COOPER NUCLEAR STATION

NEBRASKA PUBLIC POWER DISTRICT

VOLTAGE DROP ANALYSIS

COMPUTATIONS

W. O. 3401-27

OCTOBER 31, 1979
(Rev. 1)

BURNS AND ROE, INC.

ENGINEERS AND CONSTRUCTORS

WOODBURY, NEW YORK

Prepared by _____

Checked by _____

Approved by _____
for Chief Electrical
Engineer

BURNS AND ROE, INC.
Headquarters Office–Oradell, N.J.

W.O. No. 3401-27 Date 10/29/79 Book No. _____ Page No. 1 OF 93
Drawing No. _____ Calc. No. 2.15.01 Sheet 1 Cont. on Sheet 2.
By PSHENOY Checked John McCarthy 10/30/79 Approved _____ 10/31/79
Title NPPD/CNS - VOLTAGE DROP STUDY - LEAD SHEET

THE CHECK PERFORMED IN ACCORDANCE WITH ENGG. STANDARD P01B105G1 DATED JAN 79 : RESULTS ARE SATISFACTORY
John J. McCarthy 10/30/79

1. PURPOSE : TO DETERMINE ANALYTICALLY IF THE OFFSITE POWER SYSTEM AND THE ONSITE DISTRIBUTION SYSTEM IS OF SUFFICIENT CAPACITY AND CAPABILITY TO AUTOMATICALLY START AS WELL AS OPERATE ALL REQUIRED SAFETY LOADS WITHIN THEIR VOLTAGE RATINGS IN THE EVENT OF : 1) AN ANTICIPATED TRANSIENT (SUCH AS A UNIT TRIP), OR 2) AN ACCIDENT (SUCH AS LOCA)

2. REFERENCES:

A. BURNS & ROE APPROVED COMPUTER PROGRAM NO. EL 0110.

B. BURNS & ROE ONE LINE DIAGRAMS:

DWG NOS; 3001 REV. 10 , 3006 REV. 17
3002 REV. 23 , 3007 REV. 24
3005 REV. 13 ,

C. NRC GUIDELINES , ATTACHMENT TO NRC LETTER DATED AUG 8, 1979, "RE: ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEMS VOLTAGES", ATTACHED

3. DESIGN REQUIREMENTS :

A. MOTOR TERM. VOLTAGES SHALL BE COMPUTED WITH OFFSITE VOLTAGES AT HIGH & LOW VALUES RECORDED DURING THE OPERATION OF COOPER NUCLEAR STATION.

B. MOTOR TERMINAL VOLTAGES SHALL BE COMPUTED UNDER THE FOLLOWING MODES OF PLANT OPERATION INCLUDING TRANSIENT & ACCIDENTS:

PLANT ON HOT STAND BY
PLANT COLD SHUTDOWN
PLANT ON LOCA SHUTDOWN
PLANT NORMAL OPERATION
PLANT NORMAL OPERATION & LOCA SHUTDOWN.

THE MOTOR TERMINAL VOLTAGE SHALL BE WITHIN ± 10% OF NAME PLATE RATING DURING "RUN" & -2.5% OF NAME PLATE RATING DURING "START"

C. LOADS REQUIRED TO OPERATE UNDER VARIOUS MODES OF PLANT OPERATION ARE AS SHOWN IN TABLE BELOW:
CERTAIN LOADS NOT REQUIRED, BUT USEFULL IF AVAILABLE, ARE INCLUDED FOR MAX. VOLTAGE DROP & ARE MARKED "N/R"

EQUIPMENT	HP OR KVA EACH	NO. OF UNITS	NO. OF UNITS REQUIRED TO OPERATE			
			NORMAL PLANT	LOCA	HOT STANDBY	COLD SHUTDOWN
STATION SERVICE WTR PP.	300	4	0	2+2(N/R)	2	1+1(N/R)
RHR PUMP	1090 (BHP)	4	0	2	0	1+1(N/R)
RHR SW. BOOSTER PP.	1000	4	0	1**	0	2**+2**(N/R)
CORE SPRAY PUMP	1090 (BHP)	2	0	1+1 N/R	0	0
CONTROL ROD DRIVE	250	2	1+1(N/R)	1+1 (N/R)	1	1+1 (N/R)
STN. AIR COMPRESSOR	125	3	1+1(N/R)	1+1 (N/R)	1	1+1 (N/R)
MCC "K" LOADS	600	-	600	600	SUBSTN. "1F"	600
MCC "LX" LOADS	475		475	475	-480	475
MCC "TX" LOADS	100		100	100	SUBSTN. "1G"	100
MCC "S" LOADS	480		480	480	-150	480
MCC "CA" OR "CB" *	-		-	-	-	-
NON-CRITICAL LOADS:						
CIRC WTR PUMP	1750	4	4	0	2	0
COND BOOSTER PUMP	2500	3	2		1	
CONDENSATE PUMP	800	3	2		1	
REACT. RECIRC MG	7000	2	2		1+1 N/R	
4.80V SUBSTN. "1A"	1200	-	1200		1200	
"1B"	1000	-	1000		1000	
"1C"	300	-	300		300	
"1D"	300	-	300		300	
"1E"	400	-	400		400	
MCC M	500	-	500			
N	240	-	240			
P	430	-	430		INCLUDED IN SUBSTN "1F & 1G"	
U	400	-	400			
V	200	-	200			
W	320	-	320			
MR	200	-	200			
OG1	235	-	235			

* NOT CONSIDERED FOR THIS STUDY, AS SYS. SERVED NOT IN OPERATION
** REQUIRED AFTER ONE RHR PUMP SHUT-DOWN (10 MIN. AFTER LOCA) & NOT CONSIDERED

D. EVENTHOUGH ONE OF THE TWO CRITICAL BUSES ARE REQUIRED DURING A SHUTDOWN, BOTH BUSES MAY BE OPERATING BECAUSE OF AUTOMATIC OPERATION AND CONSEQUENT HIGHER VOLTAGE DROP. HENCE, OPERATION OF BOTH CRITICAL BUSES ARE INCLUDED DURING PLANT SHUTDOWN MODE.

E. ONLY A FEW LOADS THAT WILL PRODUCE MAXIMUM VOLTAGE DROP ARE CONSIDERED FOR MOTORS LESS THAN 100 HP MOTORS THAT ARE CONNECTED TO MCCS.

F. LOCA LOADS ARE STARTED SEQUENTIALLY ON LOCA DETECTION SIGNALS. LOADS OF SAME CAPACITY OR LOWER ARE LEFT OUT FROM START & RUN VOLTAGE DROP CONSIDERATION BASED ON - IF WORST CASE IS ACCEPTABLE, OTHER LESS SEVERE CASES WILL ALSO BE ACCEPTABLE.

G. EXISTING TAP SETTING FOR TRANSFORMERS IS PER TELECON - J. PHILBRICK TO P.SHENOY DATED 9.7.79 :

MAIN TRANSFORMER : +2.5% TAP
NORMAL STATION TRANS. : 0% TAP
STARTUP TRANSFORMER: -5% TAP
EMERGENCY TRANSFORMER: -5% TAP

H. ACTUAL FLUCTUATION IN OFFSITE VOLTAGES DURING PLANT OPERATION, PER TELECON J PHILBRICK TO P SHENOY DATED 9.7.79 :

	HIGH	LOW
161 KV START UP	161 KV	154 KV

J. NO FLUCTUATION IN EMERGENCY OFFSITE VOLTAGE DURING PLANT OPERATION, PER TELECON J.HAGGE TO P.SHENOY DATED 12.12.79 : VOLTAGE @ FULL LOAD - 6.67 KV

K. NRC GUIDELINES PER ATTACHMENT TO NRC LETTER DATED AUG. 8, 1979 "RE: ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES". THESE GUIDELINES WERE FOLLOWED AS DETAILED BELOW:

