from the RCS during any plant condition whenever there is an indication of a leaking or stuck-open PORV to ensure the integrity of the reactor coolant pressure boundary [1,5,6]. Additionally, when closed, these valves may be required to open to support depressurization of the RCS for some postulated events [1]. Their required actions are:

1. Close to isolate a leaking or stuck-open PORV to maintain RCS pressure boundary integrity [7,9].
2. Verify open prior to RCS startup & remain open during normal power operations to allow the PORVs to provide for overpressure protection [13].
3. Cycle closed and reopen during quarterly surveillance with PORVs closed [8].
4. Close for PORV maintenance [6].
5. Open during EOP functional recovery for RCS depressurization if required [12].
6. Close during EOP post trip action if PORV is still open at less than 2300 psia [10].
7. Open (if closed due to a leaking or stuck-open PORV) to establish EOP once-through-cooling operation [12].
8. Open (if closed during abnormal operation to isolate a leaking PORV) to enable low temperature overpressurization protection (LTOP) during cooldown [7].

|      |      |         |         |          |                               |      |
|------|------|---------|---------|----------|-------------------------------|------|
|      |      |         |         | JOB No.  | 159-90-05                     | PAGE |
|      |      |         |         | CALC No. | 159-90-05.01                  | 4    |
|      |      |         |         |          |                               | OF   |
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| REV. | BY   | DATE    | CHECKED | DATE     | ENGINEERING AND RESEARCH INC. |      |

## 5.1 Normal Operations

The PORV Block Valves are normally open during power operations unless they are closed due to excessive leakage of the PORV, the PORV is stuck open or the PORV is inoperable for some other reason. A closing function considered under normal operations is to close for PORV maintenance - an operation which is not performed at power. Since the PORV block valves are normally open during normal power operations, the applicable open function involves recovery from inadvertent closure.

### MEDP<sub>open</sub>

The block valves are verified open prior to RCS startup and remain open during normal operations unless a PORV becomes inoperable due to excessive leakage. Assuming an inadvertent closure at power would result in an upstream and downstream pressure of 2100 psia (normal pressurizer pressure) and a 0 psi differential pressure to re-open.

### Maximum Pressure

The maximum pressure of 2100 psia is present upstream and downstream of the valve during the required re-opening scenario.

### Flow Conditions


The flowrate associated with this MEDP scenario is zero (0) gpm.

### Temperature Conditions

The temperature of saturated steam at 2100 psia is 343°F [15].

### Stroke Time

No design basis stroke time relative to this scenario applies.

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|-----|-----|---------|---------|---------|--|--------------|------|
|     |     |         |         |         | JOB No.  | 159-90-05    | PAGE |
|     |     |         |         |         | CALC No.   | 159-90-05 01 | 5    |
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| REV | BY  | DATE    | CHECKED | DATE    |  |              | 15   |

### Normal Operations (cont'd)

#### MEDP

Closing for PORV maintenance is not performed at power; therefore, the pressure on either side of the valve is essentially zero.

#### Maximum Pressure

The maximum pressure on either side of the valve during this scenario is assumed to be 0 psig (14.7 psia).

#### Flow Conditions


The flowrate associated with this MEDP scenario is zero (0) gpm.

#### Temperature Conditions

The temperature associated with this scenario is the containment ambient temperature during refueling operations.

#### Stroke Time

No design basis stroke time relative to this scenario applies.

|     |     |         |         |         |   |              |                                     |
|-----|-----|---------|---------|---------|---|--------------|-------------------------------------|
|     |     |         |         |         | JOB No.   | 159-90-05    | PAGE<br><u>6</u><br>OF<br><u>15</u> |
|     |     |         |         |         | CALC No.  | 159-90-05.01 |                                     |
| 0   | CHS | 7-17-91 | DJR     | 7-17-91 |  <b>ENGINEERING AND RESEARCH INC</b> |              |                                     |
| REV | BY  | DATE    | CHECKED | DATE    |   |              |                                     |



## 5.2 Abnormal Operations

When conditions indicate an RCS leak via PORV leakage, continued operation with the block valves closed is allowed per the Technical Specifications. Operation under these conditions is described in Abnormal Operating Procedure AOP-22, REACTOR COOLANT LEAK [7].

### MEDP<sub>open</sub>

Assuming the block valve(s) were closed during power operation due to a leaking PORV, the block valves would be required to open to enable low temperature overpressurization protection (LTOP) during cooldown. LTOP is initiated when RCS pressure is less than or equal to 1650 psia [7]. To account for instrument inaccuracy, this pressure is conservatively assumed to be 1700 psia (1650 + 3%). While the normal operating pressure in the quench tank is 3 psig with a normal maximum of 10 psig [14], for conservatism a downstream pressure of 0 psig (14.7 psia) is assumed.

### Maximum Pressure

The maximum pressure conditions associated with this open scenario are equivalent to the upstream pressure during LTOP initiation of 1700 psia [7].

### Flow Conditions

The flow conditions during this open scenario are essentially static.

### Temperature Conditions

The temperature of saturated steam at 1700 psia 613°F [15].

### Stroke Time

No design basis stroke time relative to this scenario applies.

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|------|-----|---------|---------|----------|--|-----------------------|
|      |     |         |         | JOB No.  | 159-90-05                              | PAGE<br>7<br>OF<br>15 |
|      |     |         |         | CALC No. | 159-90-05.01                           |                       |
| 0    | ETS | 9-17-91 | Jed     | 9-17-91  |  |                       |
| REV. | BY  | DATE    | CHECKED | DATE     | ERIN®<br>ENGINEERING AND RESEARCH INC. |                       |



### Abnormal Operations (cont'd)

#### MEDP

The PORV block valves are required to close to isolate the PORVs when conditions indicate abnormal RCS leakage. If high quench tank temperature, pressure, and/or level conditions are indicated, RCS pressure is verified to be less than 2300 psia prior to closing the PORV block valves [7]. To account for instrument inaccuracy, the pressure is conservatively assumed to be 2369 psia ( $2300 + 3\%$ ). Since this scenario applies to a leaking PORV and not a stuck-open PORV, it is assumed that the PORVs are still able to hold back-pressure on the block valves during closure. Therefore, the upstream and downstream pressure are essentially equivalent and the MEDP is zero.

#### Maximum Pressure

The maximum pressure of 2369 psia is present upstream and downstream of the valve during this closing scenario.

#### Flow Conditions


The flowrate due to a leaking PORV (as opposed to a stuck-open PORV) is assumed to be within the limiting condition for operation for RCS leakage of 10 gpm [Ref. 5, Section 2.1.4].

#### Temperature Conditions

The temperature of saturated steam at 2369 psia is 660°F [15].

#### Stroke Time

No design basis stroke time relative to this scenario applies.

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|-----|-----|---------|---------|---------|---|--------------|-----------------------|
|     |     |         |         |         | JOB No.   | 159-90-05    | PAGE<br>8<br>OF<br>15 |
|     |     |         |         |         | CALC No.  | 159-90-05.01 |                       |
| 0   | ENS | 9-17-91 | DA      | 9-17-91 |  <b>ERIN</b><br>ENGINEERING AND RESEARCH INC. |              |                       |
| REV | BY  | DATE    | CHECKED | DATE    |   |              |                       |

### 5.3 Design Basis Accident Conditions

The block valves must be capable of closing in the event of a stuck-open PORV to limit the loss of RCS inventory. While the block valves are used for certain EOP actions, there are no design basis open scenarios for the PORV block valves. The accident conditions for which the block valves may be required to open are beyond the design bases of the plant.

