EPRI ENGINEERING AND RESEARCH INC

CALCULATION COVER SHEET

TITLE:	Reactor Coolant System MOVs HCV-150/151
CLIENT:	OPPD - Fort Calhoun Station
PROJECT:	Generic Letter 89-10 MOV Program
CALC No:	C159-90-05.01
JOB No:	159-90-05

Rev.	Description	Approvals	Date
0	Original Issue		9-17-91

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1.0 Purpose

The purpose of this calculation is to document the design bases for operation of motor-operated valves (MOVs) HCV-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

Steam Tables

16. OPPD P&ID E-23866-210-110, Rev. 61

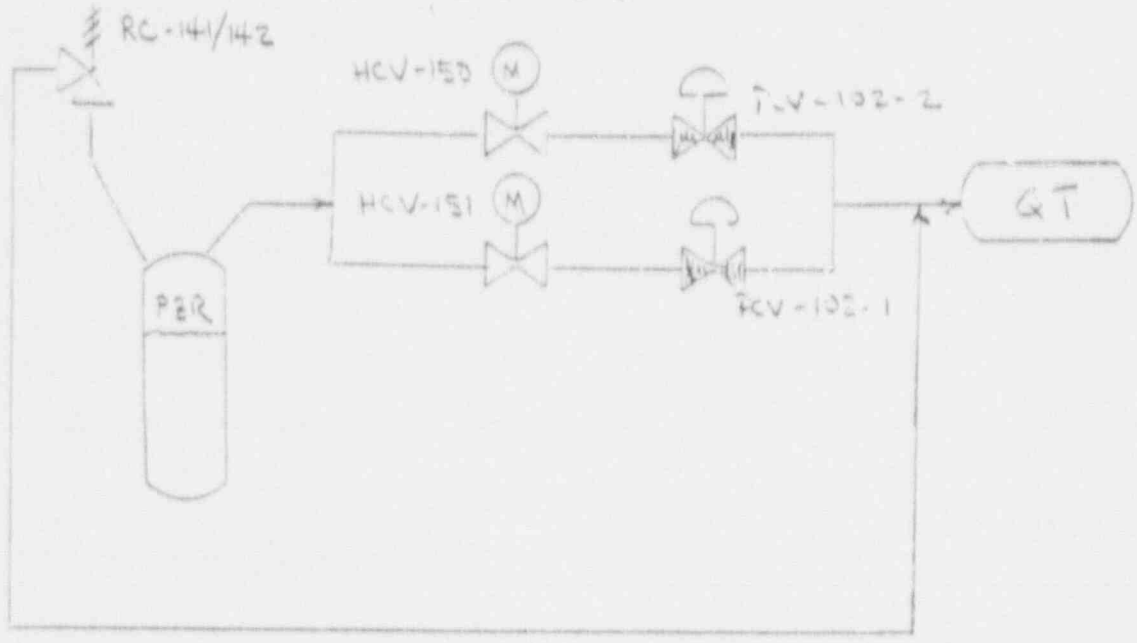
17. FCS Updated Safety Analysis Report, 1991 Submittal, Section 4

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.

SKETCH



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

Description:

Crane Model 797-U 2½" 2500 pound, pressure sealed bonnet, stainless steel, solid wedge gate valve; Crane drawing H-30321, Rev. C. SMB-00-7½ 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 Valves 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].

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.

$MEDP_{open}$

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 643°F [15].

Stroke Time

No design basis stoke time relative to this scenario applies.

Normal Operations (cont'd)

$MEDP_{close}$

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 stoke time relative to this scenario applies.

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$_{open}$

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 stoke time relative to this scenario applies.

Abnormal Operations (cont'd)

MEDP$_{close}$

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 stoke time relative to this scenario applies.

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$_{close}$

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 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 stoke time relative to this scenario applies.

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$_{open}$

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].

Surveillance/Test (cont'd)

$MEDP_{close}$

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.

ature Conditions

nperature 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].

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].

$MEDP_{open}$

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 stoke time relative to this scenario applies.

Emergency Operating Procedures (cont'd)

$MEDP_{close}$

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 stoke time relative to this scenario applies.

6.0 Summary of Results

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

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

Notes:

[1] The open (inadvertent operation at power) and the close (PORV maintenance) scenarios for this case are unrelated.

[2] This case involves opening (to enable LTOP) and closing (to isolate a leaking PORV) assuming PORV leakage.

[3] This case involves the worst case closing scenario for a stuck-open PORV; no associated open scenario applies.

[4] This case involves opening and closing for valve timing surveillance test.

[5] The open (once-through-cooling) and the close (EOP post trip action) scenarios for this case are unrelated.

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.