NRC GUIDELINE NO. (SEE PAGE 1, SHS 11 & 12)	ADHERENCE TO GUIDELINE
1.	YES, FULLY.
2.	NOT APPLICABLE TO CNS, AS IT IS A SINGLE UNIT.
3.	ANALYSIS IS BASED ON AUTO-SEQUENCING FOR LOCA LOADS AND AUTOMATIC LOAD SHEDDING DUE TO BUS UNDERVOLTAGE ONLY.
4	NO MANUAL SHEDDING IS ASSUMED.
5.	YES, FULLY.
6.	SEPARATE ANALYSIS IS MADE FOR MINIMUM AND MAXIMUM GRID VOLTAGES. THE MINIMUM GRID VOLTAGES ARE PER THE NRC GUIDELINE, AS FURNISHED BY THE UTILITY. FURTHER EXPLANATIONS ARE NOTED IN THE REPORT.
7.	COMPUTATIONS PROVIDE THIS INFORMATION, HOWEVER VOLTAGES AT SAFETY LOADS

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By PS Checked [illegible] Approved _____

Title NPPD/CNS - VOLTAGE DROP STUDY - LEAD SHEET

NRC GUIDELINE NO.	ADHERENCE TO GUIDELINE (CO. JTD.)
	COMPUTED WERE LIMITED TO CASES YIELDING MAXIMUM VOLTAGE DROP AND THEREBY, CONCLUDING THAT ACCEPTABILITY FOR THE WORST CASES CAN BE GENERALIZED TO ALL SAFETY LOADS.
8.	DOCUMENTATION FURNISHED PER NPPD LETTER DATED JULY 18, 1977, NRC DOCKET NO. 50-298, DPR-46
9.	YES, WITH EXCEPTION MENTIONED IN ITEM 7.
10.	YES, FULLY.
11.	YES, FULLY.
12.	SEE ITEM 8.
13.	YES.

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4. ASSUMPTIONS:

A. LOADING OF THE VARIOUS BUSES WERE SIMPLIFIED CONSERVATIVELY, BY DROPPING CERTAIN NORMAL PLANT LOADS SUCH AS LIGHTING, HVAC & OTHERS WHILE DETERMINING POSSIBLE OVERVOLTAGE AND ALL SUCH LOADS WERE ADDED-ON WHILE DETERMINING POSSIBLE UNDERVOLTAGE CONDITION.

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Title NPPD/CNS - VOLTAGE DROP STUDY - LEAD SHEET

5. SUMMARY OF VOLTAGE DROP COMPUTATIONS

TABLE I - 69KV EMERGENCY OFFSITE POWER

PLANT OPERATING CONDITION	MOTOR STARTING CASES FOR MAX. UNDERVOLTAGE WITH ALL OTHER LOADS OPERATING	% MOT. TERM. VOLTAGE (EM. TR. TAP: -5%)	
		RUN	START
CASE 1: EM. OFFSITE LINE VOLTAGE LOW (66.7KV) & LOCA SHUTDOWN LOADS ON AUTO SEQUENCE STARTING	SUBCASE 1: TWO CORE SPRAY PPS.	106.11	92.42
	2: TWO RHR PUMPS	106.11	92.42
	3: CRD PUMP 1A	102.21	92.62
	4: CRD PUMP 1B	103.12	93.41
	5: DRYWELL FAN COIL UNIT	106.1	99.31
	6: SW GLAND SEAL PP 1A	106.67	103.0
CASE 2: EM. OFFSITE LINE VOLTAGE LOW (66.7KV) & COLD SHUTDOWN LOADS MANUAL START	SUBCASE 1: RHRB PUMP 1A	104.82	98.62
	2: RHRB PUMP 1B	104.82	98.62
	3: CRD PUMP 1A	101.58	92.05
	4: CRD PUMP 1B	102.49	92.83
	5: DRYWELL FAN COIL 1A	105.4	98.65
	6: SW GLAND SEAL PP 1A	106.0	102.32
	7: RHR M.O.V. RH51GA	106.34	104.27
CASE 3: EM. OFFSITE LINE VOLTAGE HIGH(-) & LOCA SHUTDOWN LOADS	SEE NOTE 1	SEE NOTE 1	
CASE 4: EM OFFSITE LINE VOLTAGE HIGH(-) & COLD SHUTDOWN LOADS	SEE NOTE 1	SEE NOTE 1	

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REMARKS: VOLTAGE LEVELS UNDER ALL CASES LISTED ABOVE ARE ACCEPTABLE: WITHIN ± 10% FOR MOTOR RUN & WITHIN -20% FOR MOTOR START

NOTE: COMPUTATIONS BASED ON HIGH VALUE IS NOT REQUIRED PER CHANGE NON-FLUCTUATING VOLTAGE LEVEL AT THE EM. TRANSFORMER, PER TELECON J. HAGGE TO P. SHENOI, DATED 12/12/79

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SUMMARY OF VOLTAGE DROP
TABLE II - 161 KV START UP OFFSITE POWER

PLANT OPERATING CONDITION	MOTOR STARTING CASES FOR MAX. UNDERVOLTAGE WITH ALL OTHER LOADS RUNNING	% MOTOR TERM. VOLTAGE (START UP TR. TAP -5%)	
		RUN	START
CASE 5: STARTUP OFFSITE LINE VOLTAGE HIGH (161 KV) & PLANT ON HOT STANDBY MANUAL STARTING	SUBCASE 1: TWO CIRC. WTR. PPS	106.52	96.96
	2: ONE COND. BOOSTER PP.	106.45	98.89
	3: ONE REACT. RECIRC MG	107.08	90.21
	4: RHR M.O.V. 51GA	109.8	107.8
	5: R.B. CLD CLG WTR PP 1A	109.94	108.25
CASE 6: START UP OFFSITE LINE VOLTAGE LOW (154 KV) & PLANT NORMAL OPERATION MANUAL STARTING	SUBCASE 1: TWO CIRC. WTR PPS.	98.39	89.39
	2: ONE COND. BOOSTER PP.	98.27	91.14
	3: ONE REACT. RECIRC MG SET	101.56	85.54
	4: ONE CRD PUMP	92.65	84.47
	5: DRYWELL FAN COIL UNIT	96.0.	89.31
	6: S.W. GLAND SEAL PP 1A	96.67	92.98
CASE 7: START UP OFF-SITE LINE VOLTAGE LOW (154 KV) & PLANT NORMAL OPERATION WITH SUDDEN LOCA SHUTDOWN LOADS ADDED	SUBCASE 1: TWO RHR PUMPS	96.52	88.79
	2: TWO CORE SPRAY PPS	96.52	88.79
	3: ONE REACT. RECIRC MG	101.23	85.27
	4: ONE CRD PUMP	92.95	82.91
	5: DRYWELL FAN COIL UNIT	94.26	87.31
	6: S.W. GLAND SEAL PP 1A	94.85	91.13
CASE 8: START UP OFFSITE LINE VOLTAGE HIGH (161 KV) & PLANT NORMAL OPERATION	SUBCASE 1: TWO CIRC. WTR PPS	103.46	94.02
	2: ONE COND BOOSTER PP	103.36	95.89
	3: ONE REACT. RECIRC MG	106.48	89.71
	4: ONE CRD PUMP	97.52	88.92
	5: RHR M.O.V RH 51GA	102.13	100.06
CASE 9: START UP OFFSITE LINE VOLTAGE HIGH (161 KV) & PLANT NORMAL OPERATION WITH SUDDEN LOCA SHUTDOWN	SUBCASE 1: TWO RHR PUMPS	101.73	93.64
	2: TWO CORE SPRAY PPS	101.73	93.64
	3: ONE REACT RECIRC MG	105.17	89.45
	4: ONE CRD PUMP	95.93	87.46
	5: RHR M.O.V RH 51GA	100.45	98.39

REMARKS: VOLTAGE LEVELS UNDER ALL CASES LISTED ABOVE ARE ACCEPTABLE - WITHIN ±10% RUNNING & -20% STARTING

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SUMMARY OF VOLTAGE DROP COMPUTATIONS

TABLE III - 22KV NORMAL STATION POWER

PLANT OPERATING CONDITION	MOTOR STARTING CASES FOR MAX. UNDERVOLTAGE WITH ALL OTHER LOADS RUNNING	% MOTOR TERM. VOLTAGE (NORMAL STN. START TR. TAP: 0%)	
		RUN	START
CASE 10: NORMAL STATION LINE VOLTAGE HIGH (22.05 KV = +5% OVER NOMINAL 21KV) & PLANT ON HOT STANDBY	SUBCASE 1: TWO CIRC. WTR. PUMPS	106.23	96.58
	2: ONE COND. BOOSTER PP.	106.17	93.52
	3: ONE REACT. RECIRC MG	107.15	92.95
	4: RHR M.O.V. RH15A	109.36	107.
	5: R.B. CLD CLG WTR PP 1A	109.64	107.96
	6: S.W. GLAND SEAL PP 1A	109.24	105.55
CASE 11: NORMAL STATION LINE VOLTAGE LOW (21.0 KV - NOMINAL) & PLANT NORMAL OPERATION	SUBCASE 1: TWO CIRC. WTR. PUMPS	100.91	91.56
	2: ONE COND. BOOSTER PP.	100.79	93.39
	3: ONE REACT. RECIRC MG	104.47	90.62
	4: ONE CRD PUMP	95.05	86.65
	5: DRYWELL FAN COIL UNIT	98.59	91.83
	6: S.W. GLAND SEAL PP 1A	99.19	95.5
	7: RHR M.O.V. RH 16A	99.52	97.45

REMARKS: VOLTAGE LEVELS UNDER ALL CASES LISTED ABOVE ARE ACCEPTABLE = ±10% OF NAME PLATE RATING FOR RUNNING
-20% OF NAME PLATE RATING FOR STARTING.