#### MEDP<sub>close</sub>

The maximum differential pressure associated with valve closure would occur following the pressure transient which resulted in the stuck-open PORV. The PORV reseating (blowdown) pressure is 2376 psia (2400 - 1%) assuming the PORV had not stuck open. However, there is no proceduralized operator action requiring the block valves to close until pressure is less than 2300 psia [10]. Neither the PORVs or the PORV block valves are required to close with pressurizer pressure at or near the safety valve setpoint, nor is it practical to assume that an operator would attempt to close the block valves until pressure is satisfactorily reduced per the EOPs.

To account for instrument inaccuracy, the upstream pressure is conservatively assumed to be at 2369 psia (2300 + 3%). While the quench tank can condense the steam discharged during a loss of load incident without exceeding the rupture disk setpoint [6], downstream containment atmosphere conditions (14.7 psia) are assumed for conservatism.

#### Maximum Pressure

The maximum pressure associated with valve closure due to a stuck-open PORV is the upstream pressure of 2369 psia.

#### Flow Conditions


The maximum flow through KCV-150/151 associated with valve closure assuming a stuck-open PORV is 110,220 lbs/hr assuming saturated steam, the flow capacity of a PORV [6].

#### Temperature Conditions

The temperature of saturated steam at 2369 psia is 660°F [15].

#### Stroke Time

No design basis stroke time relative to this scenario applies.

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|------|-----|---------|---------|---------|--|--------------|-----------------------|
|      |     |         |         |         | JOB No.  | 159-90-05    | PAGE<br>9<br>OF<br>15 |
|      |     |         |         |         | CALC No.   | 159-90-05.01 |                       |
| 0    | EAS | 9-17-91 | TJS     | 9-17-91 |  <b>ENGINEERING AND RESEARCH INC</b> |              |                       |
| REV. | BY  | DATE    | CHECKED | DATE    |  |              |                       |

#### 5.4 Surveillance Test

To satisfy the requirements of the Technical Specifications, the PORV block valves are cycled during quarterly surveillance with the PORVs closed [8].

##### MEDP<sub>open</sub>

During surveillance stroke testing of the PORV block valves, the PORVs are closed [15], trapping pressurizer downstream of the block valves. Since the block valves are normally open, then closed and re-opened for the stroke test, upstream and downstream pressure are essentially equivalent during valve opening. Normal pressurizer pressure of 2100 psia is assumed [6,16].

##### Maximum Pressure

The maximum pressure of 2100 psia is present upstream and downstream of the valve during valve opening.

##### Flow Conditions


The flow conditions during this open scenario are essentially static.

##### Temperature Conditions

The temperature of saturated steam at 2100 psia is 643°F [8].

##### Stroke Time

The open stroke time is not recorded during the surveillance test for HCV-150/151 [8].

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|------|-----|---------|---------|------|--|--------------|------|
|      |     |         |         |      | JOB No.  | 159-90-05    | PAGE |
|      |     |         |         |      | CALC No.   | 159-90-05.01 | 10   |
|      |     |         |         |      |  |              | OF   |
| 0    | EAS | 9-17-91 | 9-17-91 |      |  |              | 15   |
| REV. | BY  | DATE    | CHECKED | DATE |  |              |      |

## Surveillance/Test (cont'd)

### MEDP<sub>close</sub>

Since the PORVs are closed during the surveillance test and the block valves are normally open prior to the test, upstream and downstream pressure are essentially equivalent during valve closure. Normal pressurizer pressure of 2100 psia is assumed [6,17].

### Maximum Pressure

The maximum pressure of 2100 psia is present upstream and downstream of the valve during valve opening.

### Flow Conditions


Flow conditions during this closing scenario are essentially static.

### Temperature Conditions

Temperature of saturated steam at 2100 psia is 643°F [16].

### Stroke Time

The reference stroke time for HCV-150/151 is 9.5 seconds [15]. The valve must stroke within a maximum allowable stroke time of 23.7 seconds or be declared inoperable [15].

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|------|-----|---------|---------|---------|--|--------------|------|
|      |     |         |         |         | JOB No.  | 159-90-05    | PAGE |
|      |     |         |         |         | CALC No.   | 159-90-05.01 | 11   |
|      |     |         |         |         |  |              | OF   |
| 0    | EAS | 9-17-91 | DW      | 9-17-91 |  <b>ERIN</b><br>ENGINEERING AND RESEARCH INC. |              | 15   |
| REV. | BY  | DATE    | CHECKED | DATE    |  |              |      |

## 5.5 Emergency Operating Procedures

A potential EOP response to a loss of all feedwater requires the block valves to open (if closed due to a stuck-open PORV) to initiate once-through-cooling [12].

### MEDP<sub>open</sub>

Since the PORV block valves are otherwise normally open, the maximum upstream pressure at which the PORV block valves would be required to open would occur with the PORVs inoperable (stuck-open) and the block valves closed for RCS isolation per the Technical Specifications [Ref. 5, Section 2.1.6]. Automatic pressure relief capability is provided by the safety valves and any manual operator action in response to a pressure transient would likely precede reaching the safety valve setpoint of 2500 psia. However, assuming a loss of all feedwater and initiation of once-through-cooling operations, the block valves could be required to open with pressure near the safety valve setpoint of 2500 psia [6,12].

### Maximum Pressure

The maximum pressure associated with this scenario is the upstream pressure of 2500 psia.

### Flow Conditions


After once-through cooling has been established, the flow through HCV-150/151 will be the combined flow of all available HPSI and charging pumps [12]. However, there is still a bubble in the pressurizer during the initiation of once-through cooling; therefore, the initial flow conditions during unseating will be saturated steam at 110,220 lbs/hr, the flow capacity of a PORV [6].

### Temperature Conditions

The temperature of saturated steam at 2500 psia is 668°F [15].

### Stroke Time

No design basis stroke time relative to this scenario applies.

|   |     |         |     |         |   |              |                        |         |      |
|---|-----|---------|-----|---------|---|--------------|------------------------|---------|------|
|   |     |         |     |         | JOB No.   | 159-90-05    | PAGE<br>12<br>OF<br>15 |         |      |
|   |     |         |     |         | CALC No.  | 159-90-05.01 |                        |         |      |
|   |     |         |     |         |  <b>ENGINEERING AND RESEARCH INC</b> |              |                        |         |      |
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## Emergency Operating Procedures (cont'd)

### MEDP<sub>close</sub>

The PORV block valves are required to close during EOP post trip action if a PORV is still open at 2300 psia [10]. To account for instrument inaccuracy, the upstream pressure is conservatively assumed to be at 2369 psia ( $2300 + 3\%$ ). While the rupture disk setpoint may not have been exceeded, downstream containment atmosphere conditions (14.7 psia) are assumed for conservatism.

### Maximum Pressure

The maximum pressure during EOP closure is the upstream pressure of 2369 psia.

### Flow Conditions


The maximum flow through HCV-150/151 associated with valve closure assuming a stuck-open PORV is 110,220 lbs./hr assuming saturated steam, the flow capacity of a PORV [6].

### Temperature Conditions

The temperature of saturated steam at 2369 psia is 660°F [15].

### Stroke Time

No design basis stroke time relative to this scenario applies.