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

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

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

Proj. No. : 7752-01
Unit : 1

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

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

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

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

Proj. No. : 7752-01
Unit : 1

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

Internal Bus No.		Bus Rated 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 94.4 %	3952.1 95.0 %	3952.1 95.0 %	3844.0 92.4 %	3844.0 92.4 %
36	htr drn pmp b term	4160.0	3927.6 94.4 %	3952.1 95.0 %	3952.1 95.0 %	3838.2 92.3 %	3838.2 92.3 %
37	SEC WDG UAPT#T1A2	4160.0	3930.0 94.5 %	3952.1 95.0 %	3952.1 95.0 %	3856.4 92.7 %	3856.4 92.7 %

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

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

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

Proj. No. : 7752-01
Unit : 1

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

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

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

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

Proj. No. : 7752-01
Unit : 1

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* Source Number : 2 *
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Internal Bus No.		Bus Rated 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 93.8 %	3948.8 94.9 %	3905.5 93.9 %	3723.3 89.5 %	3722.3 89.5 %
36	htr drn pmp b term	4160.0	3903.1 93.8 %	3948.8 94.9 %	3905.5 93.9 %	3717.4 89.4 %	3716.3 89.3 %
38	PRI WDG OF T1B-3A	4160.0	3876.3 93.2 %	3849.6 92.5 %	3818.3 91.8 %	4005.0 96.3 %	3965.9 95.3 %
39	PRI WDG OF T1B-3B	4160.0	3875.9 93.2 %	3849.6 92.5 %	3818.8 91.8 %	4006.3 96.3 %	3967.8 95.4 %
40	PRI WDG OF T1B-3C	4160.0	3876.8 93.2 %	3850.2 92.6 %	3818.6 91.8 %	4006.2 96.3 %	3967.0 95.4 %
41	PRI WDG OF T1B-4A	4160.0	3892.2 93.7 %	3944.1 94.8 %	3899.9 93.7 %	3721.8 89.5 %	3721.1 89.4 %
42	PRI WDG OF T1B-4B	4160.0	3899.9 93.7 %	3944.8 94.8 %	3899.8 93.7 %	3723.1 89.5 %	3723.2 89.5 %
43	PRI WDG OF T1B-4C	4160.0	3899.7 93.7 %	3944.8 94.8 %	3899.9 93.7 %	3723.2 89.5 %	3722.0 89.5 %
44	SEC WDG HSPT#T1A3	4160.0	3888.8 93.5 %	3864.5 92.9 %	3834.7 92.2 %	4012.1 96.4 %	3975.8 95.6 %
45	SEC WDG HSPT#T1A4	4160.0	3912.1 94.0 %	3955.3 95.1 %	3913.4 94.1 %	3743.7 90.0 %	3742.6 90.0 %
46	480V BUS 1B3A	480.0	434.3 90.5 %	421.7 87.8 %	411.8 85.8 %	445.7 92.9 %	430.5 89.6 %
47	hp sa inj pmp a term	480.0	434.3 90.5 %	421.7 87.8 %	405.0 84.4 %	439.4 91.5 %	423.7 88.3 %
48	charging pmp a term	480.0	434.3 90.5 %	414.3 86.3 %	404.2 84.2 %	445.7 92.9 %	423.0 88.1 %
49	cont air fan 3a term	480.0	432.3 90.1 %	419.6 87.4 %	407.6 84.9 %	443.8 92.5 %	426.3 88.8 %
50	dw46a pmp term	480.0	421.6 87.8 %	412.0 85.8 %	409.7 85.3 %	454.2 94.6 %	446.8 93.1 %

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

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

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

Proj. No. : 7752-01
Unit : 1

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* Source Number : 2 *
****

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

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

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

Proj. No. : 7752-01
Unit : 1

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* Source Number : 2 *
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Internal Bus No.		Bus Rated 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 89.9 %	418.7 87.2 %	411.5 85.7 %	442.9 92.3 %	429.9 89.6 %
82	si ta 6c di vlv term	480.0	431.4 89.9 %	418.7 87.2 %	411.5 85.7 %	442.9 92.3 %	429.9 89.6 %
83	hi pr inj 317 term	480.0	431.4 89.9 %	418.7 87.2 %	411.5 85.7 %	442.9 92.3 %	429.9 89.6 %
84	hi pr inj 314 term	480.0	431.4 89.9 %	418.7 87.2 %	411.5 85.7 %	442.9 92.3 %	429.9 89.6 %
85	lo pr inj 331 term	480.0	431.4 89.9 %	418.7 87.2 %	411.5 85.7 %	442.9 92.3 %	429.9 89.6 %
86	mn fwtr vlv b term	480.0	431.4 89.9 %	418.7 87.2 %	411.5 85.7 %	442.9 92.3 %	429.9 89.6 %
87	480V MCC 3A2	480.0	433.0 90.2 %	418.6 87.2 %	411.8 85.8 %	445.7 92.9 %	430.3 89.6 %
88	cont recirc ln term	480.0	433.0 90.2 %	418.6 87.2 %	411.8 85.8 %	445.7 92.9 %	430.3 89.6 %
89	480V MCC 3A3	480.0	434.3 90.5 %	418.4 87.2 %	411.8 85.8 %	445.7 92.9 %	430.3 89.6 %
90	480V MCC 3A4	480.0	432.6 90.1 %	418.2 87.1 %	411.8 85.8 %	445.2 92.7 %	430.3 89.6 %
91	480V MCC 3B1	480.0	420.2 87.5 %	410.9 85.6 %	408.4 85.1 %	453.5 94.5 %	445.6 92.8 %
92	si ta 6a di vlv term	480.0	420.2 87.5 %	410.9 85.6 %	408.4 85.1 %	453.5 94.5 %	445.6 92.8 %
93	hpsi iso vlv 1b term	480.0	420.2 87.5 %	410.9 85.6 %	408.4 85.1 %	453.5 94.5 %	445.6 92.8 %
94	hpsi iso vlv 2b term	480.0	420.2 87.5 %	410.9 85.6 %	408.4 85.1 %	453.5 94.5 %	445.6 92.8 %
95	lpsi iso vlv 1b term	480.0	420.2 87.5 %	410.9 85.6 %	408.4 85.1 %	453.5 94.5 %	445.6 92.8 %