6. CONCLUSIONS:

THE PLANT ELECTRICAL DISTRIBUTION SYSTEM VOLTAGES ARE ADEQUATE TO START AND OPERATE ALL SAFETY RELATED LOADS UNDER ANTICIPATED MINIMUM AND MAXIMUM OFFSITE POWER GRID VOLTAGES DURING VARIOUS MODES OF PLANT OPERATION. IN THE CASE OF THE 69 KV EMERGENCY OFFSITE LINE, THE COMPUTATION WAS BASED ON ONLY ONE VALUE OF THE VOLTAGE. THE DISTRICT HAS DETERMINED THAT THE 69 KV EMERGENCY LINE VOLTAGE REMAINS ESSENTIALLY CONSTANT.

ENCLOSURE OF NRC LETTER DT. AUG. 8 1979
RE: ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEMS VOLTAGES
CALC# 2.15.01, PAGE 1, SH 11
CONT. ON SHEET 12

GUIDELINES FOR VOLTAGE DROP CALCULATIONS

1. Separate analyses should be performed assuming the power source to safety buses is (a) the unit auxiliary transformer; (b) the startup transformer; and (c) other available connections to the offsite network one by one assuming the need for electric power is initiated by (1) an anticipated transient (e.g., unit trip) or (2) an accident, whichever presents the largest load demand situation.

2. For multi-unit stations a separate analysis should be performed for each unit assuming (1) an accident in the unit being anlayzed and simultaneous shutdown of all other units at that station; or (2) an anticipated transient in the unit being analyzed (e.g., unit trip) and simultaneous shutdown of all other units at that station, whichever presents the largest load demand situation.

3. All actions the electric power system is designed to automatically initiate should be assumed to occur as designed (e.g., automatic bulk or sequential loading or automatic transfers of bulk loads from one transformer to another). Included should be consideration of starting of large non-safety loads (e.g., condensate pumps).

4. Manual load shedding should not be assumed.

5. For each event analyzed, the maximum load necessitated by the event and the mode of operation of the plant at the time of the event should be assumed in addition to all loads caused by expected automatic actions and manual actions permitted by administrative procedures.

6. The voltage at the terminals of each safety load should be calculated based on the above listed considerations and assumptions and based on the assumption that the grid voltage is at the "minimum expected value". The "minimum expected value" should be selected based on the least of the following:

   a. The minimum steady-state voltage experienced at the connection to the offsite circuit.

   b. The minimum voltage expected at the connection to the offsite circuit due to contingency plans which may result in reduced voltage from this grid.

   c. The minimum predicted grid voltage from grid stability analysis. (e.g., load flow studies).

In the report to NRC on this matter the licensee should state planned actions, including any proposed "Limiting Conditions for Operation" for Technical Specifications, in response to experiencing voltage at the connection to the offsite circuit which is less than the "minimum expected value." A copy of the plant procedure in this regard should be provided.

7. The voltage analysis should include documentation for each condition analyzed, of the voltage at the input and output of each transformer and at each intermediate bus between the connection to the offsite circuit and the terminals of each safety load.

8. The analysis should document the voltage setpoint and any inherent or adjustable (with nominal setting) time delay for relays which (1) initiate or execute automatic transfer of loads from one source to another; (2) initiate or execute automatic load shedding; or (3) initiate or execute automatic load sequencing.

9. The calculated voltages at the terminals of each safety load should be compared with the required voltage range for normal operation and starting of that load. Any identified inadequacies of calculated voltage require immediate remedial action and notification of NRC.

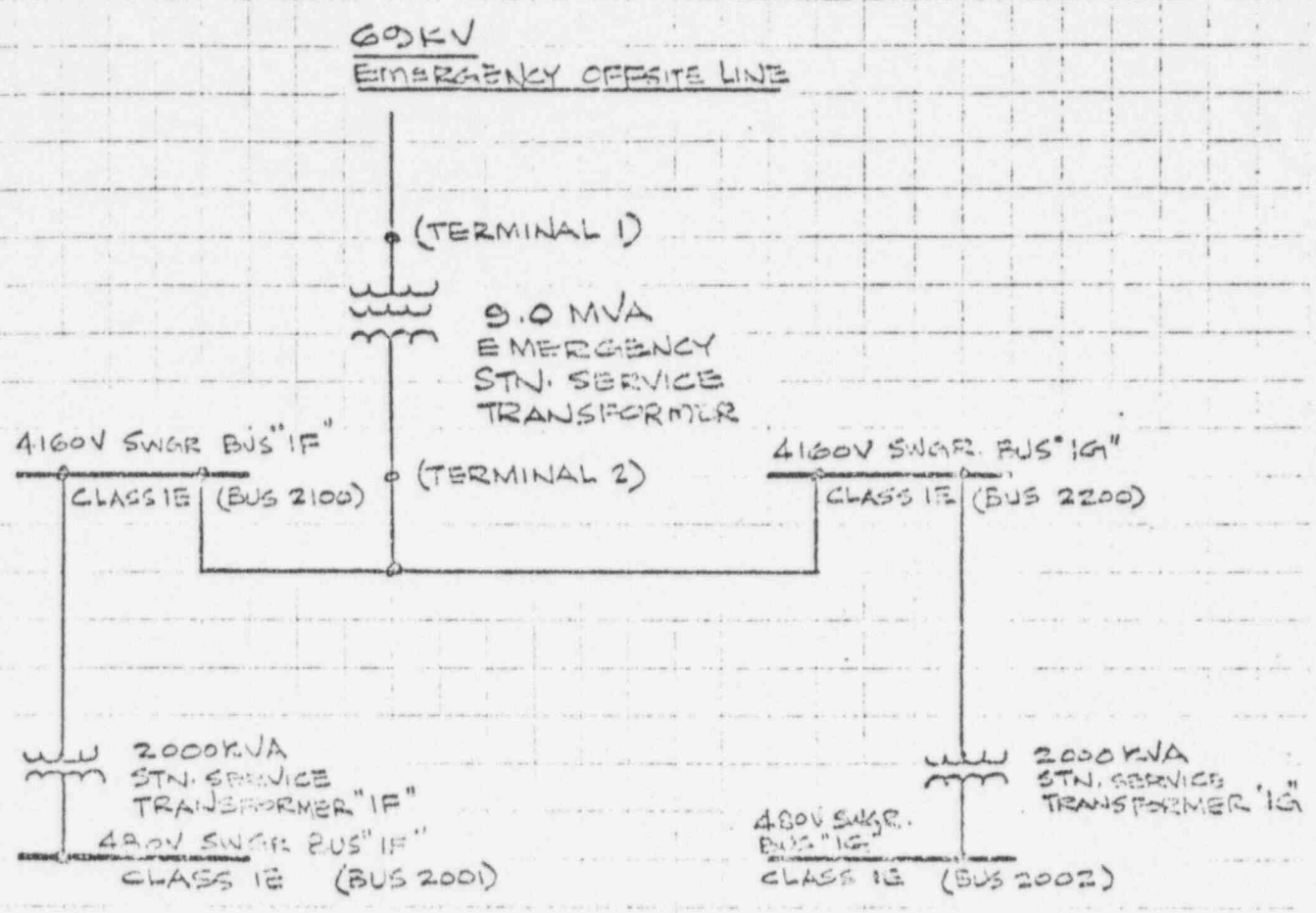
10. For each case evaluated the calculated voltages on each safety bus should be compared with the voltage-time settings for the undervoltage relays on these safety buses. Any identified inadequacies in undervoltage relay settings require immediate remedial action and notification of NRC.