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|------|-----|---------|---------|---|--------------|------|
|      |     |         |         | JOB No.   | 159-90-05    | PAGE |
|      |     |         |         | CALC No.  | 159-90-05.01 | 13   |
|      |     |         |         |   |              | OF   |
| 0    | EAS | 9-17-91 | 9-17-91 |  <b>ERIN</b><br>ENGINEERING AND RESEARCH, INC. |              | 15   |
| REV. | BY  | DATE    | CHECKED |   |              |      |



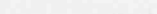
## 6.0 Summary of Results

The following table presents the numerical service conditions for the individual operating states:

| Case           | STROKE<br>Direction/Time |      | Upstream<br>Pressure<br>psia | Downstream<br>Pressure<br>psia | MEDP<br>psid | Flow              | Temp<br>°F |
|----------------|--------------------------|------|------------------------------|--------------------------------|--------------|-------------------|------------|
| 1 <sup>1</sup> | open                     | N/A  | 2100                         | 2100                           | 0            | 0                 | 643        |
|                | close                    | N/A  | 15                           | 15                             | 0            | 0                 | Ambient    |
| 2 <sup>2</sup> | open                     | N/A  | 1700                         | 1700                           | 0            | 10 gpm            | 613        |
|                | close                    | N/A  | 2369                         | 2369                           | 0            | 10 gpm            | 660        |
| 3 <sup>3</sup> | open                     | N/A  | N/A                          | N/A                            | N/A          | N/A               | N/A        |
|                | close                    | N/A  | 2369                         | 15                             | 2354         | 110,220<br>lbs/hr | 660        |
| 4 <sup>4</sup> | open                     | N/A  | 2100                         | 2100                           | 0            | 0                 | 643        |
|                | close                    | 23.7 | 2100                         | 2100                           | 0            | 0                 | 643        |
| 5 <sup>5</sup> | open                     | N/A  | 2500                         | 15                             | 2485         | 110,220<br>lbs/hr | 668        |
|                | close                    | N/A  | 2369                         | 15                             | 2354         | 110,220<br>lbs/hr | 660        |

### Notes:

- <sup>1</sup> The open (inadvertent operation at power) and the close (PORV maintenance) scenarios for this case are unrelated.
- <sup>2</sup> This case involves opening (to enable LTOP) and closing (to isolate a leaking PORV) assuming PORV leakage.
- <sup>3</sup> This case involves the worst case closing scenario for a stuck-open PORV; no associated open scenario applies.
- <sup>4</sup> This case involves opening and closing for valve timing surveillance test.
- <sup>5</sup> The open (once-through-cooling) and the close (EOP post trip action) scenarios for this case are unrelated.

|      |     |         |         |         |  |              |                        |
|------|-----|---------|---------|---------|--|--------------|------------------------|
|      |     |         |         |         | JOB No.  | 159-90-05    | PAGE<br>14<br>OF<br>15 |
|      |     |         |         |         | CALC No.   | 159-90-05.01 |                        |
| 0    | ERS | 9-17-91 | 6/25    | 9-17-91 |  <u>ENGINEERING AND RESEARCH INC</u> |              |                        |
| REV. | BY  | DATE    | CHECKED | DATE    |  |              |                        |



# Summary of Results (cont'd)

The worst case operating scenarios for the PORV block valves are: 1) opening against a 2485 psi differential pressure to initiate once-through-cooling per the Emergency Operating Procedures; and 2) closing for a design basis event resulting in a stuck-open PORV against a differential pressure of 2354 psi.

|     |     |         |         |          |   |                        |
|-----|-----|---------|---------|----------|---|------------------------|
|     |     |         |         | JOB No.  | 159-90-05                                 | PAGE<br>15<br>OF<br>15 |
|     |     |         |         | CALC No. | 159-90-05.01                              |                        |
| 0   | EAS | 9-17-91 | Jed     | 9-17-91  | <b>ERIN</b> ENGINEERING AND RESEARCH INC. |                        |
| REV | BY  | DATE    | CHECKED | DATE     |   |                        |

# Memorandum

DATE: January 2, 1991

PED-FC-91-305

FROM: R. L. Phelps

TO: T. J. McIvor

SUBJECT: Degraded Voltage Operation of the PORV Block Valves HCV-150 and HCV-151

The purpose of this memorandum is to provide the results of an investigation into the expected motor terminal voltage during a DBA with degraded voltage on the 161 KV grid. This information was requested by R. J. Mueller to insure adequate thrust was available to close the block valve(s) should a PORV(s) stick open causing a LOCA. The criteria provided by Mr. Mueller was 396 volts (90% of the motor 440v rating) to assure rated MOV thrust.

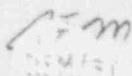
The attached ELMS degraded voltage analysis indicates a worst case voltage of 408V for HCV-150 (condition 3) and 396.5 volts for HCV-151 (condition 5). These voltage correspond to the expected worst case bus loadings with the condensate system at full load, buses 1A1 and 1A2 on the 161 KV and all safety loads sequenced on. The bus voltage on buses 1A3 and 1A4 are at the OPLS setting which corresponds to approximately 158900 volts on the 161 KV grid.

Under these conditions, the 396 volt criteria is met. Please noted that this calculation is not complete and the results are considered preliminary. The approved calculation based on QP-3 including necessary reviews will be completed by 2/22/91.

If there are any questions, please contact Mr. R. F. Mehaffey at extension 3471.



R. L. Phelps  
Manager - Design Engineering Nuclear  
Production Engineering Division



c: R. J. Mueller  
R. K. Schwartzbeck

Date : 12-21-90

Sargent & Lundy Engineers  
Chicago, Ill.Page : 1  
Initials : pfv

## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District  
Station : FT.CALHOUN-1523MVA,SCC;FW&CND.LOADRUNBAKProj. No. : 7752-01  
Unit : 1\*\*\*\*\*  
\* Source Number : 1 \*  
\*\*\*\*\*

| Internal<br>Bus No. |        |                      | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                   |                   |                   |                   |
|---------------------|--------|----------------------|--------------------|---|-------------------|-------------------|-------------------|-------------------|
|                     |        |                      |                    | Cond. 1   | Cond. 2           | Cond. 3           | Cond. 4           | Cond. 5           |
| 1                   | Source | GENERATOR TERMINAL   | 22000.0            | 20900.0<br>95.0 %                                   | 20900.0<br>95.0 % | 20900.0<br>95.0 % | 20900.0<br>95.0 % | 20900.0<br>95.0 % |
| 4                   |        | T1A1 TIE PT          | 4160.0             | 3847.6<br>92.5 %                                    | 3847.6<br>92.5 %  | 3847.6<br>92.5 %  | 3928.5<br>94.4 %  | 3928.5<br>94.4 %  |
| 5                   |        | T1A2 TIE PT          | 4160.0             | 3928.4<br>94.4 %                                    | 3952.1<br>95.0 %  | 3952.1<br>95.0 %  | 3849.7<br>92.5 %  | 3849.7<br>92.5 %  |
| 8                   |        | 4.16KV BUS 1A1       | 4160.0             | 3844.2<br>92.4 %                                    | 3844.2<br>92.4 %  | 3844.2<br>92.4 %  | 3927.7<br>94.4 %  | 3927.7<br>94.4 %  |
| 9                   |        | reac cool pmp a term | 4160.0             | 3841.4<br>92.3 %                                    | 3841.4<br>92.3 %  | 3841.4<br>92.3 %  | 3925.0<br>94.3 %  | 3925.0<br>94.3 %  |
| 10                  |        | stm gen pmp a term   | 4160.0             | 3839.9<br>92.3 %                                    | 3839.9<br>92.3 %  | 3839.9<br>92.3 %  | 3927.7<br>94.4 %  | 3927.7<br>94.4 %  |
| 11                  |        | circ wtr pmp a term  | 4160.0             | 3831.4<br>92.1 %                                    | 3831.4<br>92.1 %  | 3831.4<br>92.1 %  | 3927.7<br>94.4 %  | 3927.7<br>94.4 %  |
| 12                  |        | cond pmp a term      | 4160.0             | 3841.0<br>92.3 %                                    | 3841.0<br>92.3 %  | 3841.0<br>92.3 %  | 3927.7<br>94.4 %  | 3927.7<br>94.4 %  |
| 13                  |        | htr drain pmp a term | 4160.0             | 3836.3<br>92.2 %                                    | 3836.3<br>92.2 %  | 3836.3<br>92.2 %  | 3927.7<br>94.4 %  | 3927.7<br>94.4 %  |
| 14                  |        | fire pmp 1a term     | 4160.0             | 3838.0<br>92.3 %                                    | 3838.0<br>92.3 %  | 3838.0<br>92.3 %  | 3927.7<br>94.4 %  | 3927.7<br>94.4 %  |
| 30                  |        | 4.16KV BUS 1A2       | 4160.0             | 3927.6<br>94.4 %                                    | 3952.1<br>95.0 %  | 3952.1<br>95.0 %  | 3846.4<br>92.5 %  | 3846.4<br>92.5 %  |
| 31                  |        | SEC WDG UAPT#T1A1    | 4160.0             | 3853.3<br>92.6 %                                    | 3853.3<br>92.6 %  | 3853.3<br>92.6 %  | 3929.8<br>94.5 %  | 3929.8<br>94.5 %  |
| 32                  |        | reac cool pmp b term | 4160.0             | 3925.1<br>94.4 %                                    | 3952.1<br>95.0 %  | 3952.1<br>95.0 %  | 3843.9<br>92.4 %  | 3843.9<br>92.4 %  |
| 33                  |        | stm gen pmp b term   | 4160.0             | 3927.6<br>94.4 %                                    | 3952.1<br>95.0 %  | 3952.1<br>95.0 %  | 3841.3<br>92.3 %  | 3841.3<br>92.3 %  |
| 34                  |        | circ wtr pmp b term  | 4160.0             | 3927.6<br>94.4 %                                    | 3952.1<br>95.0 %  | 3952.1<br>95.0 %  | 3833.6<br>92.2 %  | 3833.6<br>92.2 %  |