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

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

Proj. No. : 7752-01
Unit : 1

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

***** 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 Bus No.		Bus Rated 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	480.0	426.0 88.8 %	440.9 91.9 %	432.1 90.0 %	393.7 82.0 %	397.0 82.7 %
112	hi pr inj 315 term	480.0	426.0 88.8 %	440.9 91.9 %	432.1 90.0 %	393.7 82.0 %	397.0 82.7 %
113	lo pr inj 329 term	480.0	426.0 88.8 %	440.9 91.9 %	432.1 90.0 %	393.7 82.0 %	397.0 82.7 %
114	mn st byp vlv c term	480.0	426.0 88.8 %	440.9 91.9 %	432.1 90.0 %	393.7 82.0 %	397.0 82.7 %
115	CT RM AC VA-46B TERM	480.0	426.0 88.8 %	440.9 91.9 %	428.8 89.3 %	390.1 81.3 %	393.4 82.0 %
116	480V DG AUX PNL D2	480.0	424.9 88.5 %	439.9 91.6 %	431.6 89.9 %	392.5 81.8 %	396.5 82.6 %
117	hcv-151 terminal	480.0	425.6 88.7 %	440.5 91.8 %	431.6 89.9 %	393.2 81.9 %	396.5 82.6 %
118	480V MCC 4A2	480.0	427.2 89.0 %	441.2 91.9 %	433.2 90.3 %	392.5 81.8 %	395.1 82.3 %
119	480V MCC 4A3	480.0	421.9 87.9 %	438.5 91.4 %	433.7 90.4 %	392.9 81.9 %	398.6 83.0 %
120	480V MCC 4B1	480.0	445.0 92.7 %	447.0 93.1 %	427.0 89.0 %	405.9 84.6 %	419.1 87.3 %
121	sol re vv 102-2 term	480.0	445.0 92.7 %	447.0 93.1 %	427.0 89.0 %	405.9 84.6 %	419.1 87.3 %
122	480V MCC 4B2	480.0	444.5 92.6 %	444.6 92.6 %	426.7 88.9 %	404.3 84.2 %	418.8 87.3 %
123	480V MCC 4B3	480.0	446.1 92.9 %	446.8 93.1 %	427.0 89.0 %	405.1 84.4 %	419.1 87.3 %
124	480V MCC 4C1	480.0	439.7 91.6 %	446.7 93.1 %	427.2 89.0 %	409.2 85.3 %	402.4 83.8 %
125	mtr on st ch vv term	480.0	439.7 91.6 %	446.7 93.1 %	427.2 89.0 %	409.2 85.3 %	402.4 83.8 %

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

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

Proj. No. : 7752-01
Unit : 1

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

Internal Bus No.		Bus Rated Volts	Bus Running Voltage and Per Cent of Bus Rated Volts				
			Cond. 1	Cond. 2	Cond. 3	Cond. 4	Cond. 5
126	mn fwtr to gn a term	480.0	439.7 91.6 %	446.7 93.1 %	427.2 89.0 %	409.2 85.3 %	402.4 83.8 %
127	si tnk 6d vlv term	480.0	439.7 91.6 %	446.7 93.1 %	427.2 89.0 %	409.2 85.3 %	402.4 83.8 %
128	hpsi vlv to 1b term	480.0	439.7 91.6 %	446.7 93.1 %	425.3 88.6 %	407.2 84.8 %	402.4 83.8 %
129	hpsi vlv to 2b term	480.0	439.7 91.6 %	446.7 93.1 %	426.2 88.8 %	408.2 85.0 %	402.4 83.8 %
130	lpsi iso vlv 2b term	480.0	439.7 91.6 %	446.7 93.1 %	425.9 88.7 %	407.8 85.0 %	402.4 83.8 %
131	480V MCC 4C2	480.0	439.2 91.5 %	446.0 92.9 %	426.3 88.8 %	404.0 84.2 %	399.8 83.3 %
132	co cu vv 383-4 term	480.0	439.2 91.5 %	446.0 92.9 %	426.3 88.8 %	404.0 84.2 %	399.8 83.3 %
133	480V MCC 4C3	480.0	436.9 91.0 %	444.7 92.7 %	424.9 88.5 %	406.7 84.7 %	399.1 83.2 %
134	480V MCC 4C4	480.0	436.3 90.9 %	443.4 92.4 %	423.8 88.3 %	406.7 84.7 %	398.8 83.1 %