11. To provide assurance that actions taken to assure adequate voltage levels for safety loads do not result in excessive voltage, assuming the maximum expected value of voltage at the connection to the offsite circuit, a determination should be made of the maximum voltage expected at the terminals of each safety load and its starting circuit. If this voltage exceeds the maximum voltage rating of any item of safety equipment immediate remedial action is required and NRC shall be notified.

12. Voltage-time settings for undervoltage relays shall be selected so as to avoid spurious separation of safety buses from offsite power during plant startup, normal operation and shutdown due to startup and/or operation of electric loads.

13. Analysis documentation should include a statement of the assumptions for each case analyzed.

VOLTAGE DROP CASE RUNS



CASE 1 : EMERGENCY OFFSITE POWER LINE VOLTAGE LOW (69 KV*) & LOCA SHUTDOWN LOADS

CASE 2 : EMERGENCY OFFSITE POWER LINE VOLTAGE LOW (69 KV*) & COLD SHUTDOWN LOADS

CASE 3 : EMERGENCY OFFSITE POWER LINE VOLTAGE HIGH (73.5 KV) & LOCA SHUTDOWN LOADS

CASE 4 : EMERGENCY OFFSITE POWER LINE VOLTAGE HIGH (73.5 KV) & COLD SHUTDOWN LOADS.

NOTE : TAG NUMBERS IN PARANTHESIS ARE FOR COMPUTER PROGRAM ELD110

* : LOWEST STEADY STATE VOLTAGE RECORDED IN NPPD LOG IS 70KV, BUT NOMINAL VOLTAGE IS CONSERVATIVELY TAKEN.

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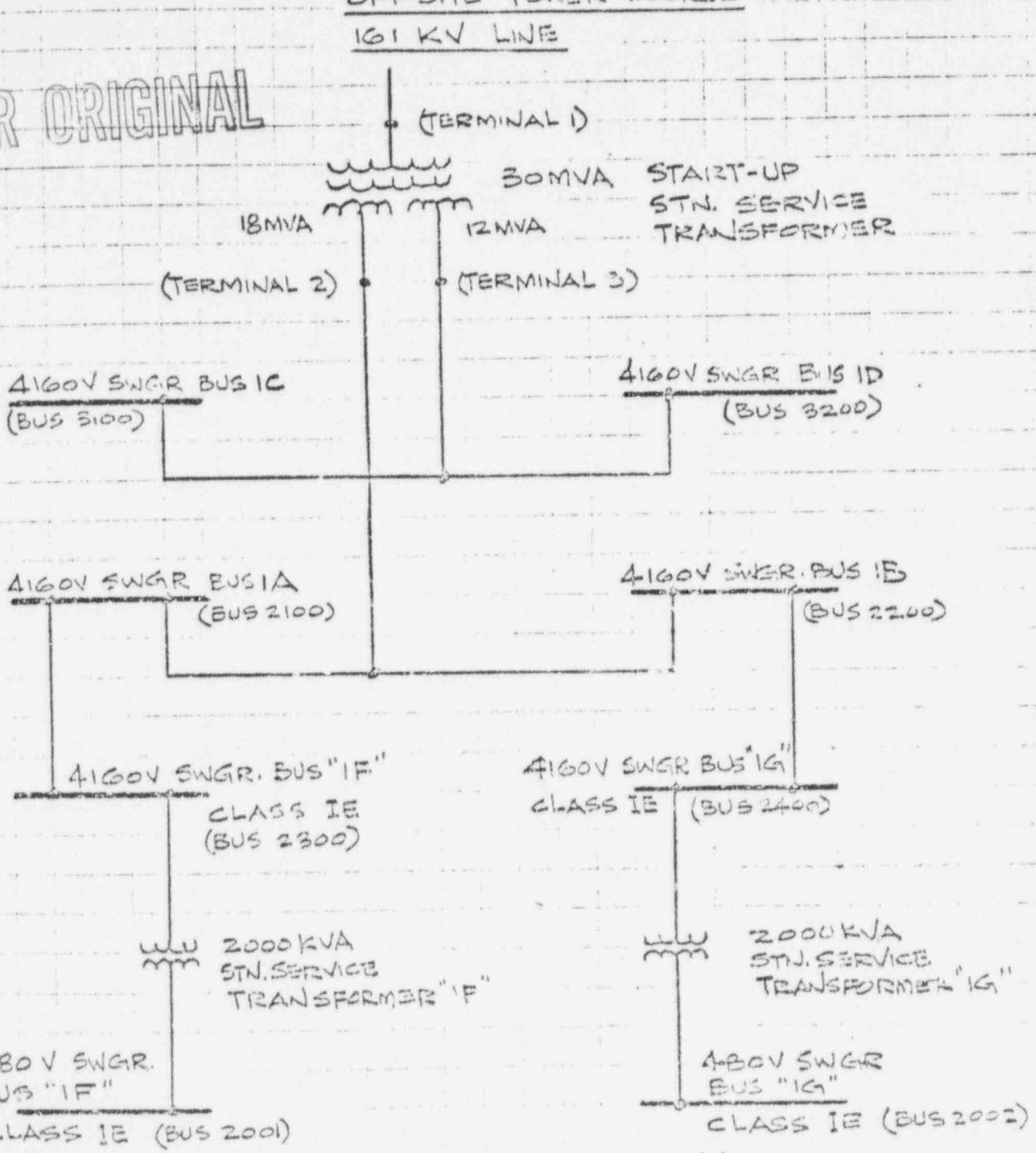
NOTE: TAG NUMBERS IN PARANTHESIS ARE FOR COMPUTER PROGRAM ELOIIO



CASE 5 : OFFSITE START-UP POWER LINE VOLTAGE HIGH (161KV) & PLANT ON HOT STAND-BY.

CASE 6 : OFFSITE STARTUP POWER LINE VOLTAGE LOW (154 KV) & PLANT NORMAL OPERATION

CASE 7 : SAME AS CASE 6, BUT WITH LOCA LOADS ADDED.

CASE 8 : OFFSITE START-UP POWER LINE VOLT. HIGH (161KV) & PLANT NORMAL LOADS.

CASE 9 : SAME AS CASE 8, BUT WITH LOCA LOADS ADDED.