Date : 12-21-90

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Page : 2  
Initials : pfv

## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District

Proj. No. : 7752-01

\*\*\*\*\*  
\* Source Number : 1 \*

Station : FT.CALHDUN-1523MVA,SCC;FW&amp;CND.LOADRUNBAK

Unit : 1

\*\*\*\*\*

| Internal<br>Bus No. |                    | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                  |                  |                  |                  |
|---------------------|--------------------|--------------------|---|------------------|------------------|------------------|------------------|
|                     |                    |                    | Cond. 1   | Cond. 2          | Cond. 3          | Cond. 4          | Cond. 5          |
| 35                  | cond pmp b term    | 4160.0             | 3927.6<br>94.4 %                                    | 3952.1<br>95.0 % | 3952.1<br>95.0 % | 3844.0<br>92.4 % | 3844.0<br>92.4 % |
| 36                  | htr drn pmp b term | 4160.0             | 3927.6<br>94.4 %                                    | 3952.1<br>95.0 % | 3952.1<br>95.0 % | 3838.2<br>92.3 % | 3838.2<br>92.3 % |
| 37                  | SEC WDG UAPT#T1A2  | 4160.0             | 3936.0<br>94.5 %                                    | 3952.1<br>95.0 % | 3952.1<br>95.0 % | 3856.4<br>92.7 % | 3856.4<br>92.7 % |

AC Electrical Load Monitoring System Ver 2.10  
Sargent & Lundy Engineers  
Chicago, Ill.

Date : 12-21-90

Page : 3  
Initials : pfv

\*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District  
Station : FT.CALHOUN-1523MVA,SCC;FW&CND.LOADRUNBAK

Proj. No. : 7752-01  
Unit : 1

\*\*\*\*\*  
\* Source Number : 2 \*  
\*\*\*\*\*

| Internal<br>Bus No. |                      | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                    |                    |                    |                    |
|---------------------|----------------------|--------------------|---|--------------------|--------------------|--------------------|--------------------|
|                     |                      |                    | Cond. 1   | Cond. 2            | Cond. 3            | Cond. 4            | Cond. 5            |
| 2                   | Source 161KV SOURCE  | 161000.0           | 160718.0<br>99.8 %                                  | 160718.0<br>99.8 % | 160718.0<br>99.8 % | 160718.0<br>99.8 % | 160718.0<br>99.8 % |
| 3                   | SUBSTATION 1251      | 161000.0           | 158789.4<br>98.6 %                                  | 158870.1<br>98.7 % | 158603.4<br>98.5 % | 158601.8<br>98.5 % | 158468.4<br>98.4 % |
| 6                   | T1A3 TIE PT          | 4160.0             | 3879.5<br>93.3 %                                    | 3854.2<br>92.6 %   | 3823.5<br>91.9 %   | 4008.2<br>96.4 %   | 3970.5<br>95.4 %   |
| 7                   | T1A4 TIE PT          | 4160.0             | 3903.9<br>93.8 %                                    | 3948.8<br>94.9 %   | 3905.5<br>93.9 %   | 3729.2<br>89.6 %   | 3728.1<br>89.6 %   |
| 8                   | 4.16KV BUS 1A1       | 4160.0             | 3876.3<br>93.2 %                                    | 3851.0<br>92.6 %   | 3820.3<br>91.8 %   | 4007.4<br>96.3 %   | 3969.8<br>95.4 %   |
| 9                   | reac cool pmp a term | 4160.0             | 3873.5<br>93.1 %                                    | 3848.2<br>92.5 %   | 3817.5<br>91.8 %   | 4004.7<br>96.3 %   | 3967.1<br>95.4 %   |
| 10                  | stm gen pmp a term   | 4160.0             | 3872.0<br>93.1 %                                    | 3846.7<br>92.5 %   | 3815.9<br>91.7 %   | 4007.4<br>96.3 %   | 3969.8<br>95.4 %   |
| 11                  | circ wtr pmp a term  | 4160.0             | 3863.6<br>92.9 %                                    | 3838.2<br>92.3 %   | 3807.4<br>91.5 %   | 4007.4<br>96.3 %   | 3969.8<br>95.4 %   |
| 12                  | cond pmp a term      | 4160.0             | 3873.2<br>93.1 %                                    | 3847.8<br>92.5 %   | 3817.1<br>91.8 %   | 4007.4<br>96.3 %   | 3969.8<br>95.4 %   |
| 13                  | htr drain pmp a term | 4160.0             | 3868.5<br>93.0 %                                    | 3843.1<br>92.4 %   | 3812.4<br>91.6 %   | 4007.4<br>96.3 %   | 3969.8<br>95.4 %   |
| 14                  | fire pmp 1a term     | 4160.0             | 3870.2<br>93.0 %                                    | 3844.8<br>92.4 %   | 3814.0<br>91.7 %   | 4007.4<br>96.3 %   | 3969.8<br>95.4 %   |
| 15                  | 4.16KV BUS 1A3       | 4160.0             | 3877.9<br>93.2 %                                    | 3852.2<br>92.6 %   | 3821.2<br>91.9 %   | 4006.9<br>96.3 %   | 3968.7<br>95.4 %   |
| 16                  | reac cool pmp c term | 4160.0             | 3874.4<br>93.1 %                                    | 3848.6<br>92.5 %   | 3817.6<br>91.8 %   | 4003.5<br>96.2 %   | 3965.2<br>95.3 %   |
| 17                  | lp sa inj pmp a term | 4160.0             | 3877.9<br>93.2 %                                    | 3852.2<br>92.6 %   | 3817.9<br>91.8 %   | 4006.9<br>96.3 %   | 3965.5<br>95.3 %   |
| 18                  | md aux fwtr pp term  | 4160.0             | 3877.9<br>93.2 %                                    | 3852.2<br>92.6 %   | 3820.6<br>91.8 %   | 4006.9<br>96.3 %   | 3968.1<br>95.4 %   |

## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District  
Station : FT.CALHOUN-1523MVA,SCC:FW&CND,LOADRUMBAKProj. No. : 7752-01  
Unit : 1\*\*\*\*\*  
\* Source Number : 2 \*  
\*\*\*\*\*

| Internal<br>Bus No. |                      | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                  |                  |                  |                  |
|---------------------|----------------------|--------------------|---|------------------|------------------|------------------|------------------|
|                     |                      |                    | Cond. 1   | Cond. 2          | Cond. 3          | Cond. 4          | Cond. 5          |
| 19                  | raw wtr pmp a term   | 4160.0             | 3877.9<br>93.2 %                                    | 3847.3<br>92.5 % | 3816.3<br>91.7 % | 4006.9<br>96.3 % | 3964.0<br>95.3 % |
| 20                  | raw wtr pmp c term   | 4160.0             | 3872.9<br>93.1 %                                    | 3847.1<br>92.5 % | 3816.0<br>91.7 % | 4006.9<br>96.3 % | 3963.7<br>95.3 % |
| 21                  | 4.16KV BUS 1A4       | 4160.0             | 3900.4<br>93.8 %                                    | 3945.4<br>94.8 % | 3901.5<br>93.8 % | 3724.9<br>89.5 % | 3723.9<br>89.5 % |
| 22                  | reac cool pmp d term | 4160.0             | 3897.7<br>93.7 %                                    | 3942.8<br>94.8 % | 3898.8<br>93.7 % | 3722.0<br>89.5 % | 3721.1<br>89.4 % |
| 23                  | lp sa inj pmp b term | 4160.0             | 3900.4<br>93.8 %                                    | 3945.4<br>94.8 % | 3898.9<br>93.7 % | 3724.8<br>89.5 % | 3721.2<br>89.5 % |
| 24                  | stm gen pmp c term   | 4160.0             | 3894.9<br>93.6 %                                    | 3940.0<br>94.7 % | 3896.0<br>93.7 % | 3719.1<br>89.4 % | 3718.1<br>89.4 % |
| 25                  | circ wtr pmp c term  | 4160.0             | 3889.7<br>93.5 %                                    | 3934.9<br>94.6 % | 3890.8<br>93.5 % | 3713.7<br>89.3 % | 3712.7<br>89.2 % |
| 26                  | cond pmp c term      | 4160.0             | 3897.2<br>93.7 %                                    | 3942.3<br>94.8 % | 3898.3<br>93.7 % | 3721.6<br>89.5 % | 3720.6<br>89.4 % |
| 27                  | htr drn pmp c term   | 4160.0             | 3892.5<br>93.6 %                                    | 3937.6<br>94.7 % | 3893.6<br>93.6 % | 3716.6<br>89.3 % | 3715.6<br>89.3 % |
| 28                  | raw wtr pmp b term   | 4160.0             | 3900.4<br>93.8 %                                    | 3945.4<br>94.8 % | 3896.6<br>93.7 % | 3719.7<br>89.4 % | 3718.8<br>89.4 % |
| 29                  | raw wtr pmp d term   | 4160.0             | 3900.4<br>93.8 %                                    | 3945.4<br>94.8 % | 3896.4<br>93.7 % | 3719.5<br>89.4 % | 3718.5<br>89.4 % |
| 30                  | 4.16KV BUS 1A2       | 4160.0             | 3903.1<br>93.8 %                                    | 3948.8<br>94.9 % | 3905.5<br>93.9 % | 3725.8<br>89.6 % | 3724.8<br>89.5 % |
| 32                  | reac cool pmp b term | 4160.0             | 3900.6<br>93.8 %                                    | 3948.8<br>94.9 % | 3905.5<br>93.9 % | 3723.2<br>89.5 % | 3722.2<br>89.5 % |
| 33                  | stm gen pmp b term   | 4160.0             | 3903.1<br>93.8 %                                    | 3948.8<br>94.9 % | 3905.5<br>93.9 % | 3720.5<br>89.4 % | 3719.5<br>89.4 % |
| 34                  | circ wtr pmp b term  | 4160.0             | 3903.1<br>93.8 %                                    | 3948.8<br>94.9 % | 3905.5<br>93.9 % | 3712.6<br>89.2 % | 3711.6<br>89.2 % |



## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District  
Station : FT.CALHOUN-1523MVA,SCC;FK&CND,LOADRUNBAKProj. No. : 7752-01  
Unit : 1\*\*\*\*\*  
\* Source Number : 2 \*  
\*\*\*\*\*

| Internal<br>Bus No. |                      | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                  |                  |                  |                  |
|---------------------|----------------------|--------------------|---|------------------|------------------|------------------|------------------|
|                     |                      |                    | Cond. 1   | Cond. 2          | Cond. 3          | Cond. 4          | Cond. 5          |
| 35                  | cond pmp b term      | 4160.0             | 3903.1<br>93.8 %                                    | 3948.8<br>94.9 % | 3905.5<br>93.9 % | 3723.3<br>89.5 % | 3722.3<br>89.5 % |
| 36                  | htr drn pmp b term   | 4160.0             | 3903.1<br>93.8 %                                    | 3948.8<br>94.9 % | 3905.5<br>93.9 % | 3717.4<br>89.4 % | 3716.3<br>89.3 % |
| 38                  | PRI WDG OF T1B-3A    | 4160.0             | 3876.3<br>93.2 %                                    | 3849.6<br>92.5 % | 3818.3<br>91.8 % | 4005.0<br>96.3 % | 3965.9<br>95.3 % |
| 39                  | PRI WDG OF T1B-3B    | 4160.0             | 3875.9<br>93.2 %                                    | 3849.6<br>92.5 % | 3818.8<br>91.8 % | 4006.3<br>96.3 % | 3967.8<br>95.4 % |
| 40                  | PRI WDG OF T1B-3C    | 4160.0             | 3876.8<br>93.2 %                                    | 3850.2<br>92.6 % | 3818.6<br>91.8 % | 4006.2<br>96.3 % | 3967.0<br>95.4 % |
| 41                  | PRI WDG OF T1B-4A    | 4160.0             | 3898.2<br>93.7 %                                    | 3944.1<br>94.8 % | 3899.9<br>93.7 % | 3721.8<br>89.5 % | 3721.1<br>89.4 % |
| 42                  | PRI WDG OF T1B-4B    | 4160.0             | 3899.9<br>93.7 %                                    | 3944.8<br>94.8 % | 3899.8<br>93.7 % | 3723.1<br>89.5 % | 3723.2<br>89.5 % |
| 43                  | PRI WDG OF T1B-4C    | 4160.0             | 3899.7<br>93.7 %                                    | 3944.8<br>94.8 % | 3899.9<br>93.7 % | 3723.2<br>89.5 % | 3722.0<br>89.5 % |
| 44                  | SEC WDG HSPT#T1A3    | 4160.0             | 3888.8<br>93.5 %                                    | 3864.5<br>92.9 % | 3834.7<br>92.2 % | 4012.1<br>96.4 % | 3975.8<br>95.6 % |
| 45                  | SEC WDG HSPT#T1A4    | 4160.0             | 3912.1<br>94.0 %                                    | 3955.3<br>95.1 % | 3913.4<br>94.1 % | 3743.7<br>90.0 % | 3742.6<br>90.0 % |
| 46                  | 480V BUS 1B3A        | 480.0              | 434.3<br>90.5 %                                     | 421.7<br>87.8 %  | 411.8<br>85.8 %  | 445.7<br>92.9 %  | 430.5<br>89.6 %  |
| 47                  | hp sa inj pmp a term | 480.0              | 434.3<br>90.5 %                                     | 421.7<br>87.8 %  | 405.0<br>84.4 %  | 439.4<br>91.5 %  | 423.7<br>88.3 %  |
| 48                  | charging pmp a term  | 480.0              | 434.3<br>90.5 %                                     | 414.3<br>86.3 %  | 404.2<br>84.2 %  | 445.7<br>92.9 %  | 423.0<br>88.1 %  |
| 49                  | cont air fan 3a term | 480.0              | 432.3<br>90.1 %                                     | 419.6<br>87.4 %  | 407.6<br>84.9 %  | 443.8<br>92.5 %  | 426.3<br>88.8 %  |
| 50                  | dw46a pmp term       | 480.0              | 421.6<br>87.8 %                                     | 412.0<br>85.8 %  | 409.7<br>85.3 %  | 454.2<br>94.6 %  | 446.8<br>93.1 %  |



## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District  
Station : FT.CALHOUN-1523MVA,SCC;FW&CND,LOADRUNBAKProj. No. : 7752-01  
Unit : 1\*\*\*\*\*  
\* Source Number : 2 \*  
\*\*\*\*\*

| Internal<br>Bus No. |                       | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                 |                 |                 |                 |
|---------------------|-----------------------|--------------------|---|-----------------|-----------------|-----------------|-----------------|
|                     |                       |                    | Cond. 1   | Cond. 2         | Cond. 3         | Cond. 4         | Cond. 5         |
| 51                  | 480V BUS 1B3A-4A      | 480.0              | 433.8<br>90.4 %                                     | 421.2<br>87.7 % | 410.4<br>85.5 % | 445.3<br>92.8 % | 429.0<br>89.4 % |
| 52                  | air comp c term       | 480.0              | 430.0<br>89.6 %                                     | 417.2<br>86.9 % | 406.3<br>84.7 % | 441.5<br>92.0 % | 425.0<br>88.5 % |
| 53                  | hp sa inj pmp c term  | 480.0              | 433.8<br>90.4 %                                     | 421.2<br>87.7 % | 403.3<br>84.0 % | 445.3<br>92.8 % | 422.2<br>88.0 % |
| 54                  | 480V BUS 1B4A         | 480.0              | 427.2<br>89.0 %                                     | 442.1<br>92.1 % | 433.7<br>90.4 % | 395.5<br>82.4 % | 398.6<br>83.0 % |
| 55                  | comp cool pp 3b term  | 480.0              | 424.0<br>88.3 %                                     | 442.1<br>92.1 % | 430.5<br>89.7 % | 392.0<br>81.7 % | 395.1<br>82.3 % |
| 56                  | cond vac pp 8b term   | 480.0              | 422.3<br>88.0 %                                     | 442.1<br>92.1 % | 433.7<br>90.4 % | 390.2<br>81.3 % | 393.3<br>81.9 % |
| 57                  | scrnwash pmp 3b term  | 480.0              | 427.2<br>89.0 %                                     | 442.1<br>92.1 % | 433.7<br>90.4 % | 384.3<br>80.1 % | 387.4<br>80.7 % |
| 58                  | dw-46b pump term      | 480.0              | 446.1<br>92.9 %                                     | 447.0<br>93.1 % | 427.0<br>89.0 % | 406.7<br>84.7 % | 419.1<br>87.3 % |
| 59                  | 480V BUS 1B3B         | 480.0              | 422.0<br>87.9 %                                     | 412.5<br>85.9 % | 409.7<br>85.3 % | 454.2<br>94.6 % | 446.8<br>93.1 % |
| 60                  | scrnwash pmp 3a term  | 480.0              | 422.0<br>87.9 %                                     | 402.0<br>83.7 % | 399.1<br>83.1 % | 454.2<br>94.6 % | 446.8<br>93.1 % |
| 61                  | cont co wa pp 3a term | 480.0              | 422.0<br>87.9 %                                     | 408.4<br>85.1 % | 405.5<br>84.5 % | 454.2<br>94.6 % | 446.8<br>93.1 % |
| 62                  | 480V BUS 1B3B-4B      | 480.0              | 446.1<br>92.9 %                                     | 446.6<br>93.1 % | 425.2<br>88.6 % | 406.5<br>84.7 % | 418.5<br>87.2 % |
| 63                  | cond vac pmp c term   | 480.0              | 446.1<br>92.9 %                                     | 441.9<br>92.1 % | 420.3<br>87.6 % | 401.3<br>83.6 % | 413.4<br>86.1 % |
| 64                  | cont spr pp 3c term   | 480.0              | 446.1<br>92.9 %                                     | 446.6<br>93.0 % | 419.1<br>87.3 % | 406.5<br>84.7 % | 418.5<br>87.2 % |
| 65                  | cont air fan 7d term  | 480.0              | 446.1<br>92.9 %                                     | 446.6<br>93.0 % | 422.5<br>88.0 % | 406.5<br>84.7 % | 418.5<br>87.2 % |

## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District

Proj. No. : 7752-01

\*\*\*\*\*  
\* Source Number : 2 \*  
\*\*\*\*\*

Station : FT.CALHOUN-1523MVA,SCC:FW&amp;CND.LOADRUNBAK

Unit : 1

| Internal<br>Bus No. |                      | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                 |                 |                 |                 |
|---------------------|----------------------|--------------------|---|-----------------|-----------------|-----------------|-----------------|
|                     |                      |                    | Cond. 1   | Cond. 2         | Cond. 3         | Cond. 4         | Cond. 5         |
| 66                  | charging pmp c term  | 480.0              | 446.1<br>92.9 %                                     | 446.6<br>93.0 % | 419.1<br>87.3 % | 400.0<br>83.3 % | 412.2<br>85.9 % |
| 67                  | 480V BUS 1B4B        | 480.0              | 446.1<br>92.9 %                                     | 447.0<br>93.1 % | 427.0<br>89.0 % | 407.1<br>84.8 % | 419.1<br>87.3 % |
| 68                  | cc.it spr pmp b term | 480.0              | 446.1<br>92.9 %                                     | 447.0<br>93.1 % | 421.1<br>87.7 % | 407.1<br>84.8 % | 419.1<br>87.3 % |
| 69                  | air comp b term      | 480.0              | 446.1<br>92.9 %                                     | 447.0<br>93.1 % | 427.0<br>89.0 % | 402.8<br>83.9 % | 414.9<br>86.4 % |
| 70                  | 480V BUS 1B3C        | 480.0              | 433.0<br>90.2 %                                     | 417.3<br>86.9 % | 401.3<br>83.6 % | 453.1<br>94.4 % | 434.7<br>90.6 % |
| 71                  | cont spr pmp a term  | 480.0              | 433.0<br>90.2 %                                     | 417.3<br>86.9 % | 393.3<br>81.9 % | 453.1<br>94.4 % | 427.3<br>89.0 % |
| 72                  | air comp a term      | 480.0              | 433.0<br>90.2 %                                     | 413.4<br>86.1 % | 397.3<br>82.8 % | 453.1<br>94.4 % | 434.7<br>90.6 % |
| 73                  | cond vac pmp a term  | 480.0              | 433.0<br>90.2 %                                     | 412.2<br>85.9 % | 396.0<br>82.5 % | 453.1<br>94.4 % | 434.7<br>90.6 % |
| 74                  | 480V BUS 1B3C-4C     | 480.0              | 432.4<br>90.1 %                                     | 416.6<br>86.8 % | 400.0<br>83.3 % | 452.5<br>94.3 % | 433.6<br>90.3 % |
| 75                  | cont cc fan 7c term  | 480.0              | 432.4<br>90.1 %                                     | 416.6<br>86.6 % | 396.5<br>82.6 % | 452.5<br>94.3 % | 430.3<br>89.6 % |
| 76                  | com co wa pp 3c term | 480.0              | 432.4<br>90.1 %                                     | 416.6<br>86.8 % | 395.2<br>82.3 % | 452.5<br>94.3 % | 429.2<br>89.4 % |
| 77                  | 480V BUS 1B4C        | 480.0              | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 427.3<br>89.0 % | 410.4<br>85.5 % | 402.5<br>83.8 % |
| 78                  | hp sa inj pmp b term | 480.0              | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 420.5<br>87.6 % | 410.4<br>85.5 % | 395.3<br>82.3 % |
| 79                  | charging pmp b term  | 480.0              | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 419.4<br>87.4 % | 410.4<br>85.5 % | 394.1<br>82.1 % |
| 80                  | cont ca fan 3b term  | 480.0              | 438.4<br>91.3 %                                     | 445.4<br>92.8 % | 424.6<br>88.5 % | 409.0<br>85.2 % | 399.6<br>83.3 % |

## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District  
Station : FT.CALHOUN-1523MVA,SCC;FW&CND.LOADRUNBAKProj. No. : 7752-01  
Unit : 1\*\*\*\*\*  
\* Source Number : 2 \*  
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| Internal<br>Bus No. |                      | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                 |                 |                 |                 |
|---------------------|----------------------|--------------------|---|-----------------|-----------------|-----------------|-----------------|
|                     |                      |                    | Cond. 1   | Cond. 2         | Cond. 3         | Cond. 4         | Cond. 5         |
| 81                  | 480V MCC 3A1         | 480.0              | 431.4<br>89.9 %                                     | 418.7<br>87.2 % | 411.5<br>85.7 % | 442.9<br>92.3 % | 429.9<br>89.6 % |
| 82                  | si ta 6c di vlv term | 480.0              | 431.4<br>89.9 %                                     | 418.7<br>87.2 % | 411.5<br>85.7 % | 442.9<br>92.3 % | 429.9<br>89.6 % |
| 83                  | hi pr inj 317 term   | 480.0              | 431.4<br>89.9 %                                     | 418.7<br>87.2 % | 411.5<br>85.7 % | 442.9<br>92.3 % | 429.9<br>89.6 % |
| 84                  | hi pr inj 314 term   | 480.0              | 431.4<br>89.9 %                                     | 418.7<br>87.2 % | 411.5<br>85.7 % | 442.9<br>92.3 % | 429.9<br>89.6 % |
| 85                  | lo pr inj 331 term   | 480.0              | 431.4<br>89.9 %                                     | 418.7<br>87.2 % | 411.5<br>85.7 % | 442.9<br>92.3 % | 429.9<br>89.6 % |
| 86                  | mn fwtr vlv b term   | 480.0              | 431.4<br>89.9 %                                     | 418.7<br>87.2 % | 411.5<br>85.7 % | 442.9<br>92.3 % | 429.9<br>89.6 % |
| 87                  | 480V MCC 3A2         | 480.0              | 433.0<br>90.2 %                                     | 418.6<br>87.2 % | 411.8<br>85.8 % | 445.7<br>92.9 % | 430.3<br>89.6 % |
| 88                  | cont recirc ln term  | 480.0              | 433.0<br>90.2 %                                     | 418.6<br>87.2 % | 411.8<br>85.8 % | 445.7<br>92.9 % | 430.3<br>89.6 % |
| 89                  | 480V MCC 3A3         | 480.0              | 434.3<br>90.5 %                                     | 418.4<br>87.2 % | 411.8<br>85.8 % | 445.7<br>92.9 % | 430.3<br>89.6 % |
| 90                  | 480V MCC 3A4         | 480.0              | 432.6<br>90.1 %                                     | 418.2<br>87.1 % | 411.8<br>85.8 % | 445.2<br>92.7 % | 430.3<br>89.6 % |
| 91                  | 480V MCC 3B1         | 480.0              | 420.2<br>87.5 %                                     | 410.9<br>85.6 % | 408.4<br>85.1 % | 453.5<br>94.5 % | 445.6<br>92.8 % |
| 92                  | si ta 6a di vlv term | 480.0              | 420.2<br>87.5 %                                     | 410.9<br>85.6 % | 408.4<br>85.1 % | 453.5<br>94.5 % | 445.6<br>92.8 % |
| 93                  | hpsi iso vlv 1b term | 480.0              | 420.2<br>87.5 %                                     | 410.9<br>85.6 % | 408.4<br>85.1 % | 453.5<br>94.5 % | 445.6<br>92.8 % |
| 94                  | hpsi iso vlv 2b term | 480.0              | 420.2<br>87.5 %                                     | 410.9<br>85.6 % | 408.4<br>85.1 % | 453.5<br>94.5 % | 445.6<br>92.8 % |
| 95                  | lpsi iso vlv 1b term | 480.0              | 420.2<br>87.5 %                                     | 410.9<br>85.6 % | 408.4<br>85.1 % | 453.5<br>94.5 % | 445.6<br>92.8 % |

## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District  
Station : FT.CALHOUN-1523MVA,SCC;FW&CND.LOADRUNDAKProj. No. : 7752-01  
Unit : 1\*\*\*\*\*  
\* Source Number : 2 \*  
\*\*\*\*\*

| Internal<br>Bus No. |                      | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                 |                 |                 |                 |
|---------------------|----------------------|--------------------|---|-----------------|-----------------|-----------------|-----------------|
|                     |                      |                    | Cond. 1   | Cond. 2         | Cond. 3         | Cond. 4         | Cond. 5         |
| 96                  | hcv-150 terminal     | 480.0              | 419.7<br>87.4 %                                     | 410.4<br>85.5 % | 408.0<br>85.0 % | 453.1<br>94.4 % | 445.2<br>92.7 % |
| 97                  | CT RM AC VA-46A TERM | 480.0              | 413.4<br>86.1 %                                     | 404.0<br>84.2 % | 401.5<br>83.6 % | 453.5<br>94.5 % | 439.3<br>91.5 % |
| 98                  | 480V DG AUX PNL D1   | 480.0              | 418.6<br>87.2 %                                     | 409.3<br>85.3 % | 406.8<br>84.7 % | 452.0<br>94.2 % | 444.1<br>92.5 % |
| 99                  | 480V MCC 3B2         | 480.0              | 417.2<br>86.9 %                                     | 409.0<br>85.2 % | 404.7<br>84.3 % | 452.8<br>94.3 % | 445.3<br>92.8 % |
| 100                 | 480V MCC 3B3         | 480.0              | 418.2<br>87.1 %                                     | 409.0<br>85.2 % | 405.7<br>84.5 % | 452.2<br>94.2 % | 444.4<br>92.6 % |
| 101                 | 480V MCC 3C1         | 480.0              | 432.8<br>90.2 %                                     | 416.1<br>86.7 % | 400.6<br>83.5 % | 452.8<br>94.3 % | 434.4<br>90.5 % |
| 102                 | 480V MCC 3C2         | 480.0              | 423.7<br>88.3 %                                     | 409.9<br>85.4 % | 390.4<br>81.3 % | 446.7<br>93.1 % | 426.9<br>88.9 % |
| 103                 | bo ac tk ch-11a term | 480.0              | 423.7<br>88.3 %                                     | 409.9<br>85.4 % | 390.4<br>81.3 % | 446.7<br>93.1 % | 426.9<br>88.9 % |
| 104                 | ear bor mv 268 term  | 480.0              | 423.7<br>88.3 %                                     | 409.9<br>85.4 % | 390.4<br>81.3 % | 446.7<br>93.1 % | 426.9<br>88.9 % |
| 105                 | 480V MCC 3C3         | 480.0              | 431.2<br>89.8 %                                     | 413.6<br>86.2 % | 401.3<br>83.6 % | 453.1<br>94.4 % | 434.7<br>90.6 % |
| 106                 | 480V MCC 3C4C 1      | 480.0              | 432.3<br>90.1 %                                     | 415.9<br>86.6 % | 399.3<br>83.2 % | 452.4<br>94.2 % | 433.4<br>90.3 % |
| 107                 | 480V MCC 3C4C-2      | 480.0              | 429.3<br>89.4 %                                     | 413.3<br>86.1 % | 400.0<br>83.3 % | 449.5<br>93.7 % | 433.6<br>90.3 % |
| 108                 | 480V MCC 3C4C-3      | 480.0              | 432.3<br>90.1 %                                     | 415.9<br>86.6 % | 399.3<br>83.2 % | 452.4<br>94.2 % | 433.4<br>90.3 % |
| 109                 | 480V MCC 4A1         | 480.0              | 426.0<br>88.8 %                                     | 440.9<br>91.9 % | 432.1<br>90.0 % | 393.7<br>82.0 % | 397.0<br>82.7 % |
| 110                 | sa inj tk si-6b term | 480.0              | 426.0<br>88.8 %                                     | 440.9<br>91.9 % | 432.1<br>90.0 % | 393.7<br>82.0 % | 397.0<br>82.7 % |