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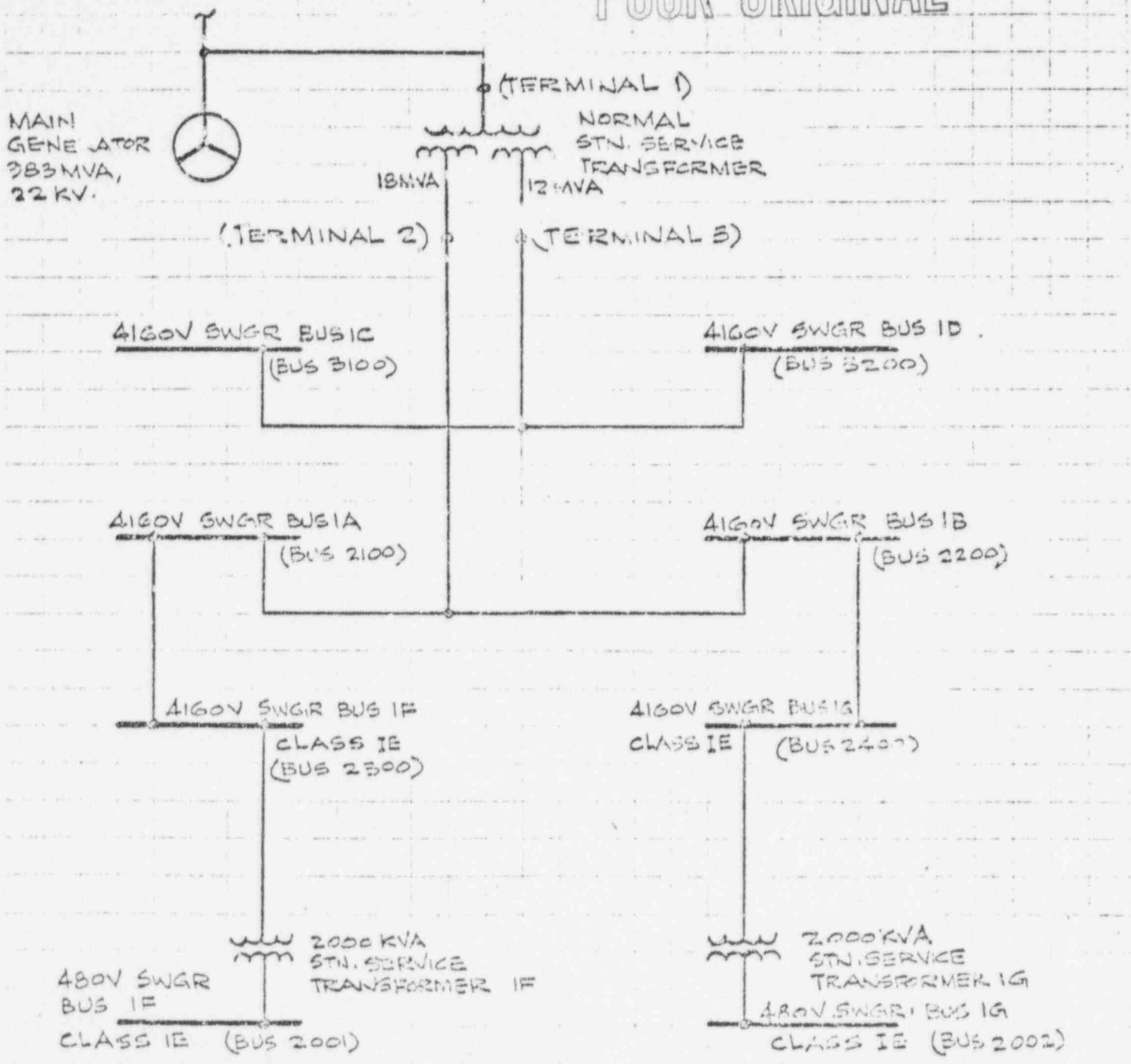
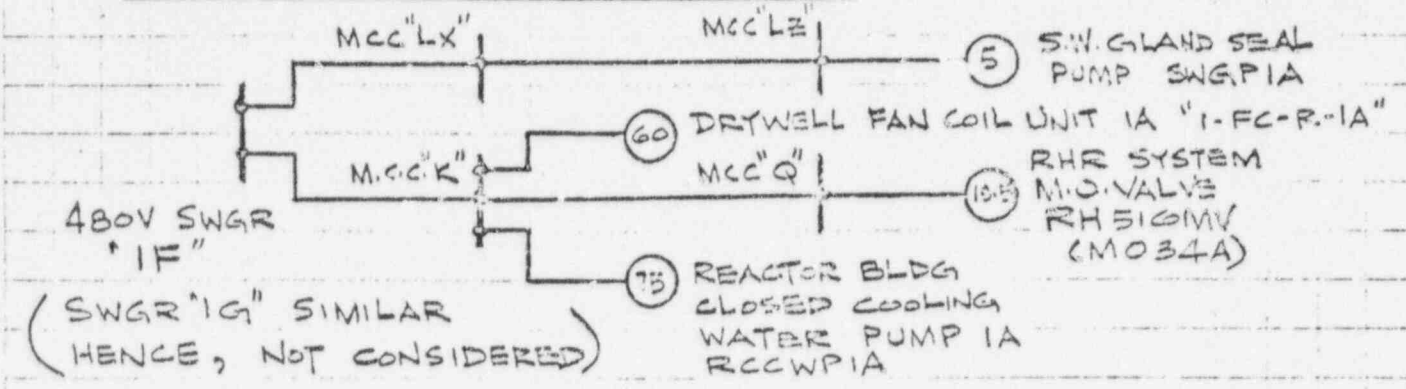


CASE 10 : NORMAL PLANT GENERATOR OUTPUT VOLTAGE HIGH (22.05KV) & PLANT = HOT STANDBY

CASE 11 : NORMAL PLANT GENERATOR OUTPUT VOLTAGE LOW (21.6KV) & PLANT NORMAL OPERATION.

NOTE: TAG NUMBERS IN PARANTHESIS ARE FOR COMPUTER PROGRAM BLOCK

VOLTAGE DROP AT SMALLER MOTORS, LIKELY TO PRODUCE MAX. VOLTAGE DROP



CABLE	SIZE	LENGTH
FEEDER TO MCC "K"	2-750MCM	70'
FEEDER TO MCC "LX"	2-500MCM	120'
FEEDER TO MCC "LE"	#4	600'
FEEDER TO MCC "Q"	#1/0	50'
MCC TO MOTOR SWGPIA (MLE1)	#12	50'
1-FC-R-1A (MK61)	#2 & 1/0	200'
RH 51GMV (MQ191)	#8	50'
RCCWP1A (MK1)	1/0	60'

1. CABLE ARE INSTALLED IN STEEL CONDUIT
2. CABLE FOR MOTORS INSIDE DRYWELL ARE ASSUMED TO BE SAME INSIDE & OUTSIDE FOR VOLTS DROP

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MOTOR	CABLE	MOTOR F.L. AMP	AMP.FT	VOLTS DROP @ 80% P.F	STARTING VOLT DROP ASSUME 6X
SWGPIA	FDR TO MCC "LX" 2-500MCM, 12d	7.5	900	0.04	
	FDR TO MCC "LZ" #4, 600'		4500	2.17	
	FDR TO MOTOR #12, 50'		375	1.04	
	TOTAL			3.25	19.5
1-FC-R-1A	FDR TO MCC "K" 2-750 MCM, 70'	75	5250	.26	
	FDR TO MOTOR #2. 235'		17625	5.68	
	TOTAL			5.94	35.64
RH 516A	FDR TO MCC K 2-750MCM, 70'	26	1820	.09	
	FDR TO MCC Q 1/0, 50'		1300	.26	
	FDR TO MOTOR #8, 50'		1300	1.47	
				1.82	10.92
RCCWPIA	FDR TO MCC K 2-750MCM, 70'	93	6510	.35	
	FDR TO MOTOR #1/0, 60'		5580	1.13	
	TOTAL			1.48	8.88

1. THE SWGR BUS VOLTAGES FOR 480VOLT UNIT SUBSTATION "1F" (1G) ARE PROVIDED BY COMPUTER PROGRAM FOR EACH CASE - STEADY STATE VOLTAGES.
2. FORMULA FOR % VOLTS DROP AT MOTOR TERM =
$10^{-2} \times$ (STEADY STATE SWGR BUS VOLTS − VOLTS DROP) ÷ MOTOR RATED VOLTS (440)

Form BR 0002-2 (5/78)

CASE 1 VOLTAGE DROP WHILE [illegible] LOCA SHUTDOWN LOADS
UPRTD/CNS 66.75V SOURCE VOLTS(LOG) = [illegible] EXP 63.65ZV

PURPOSE OBJECTIVE - [illegible] VOLTAGE DROP STUDIES

INPUT DATA

BASE MVA USED FOR CALCULATIONS = 1000.00

RATED KV ON TERMINAL 1 = 63.65

RATED KV ON TERMINAL 2 = 4.16

MAIN GENERATOR

MVA = 0.0 KV = 0.0

SUBTRANSIENT REACTANCE = 0.0 PU X/R RATIO = 0.0

TRANSIENT REACTANCE = 0.0 PU RESISTANCE = 0.0 PU

STEP-UP TRANSFORMER

MVA = 0.0 X/R RATIO = 30.00

REACTANCE = 0.0 % ON 0.0 MVA BASE

UTILITY SYSTEM

MVA = 193.00 BASE MVA OF IMPEDANCE = 0.0

IMPEDANCE = .0 PU AT 0.0 DEG.

9000502

BUS DATA ELEMENT DATA
FOR VALUES LISTED BELOW ARE ACTUAL INPUT AND PROCESSED ASSUMPTIONS
FOR ENTITIES THE STARTING ERROR FOR VOLTAGE DROP STUDY
PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),OR BUS(5)

BUS	BUS KV		IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	A SU	RES	EFF	P PF	S PF	LR/FLC	CABLE(OHMS) RES	REACT
1	0	4.16	1 SSW-1A	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
1	0	4.16	1 SSW-1C	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
1	0	4.16	1 RHR-1A*2	1250.0	1090.0	4.00			.900	.850	.200	6.50	0.0105	0.0079
1	0	4.16	1 CSP-1A*1	1250.0	1090.0	4.00			.900	.850	.200	6.50	0.0105	0.0079
2	0	4.16	1 SSW-1B	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
2	0	4.16	1 SSW-1D	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
2	0	4.16	1 RHR-1B*2	1250.0	1090.0	4.00			.900	.850	.200	6.50	0.0105	0.0079
2	0	4.16	1 CSP-1B*1	1250.0	1090.0	4.00			.900	.850	.200	6.50	0.0105	0.0079
2	0	0.48	1 CROP1A*3	250.0	0.0	0.46			.900	.850	.200	5.60	0.0068	0.0085
2	0	0.48	1 SACP1A	125.0	0.0	0.46			.900	.850	.200	6.50	0.0112	0.0077
2	0	0.48	4 MCC-K	600.0		0.48				.850			0.0010	0.0015
2	0	0.48	4 MCC-L	475.0		0.48				.850			0.0025	0.0026
2	0	0.48	1 CROP1B*4	250.0	0.0	0.46			.900	.850	.200	5.60	0.0068	0.0085
2	0	0.48	1 SACP1B	125.0	0.0	0.46			.900	.850	.200	6.50	0.0112	0.0077
2	0	0.48	4 MCC-T	100.0		0.48				.850			0.0016	0.0016
2	0	0.48	4 MCC-S	480.0		0.48				.850			0.0021	0.0027

INPUT BUS REACTOR DATA

TERM	BUS	REACTANCE (OHMS)	RESISTANCE (OHMS)
2	1 0	0.0	0.0
2	2 0	0.0	0.0

INPUT STATION SERVICE TRANSFORMER AND CABLE DATA

						CABLE VALUES (OHMS)		
TERM	BUS	MVA	REACTANCE	X/R	TOLERANCE	REACTANCE	RESISTANCE	KV
2	0 1	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
2	0 2	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16

UNIT AUXILIARY TRANSFORMER TOLERANCE USED

2-WINDING	3-WINDING
7.50 %	10.00 %

INPUT UNIT AUXILIARY TRANSFORMER DATA

			% REACTANCE				BREAKER CAPABILITIES (KA)					
							INT.		MOM.		MOM MULT	
NOG	TERM	MVA	XHL	XHT	XLT	X/R	LV	MV	LV	MV	LV	MV
2	2 0	9.0	7.00	0.0	0.0	25.00	0.0	0.0	0.0	0.0	0.0	0.0

BREAKER TIME DATA

TERM	BUS	BUS KV	TRIPPING TIME (CYCLES)	CONTACT PARTING TIME (CYCLES)
2	1 0	4.16	5.0	3.0
2	2 0	4.16	5.0	3.0
2	0 1	0.48	2.0	2.0
2	0 2	0.48	2.0	2.0

ST. LUCIE STATE VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D = 1.0463(PU)

VOLTAGE AT BUS

TYPE	BUS	RATED BUS KV	ACTUAL BUS VOLTAGE
2	1 9	4.16	4.2031 (KV)
2	2 0	4.16	4.2031 (KV)
2	0 1	0.48	0.4726 (KV)
2	0 2	0.48	0.4768 (KV)

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.048(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT STOR TERMINAL RUNNING LOAD	VOLTAGE AT STOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	1 0	4.16	1	4.2479 (KV)	3.7147 (KV)	4.2445 (KV)	3.6967 (KV)	106.11	92.42
2	2 0	4.16	1	4.2479 (KV)	3.7147 (KV)	4.2445 (KV)	3.6967 (KV)	106.11	92.42
2	0 1	0.48	1	0.4777 (KV)	0.4177 (KV)				
2	0 2	0.48	1	0.4819 (KV)	0.4214 (KV)				
2	1 0	4.16	2	4.2479 (KV)	3.7147 (KV)	4.2445 (KV)	3.6967 (KV)	106.11	92.42
2	2 0	4.16	2	4.2479 (KV)	3.7147 (KV)	4.2445 (KV)	3.6967 (KV)	106.11	92.42
2	0 1	0.48	2	0.4777 (KV)	0.4177 (KV)				
2	0 2	0.48	2	0.4819 (KV)	0.4214 (KV)				
2	1 0	4.16	3	4.2084 (KV)	4.1625 (KV)				
2	2 0	4.16	3	4.2084 (KV)	4.1625 (KV)				
2	0 1	0.48	3	0.4753 (KV)	0.4540 (KV)	0.4702 (KV)	0.4261 (KV)	102.21	92.62
2	0 2	0.48	3	0.4774 (KV)	0.4722 (KV)				
2	1 0	4.16	4	4.2084 (KV)	4.1618 (KV)				
2	2 0	4.16	4	4.2084 (KV)	4.1618 (KV)				
2	0 1	0.48	4	0.4732 (KV)	0.4680 (KV)				
2	0 2	0.48	4	0.4795 (KV)	0.4569 (KV)	0.4743 (KV)	0.4297 (KV)	103.12	93.41

CASE 2 VOLTAGE DROP [illegible] COLD SHUTDOWN LOADS
PPD/CNS 56.7KV SOURCE VOLTS(LOAD) [illegible] TAP 63.65KV

PROJECT OBJECTIVE - [redacted] VOLTAGE DROP STUDIES

INPUT DATA

BASE MVA USED FOR CALCULATIONS = 1000.00

RATED KV ON TERMINAL 1 = 63.65

RATED KV ON TERMINAL 2 = 4.16

MAIN GENERATOR

MVA = 0.0 KV = 0.0

SUBTRANSIENT REACTANCE = 0.0 PU X/R RATIO = 0.0

TRANSIENT REACTANCE = 0.0 PU RESISTANCE = 0.0 PU

STEP-UP TRANSFORMER

MVA = 0.0 X/R RATIO = 30.00

REACTANCE = 0.0 % ON 0.0 MVA BASE

UTILITY SYSTEM

MVA = 193.00 BASE MVA OF IMPEDANCE = 0.0

IMPEDANCE = .0 PU AT 0.0 DEG.

POOR ORIGINAL

9000007

[illegible] ELEMENT DATA
[illegible] VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS
- [illegible] IDENTIFIES THE STARTING BUS FOR VOLTAGE DROP STUDY
[illegible] IDENTIFICATION - MOTOR(1),STATIC LOAD (4),RECTIFIER(5)

RL

[illegible]	BUS		BUS KV		IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	% SYS	RES	EFF	M PF	S PF	LR/FLC	CABLE(S) RES	RE.
2	1	0	4.16	1	SSWP1A	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
2	1	0	4.16	1	RHRB1A*1	1000.0	0.0	4.00			.900	.850	.200	6.50	0.0212	0.0109
2	1	0	4.16	1	RHRB1C	1000.0	0.0	4.00			.900	.850	.200	6.50	0.0212	0.0109
2	1	0	4.16	1	RHR-1A	1250.0	1090.0	4.00			.900	.850	.200	6.50	0.0105	0.0079
2	2	0	4.16	1	SSWP1B	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
2	2	0	4.16	1	RHRB1B*2	1000.0	0.0	4.00			.900	.850	.200	6.50	0.0212	0.0109
2	2	0	4.16	1	RHRB1D	1000.0	0.0	4.00			.900	.850	.200	6.50	0.0212	0.0109
2	2	0	4.16	1	RHR-1B	1250.0	1090.0	4.00			.900	.850	.200	6.50	0.0105	0.0079
2	0	1	0.48	1	CRDP1A*3	250.0	0.0	0.46			.900	.850	.200	5.60	0.0068	0.0085
2	0	1	0.48	1	SACP1A	125.0	0.0	0.46			.900	.850	.200	6.50	0.0112	0.0077
2	0	1	0.48	4	MCC-K	600.0		0.48				.850			0.0010	0.0015
2	0	1	0.48	4	MCC-L	475.0		0.48				.850			0.0025	0.0026
2	0	2	0.48	1	CRDP1B*3	250.0	0.0	0.46			.900	.850	.200	5.60	0.0068	0.0085
2	0	2	0.48	1	SACP1B	125.0	0.0	0.46			.900	.850	.200	6.50	0.0112	0.0077
2	0	2	0.48	4	MCC-T	100.0		0.48				.850			0.0016	0.0016
2	0	2	0.48	4	MCC-S	480.0		0.48				.850			0.0021	0.0027