Date : 12-21-90

## AC Electrical Load Monitoring System Ver 2.10

Sargent & Lundy Engineers  
Chicago, Ill.Page : 10  
Initials : pfv

## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District  
Station : FT.CALHOUN-1523MVA,SCC;FW&CND.LOADRUNBAKProj. No. : 7752-01  
Unit : 1\*\*\*\*\*  
\* Source Number : 2 \*  
\*\*\*\*\*

| Internal<br>Bus No. | Bus Rated<br>Volts   | Bus Running Voltage and Per Cent of Bus Rated Volts |                 |                 |                 |                 |
|---------------------|----------------------|---|-----------------|-----------------|-----------------|-----------------|
|                     |                      | Cond. 1   | Cond. 2         | Cond. 3         | Cond. 4         | Cond. 5         |
| 111                 | hi pr inj 318 term   | 426.0<br>88.8 %                                     | 440.9<br>91.9 % | 432.1<br>90.0 % | 393.7<br>82.0 % | 397.0<br>82.7 % |
| 112                 | hi pr inj 315 term   | 426.0<br>88.8 %                                     | 440.9<br>91.9 % | 432.1<br>90.0 % | 393.7<br>82.0 % | 397.0<br>82.7 % |
| 113                 | lo pr inj 329 term   | 426.0<br>88.8 %                                     | 440.9<br>91.9 % | 432.1<br>90.0 % | 393.7<br>82.0 % | 397.0<br>82.7 % |
| 114                 | mn st byp vlv c term | 426.0<br>88.8 %                                     | 440.9<br>91.9 % | 432.1<br>90.0 % | 393.7<br>82.0 % | 397.0<br>82.7 % |
| 115                 | CT RM AC VA-46B TERM | 426.0<br>88.8 %                                     | 440.9<br>91.9 % | 428.8<br>89.3 % | 390.1<br>81.3 % | 393.4<br>82.0 % |
| 116                 | 480V DG AUX PNL D2   | 424.9<br>88.5 %                                     | 439.9<br>91.6 % | 431.6<br>89.9 % | 392.5<br>81.8 % | 396.5<br>82.6 % |
| 117                 | hcv-151 terminal     | 425.6<br>88.7 %                                     | 440.5<br>91.8 % | 431.6<br>89.9 % | 393.2<br>81.9 % | 396.5<br>82.6 % |
| 118                 | 480V MCC 4A2         | 427.2<br>89.0 %                                     | 441.2<br>91.9 % | 433.2<br>90.3 % | 392.5<br>81.8 % | 395.1<br>82.3 % |
| 119                 | 480V MCC 4A3         | 421.9<br>87.9 %                                     | 438.5<br>91.4 % | 433.7<br>90.4 % | 392.9<br>81.9 % | 398.6<br>83.0 % |
| 120                 | 480V MCC 4B1         | 445.0<br>92.7 %                                     | 447.0<br>93.1 % | 427.0<br>89.0 % | 405.9<br>84.6 % | 419.1<br>87.3 % |
| 121                 | sol re vv 102-2 term | 445.0<br>92.7 %                                     | 447.0<br>93.1 % | 427.0<br>89.0 % | 405.9<br>84.6 % | 419.1<br>87.3 % |
| 122                 | 480V MCC 4B2         | 444.5<br>92.6 %                                     | 444.6<br>92.6 % | 426.7<br>88.9 % | 404.3<br>84.2 % | 418.8<br>87.3 % |
| 123                 | 480V MCC 4B3         | 446.1<br>92.9 %                                     | 446.8<br>93.1 % | 427.0<br>89.0 % | 405.1<br>84.4 % | 419.1<br>87.3 % |
| 124                 | 480V MCC 4C1         | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 427.2<br>89.0 % | 409.2<br>85.3 % | 402.4<br>83.8 % |
| 125                 | mtr on st ch vv term | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 427.2<br>89.0 % | 409.2<br>85.3 % | 402.4<br>83.8 % |

## \*\*\*\*\* Running Voltage Summary \*\*\*\*\*

Utility : Omaha Public Power District  
Station : FT.CALHOUN-1523MVA,SCC;FW&CND.LOADRUNBAKProj. No. : 7752-01  
Unit : 1\*\*\*\*\*  
\* Source Number : 2 \*  
\*\*\*\*\*

| Internal<br>Bus No. |                      | Bus Rated<br>Volts | Bus Running Voltage and Per Cent of Bus Rated Volts |                 |                 |                 |                 |
|---------------------|----------------------|--------------------|---|-----------------|-----------------|-----------------|-----------------|
|                     |                      |                    | Cond. 1   | Cond. 2         | Cond. 3         | Cond. 4         | Cond. 5         |
| 126                 | mn fwr to gn a term  | 480.0              | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 427.2<br>89.0 % | 409.2<br>85.3 % | 402.4<br>83.8 % |
| 127                 | si trk 6d vlv term   | 480.0              | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 427.2<br>89.0 % | 405.2<br>85.3 % | 402.4<br>83.8 % |
| 128                 | hpsi vlv to lb term  | 480.0              | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 425.3<br>88.6 % | 407.2<br>84.8 % | 402.4<br>83.8 % |
| 129                 | hpsi vlv to 2b term  | 480.0              | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 426.2<br>88.8 % | 408.2<br>85.0 % | 402.4<br>83.8 % |
| 130                 | lpsi iso vlv 2b term | 480.0              | 439.7<br>91.6 %                                     | 446.7<br>93.1 % | 425.9<br>88.7 % | 407.8<br>85.0 % | 402.4<br>83.8 % |
| 131                 | 480V MCC 4C2         | 480.0              | 439.2<br>91.5 %                                     | 446.0<br>92.9 % | 426.3<br>88.8 % | 404.0<br>84.2 % | 399.8<br>83.3 % |
| 132                 | co cu vv 3B3-4 term  | 480.0              | 439.2<br>91.5 %                                     | 446.0<br>92.9 % | 426.3<br>88.8 % | 404.0<br>84.2 % | 399.8<br>83.3 % |
| 133                 | 480V MCC 4C3         | 480.0              | 436.9<br>91.0 %                                     | 444.7<br>92.7 % | 424.9<br>88.5 % | 406.7<br>84.7 % | 399.1<br>83.2 % |
| 134                 | 480V MCC 4C4         | 480.0              | 436.3<br>90.9 %                                     | 443.4<br>92.4 % | 423.8<br>88.3 % | 406.7<br>84.7 % | 398.6<br>83.1 % |