INPUT BUS REACTOR DATA

TERM	BUS	REACTANCE (OHMS)	RESISTANCE (OHMS)
2	1 0	0.0	0.0
2	2 0	0.0	0.0

INPUT STATION SERVICE TRANSFORMER AND CABLE DATA

TERM	BUS	MVA	REACTANCE	X/R	TOLERANCE	CABLE VALUES (OHMS) REACTANCE	RESISTANCE	KV
2	0 1	2.00	5.75 %	6.00	7.50 %	0.00	0.00	4.16
2	0 2	2.00	5.75 %	6.00	7.50 %	0.00	0.00	4.16

UNIT AUXILIARY TRANSFORMER TOLERANCE USED

2-WINDING	3-WINDING
7.50 %	10.00 %

INPUT UNIT AUXILIARY TRANSFORMER DATA

WDG	TERM	MVA	% REACTANCE XHL	XHM	XLM	X/R	BREAKER CAPABILITIES (KA) INT. LV	INT. MV	MOM. LV	MOM. MV	MOM MULT LV	MOM MULT MV
2	2 0	9.0	7.00	0.0	0.0	25.00	0.0	0.0	0.0	0.0	0.0	0.0

BREAKER TIME DATA

TERM	BUS	BUS KV	TRIPPING TIME (CYCLES)	CONTACT PARTING TIME (CYCLES)
2	1 0	4.16	5.0	3.0
2	2 0	4.16	5.0	3.0
2	0 1	0.48	2.0	2.0
2	0 2	0.48	2.0	2.0

STEADY STATE VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D = 1.0981 PU

VOLTAGE AT BUS

TERM	BUS	RATED BUS KV	ACTUAL BUS VOLTAGE
2	1 0	4.16	4.1771 (KV)
2	2 0	4.16	4.1771 (KV)
2	3 1	0.48	0.4647 (KV)
2	8 2	0.48	0.4739 (KV)

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF XFR TRANSF FOR V/D =1.048(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	1 0	4.16	1	4.1984 (KV)	3.9682 (KV)	4.1928 (KV)	3.9448 (KV)	104.82	98.02
2	2 0	4.16	1	4.1984 (KV)	3.9682 (KV)				
2	0 1	0.48	1	0.4721 (KV)	0.4462 (KV)				
2	0 2	0.48	1	0.4763 (KV)	0.4502 (KV)				
2	1 0	4.16	2	4.1984 (KV)	3.9682 (KV)				
2	2 0	4.16	2	4.1984 (KV)	3.9682 (KV)	4.1928 (KV)	3.9448 (KV)	104.82	98.02
2	0 1	0.48	2	0.4721 (KV)	0.4462 (KV)				
2	0 2	0.48	2	0.4763 (KV)	0.4502 (KV)				
2	1 0	4.16	3	4.1826 (KV)	4.1367 (KV)				
2	2 0	4.16	3	4.1826 (KV)	4.1367 (KV)				
2	0 1	0.48	3	0.4724 (KV)	0.4502 (KV)	0.4673 (KV)	0.4234 (KV)	101.58	92.05
2	0 2	0.48	3	0.4745 (KV)	0.4693 (KV)				
2	1 0	4.16	4	4.1826 (KV)	4.1360 (KV)				
2	2 0	4.16	4	4.1826 (KV)	4.1360 (KV)				
2	0 1	0.48	4	0.4703 (KV)	0.4651 (KV)				
2	0 2	0.48	4	0.4766 (KV)	0.4540 (KV)	0.4714 (KV)	0.4270 (KV)	102.49	92.83

PAGES 15 THRU 44
REV. 1

THESE PAGES ARE DELETED.

CASE 5 VOLTAGE DROP WHILE ON STARTUP ST.SER.TR. -----PLANT ON HOT STANDBY
NPPD/CNS 161KV SOURCE VOLTS(HIGH) -5.0% TAP 152.95KV

PROGRAM OBJECTIVE - SHORT CIRCUIT AND VOLTAGE DROP STUDIES

INPUT DATA

BASE MVA USED FOR CALCULATIONS = 1000.00

RATED KV ON TERMINAL 1 = 152.90

RATED KV ON TERMINAL 2 = 4.16

RATED KV ON TERMINAL 3 = 4.16

MAIN GENERATOR

MVA = 0.0 KV = 0.0

SUBTRANSIENT REACTANCE = 0.0 PU X/R RATIO = 0.0

TRANSIENT REACTANCE = 0.0 PU RESISTANCE = 0.0 PU

STEP-UP TRANSFORMER

MVA = 0.0 X/R RATIO = 30.00

REACTANCE = 0.0 % ON 0.0 MVA BASE

UTILITY SYSTEM

MVA = 10000.00 BASE MVA OF IMPEDANCE = 0.0

IMPEDANCE = .0 PU AT 0.0 DEG.

INPUT BUS ELEMENT DATA
THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS
* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY
PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB	RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	1 0	4.16	1 CWP-1A*1	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CBP-1A*2	2500.0	0.0	4.00			.900	.850	.200	5.50	0.0108	0.0149
2	1 0	4.16	1 CONP1A	800.0	0.0	4.00			.900	.850	.200	5.50	0.0609	0.0187
2	1 0	4.16	4 SUBS1A	1200.0		4.16				.850			0.0046	0.0051
2	1 0	4.16	4 SUBS1C	300.0		4.16				.850			0.1218	0.0374
2	1 0	4.16	4 BUS-1E	400.0		4.16				.850			0.0023	0.0026
2	2 0	4.16	1 CWP-1C*1	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	4 SUBS1B	1000.0		4.16				.850			0.0046	0.0051
2	2 0	4.16	4 SUBS1D	300.0		4.16				.850			0.1218	0.0374
2	3 0	4.16	1 FAKE	1.0	0.0	4.00			.900	.850	.200	6.50	0.0	0.0
2	4 0	4.16	1 FAKE	1.0	0.0	4.00			.900	.850	.200	6.50	0.0	0.0
3	1 0	4.16	1 RRMGST*3	7000.0	0.0	4.00			.900	.850	.200	5.50	0.0018	0.0025
3	2 0	4.16	1 RRMGST*3	7000.0	0.0	4.00			.900	.850	.200	5.50	0.0018	0.0025
2	0 1	0.48	4 SUBS1F	480.0		0.48				.850			0.0	0.0
2	0 2	0.48	4 SUBS1G	150.0		0.48				.850			0.0	0.0
3	0 1	0.48	4 FAKE	1.0		0.48				.850			0.0	0.0

INPUT BUS REACTOR DATA

TERM	BUS	REACTANCE(OHMS)	RESISTANCE(OHMS)
2	1 0	0.0	0.0
2	2 0	0.0	0.0
2	3 0	0.005	0.004
2	4 0	0.005	0.004
3	1 0	0.0	0.0
3	2 0	0.0	0.0

INPUT STATION SERVICE TRANSFORMER AND CABLE DATA

TERM	BUS	MVA	REACTANCE	X/R	TOLERANCE	CABLE VALUES (OHMS) REACTANCE	RESISTANCE	KV
2	0 1	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
2	0 2	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
3	0 1	0.01	0.0 %	6.60	7.50 %	0.0	0.0	0.0

UNIT AUXILIARY TRANSFORMER TOLERANCE USED

2-WINDING	3-WINDING
7.50 %	10.00 %

INPUT UNIT AUXILIARY TRANSFORMER DATA

WDG	TERM	MVA	% REACTANCE XHL	XHM	XLK	X/R	BREAKER CAPABILITIES (KA) INT. LV	INT. MV	MOM. LV	MOM. MV	MOM MULT LV	MOM MULT MV
3	2 3	30.0	12.30	12.30	0.0	25.00	0.0	0.0	0.0	0.0	0.0	0.0

BREAKER TIME DATA

TERM	BUS	BUS KV	TRIPPING TIME (CYCLES)	CONTACT PARTING TIME (CYCLES)
2	1 0	4.16	5.0	3.0
2	2 0	4.16	5.0	3.0
2	3 0	4.16	5.0	3.0
2	4 0	4.16	5.0	3.0
2	0 1	0.48	2.0	2.0
2	0 2	0.48	2.0	2.0
3	1 0	4.16	5.0	3.0
3	2 0	4.16	5.0	3.0
3	0 1	0.48	2.0	2.0

STEADY STATE VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D = 1.053(PU)

VOLTAGE AT BUS

TERM	BUS	RATED BUS KV	ACTUAL BUS VOLTAGE
2	1 0	4.16	4.2418 (KV)
2	2 0	4.16	4.2418 (KV)
2	3 0	4.16	4.2418 (KV)
2	4 0	4.16	4.2418 (KV)
2	0 1	0.48	0.4852 (KV)
2	0 2	0.48	0.4881 (KV)
3	1 0	4.16	4.2133 (KV)
3	2 0	4.16	4.2133 (KV)
3	0 1	0.48	0.4862 (KV)

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.053(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	1 0	4.16	1	4.2788 (KV)	3.9586 (KV)	4.2607 (KV)	3.8783 (KV)	106.52	96.96
2	2 0	4.16	1	4.2788 (KV)	3.9586 (KV)	4.2607 (KV)	3.8783 (KV)	106.52	96.96
2	3 0	4.16	1	4.2788 (KV)	3.9586 (KV)				
2	4 0	4.16	1	4.2788 (KV)	3.9586 (KV)				
2	0 1	0.48	1	0.4895 (KV)	0.4528 (KV)				
2	0 2	0.48	1	0.4924 (KV)	0.4555 (KV)				
3	1 0	4.16	1	4.2209 (KV)	4.1552 (KV)				
3	2 0	4.16	1	4.2209 (KV)	4.1552 (KV)				
3	0 1	0.48	1	0.4870 (KV)	0.4794 (KV)				
2	1 0	4.16	2	4.2684 (KV)	4.0110 (KV)	4.2582 (KV)	3.9554 (KV)	106.45	98.89
2	2 0	4.16	2	4.2684 (KV)	4.0110 (KV)				
2	3 0	4.16	2	4.2684 (KV)	4.0110 (KV)				
2	4 0	4.16	2	4.2684 (KV)	4.0110 (KV)				
2	0 1	0.48	2	0.4883 (KV)	0.4588 (KV)				
2	0 2	0.48	2	0.4912 (KV)	0.4616 (KV)				
3	1 0	4.16	2	4.2187 (KV)	4.1661 (KV)				
3	2 0	4.16	2	4.2187 (KV)	4.1661 (KV)				
3	0 1	0.48	2	0.4868 (KV)	0.4807 (KV)				
2	1 0	4.16	3	4.2714 (KV)	4.0339 (KV)				
2	2 0	4.16	3	4.2714 (KV)	4.0339 (KV)				

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.053(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	3 0	4.16	3	4.2714 (KV)	4.0339 (KV)				
2	4 0	4.16	3	4.2714 (KV)	4.0339 (KV)				
2	0 1	0.48	3	0.4886 (KV)	0.4615 (KV)				
2	0 2	0.48	3	0.4915 (KV)	0.4642 (KV)				
3	1 0	4.16	3	4.3589 (KV)	3.2154 (KV)	4.3540 (KV)	3.1943 (KV)	108.85	79.86
3	2 0	4.16	3	4.3589 (KV)	3.2154 (KV)	4.3540 (KV)	3.1943 (KV)	108.85	79.86
3	0 1	0.48	3	0.5029 (KV)	0.3710 (KV)				

CASE 6 VOLTAGE DROP WHILE ON STARTUP ST.SER.TR.---PLANT NORMAL OPERATION
NPPD/CNS 154KV SOURCE VOLTS(LOW) -5.0% TAP 152.95KV

PROGRAM OBJECTIVE - VOLTAGE DROP STUDY ONLY

INPUT DATA

BASE MVA USED FOR CALCULATIONS = 1000.00

RATED KV ON TERMINAL 1 = 152.90

RATED KV ON TERMINAL 2 = 4.16

RATED KV ON TERMINAL 3 = 4.16

MAIN GENERATOR

MVA = 0.0 KV = 0.0

SUBTRANSIENT REACTANCE = 0.0 PU X/R RATIO = 0.0

TRANSIENT REACTANCE = 0.0 PU RESISTANCE = 0.0 PU

STEP-UP TRANSFORMER

MVA = 0.0 X/R RATIO = 30.00

REACTANCE = 0.0 % ON 0.0 MVA BASE

UTILITY SYSTEM

MVA = 10000.00 BASE MVA OF IMPEDANCE = 0.0

IMPEDANCE = .0 PU AT 0.0 DEG.

INPUT BUS ELEMENT DATA

THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS

* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY

PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB	RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REAC
2	1 0	4.16	1 CWP 1A*1	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CWP-1B	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CWP-1A*2	2500.0	0.0	4.00			.900	.850	.200	5.50	0.0108	0.0149
2	1 0	4.16	1 CONP1A	800.0	0.0	4.00			.900	.850	.200	5.50	0.0609	0.0187
2	1 0	4.16	4 SUBS1A	1200.0		4.16				.850			0.0046	
2	1 0	4.16	4 SUBS1C	300.0		4.16				.850			0.1218	
2	1 0	4.16	4 BUS-1E	400.0		4.16				.850			0.0023	
2	2 0	4.16	1 CWP-1C*1	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CWP-1D	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CWP-1B	2500.0	0.0	4.00			.900	.850	.200	5.50	0.0108	0.0149
2	2 0	4.16	1 CONF1B	800.0	0.0	4.00			.900	.850	.200	5.50	0.0609	0.0187
2	2 0	4.16	4 SUBS1B	1000.0		4.16				.850			0.0046	0.0051
2	2 0	4.16	4 SUBS1D	300.0		4.16				.850			0.1218	0.0374
2	3 0	4.16	1 FAKE	1.0	0.0	4.00			.900	.850	.200	6.50	0.0	0.0
2	4 0	4.16	1 FAKE	.0	0.0	4.00			.900	.850	.200	6.50	0.0	0.0
3	1 0	4.16	1 RRMGST	7000.0	0.0	4.00			.900	.850	.200	5.50	0.0018	0.0025
3	2 0	4.16	1 RRMGST*3	7000.0	0.0	4.00			.900	.850	.200	5.50	0.0018	0.0025
2	0 1	0.48	1 CRDP1A*4	250.0	0.0	0.46			.900	.850	.200	5.60	0.0068	0.0085
2	0 1	0.48	1 SACP1A	125.0	0.0	0.46			.900	.850	.200	6.50	0.0112	0.0077
2	0 1	0.48	4 MCC-K	600.0		0.48				.850			0.0010	0.0015

INPUT BUS ELEMENT DATA

THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS

* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY

PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB	RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	0 1	0.48	4 MCC-L	475.0						.850			0.0025	0.0026
2	0 1	0.48	4 MCC-M	500.0		0.48				.850			0.0025	0.0031
2	0 1	0.48	4 MCC-N	240.0		0.48				.850			0.0036	0.0045
2	0 1	0.48	4 MCC-P	430.0		0.48				.850			0.0036	0.0045
2	0 1	0.48	4 MCCOGI	235.0		0.48				.850			0.0058	0.0059
2	0 2	0.48	1 CROP1B	250.0	0.0	0.46			.900	.850	.200	5.60	0.0068	0.0085
2	0 2	0.48	1 SACP1B	125.0	0.0	0.46			.900	.850	.200	6.50	0.0112	0.0077
2	0 2	0.48	4 MCC-T	100.0		0.48				.850			0.0016	0.0016
2	0 2	0.48	4 MCC-S	480.0		0.48				.850			0.0021	0.0027
2	0 2	0.48	4 MCC-U	400.0		0.48				.850			0.0032	0.0033
2	0 2	0.48	4 MCC-V	200.0		0.48				.850			0.0089	0.0092
2	0 2	0.48	4 MCC-W	320.0		0.48				.850			0.0046	0.0047
2	0 2	0.48	4 MCC-MR	200.0		0.48				.850			0.0090	0.0112
3	0 1	0.48	4 FAKE	1.0		0.48				.850			0.0	0.0

INPUT BUS REACTOR DATA

TERM	BUS	REACTANCE (OHMS)	RESISTANCE (OHMS)
2	1 0	0.0	0.0
2	2 0	0.0	0.0
2	3 0	0.005	0.004
2	4 0	0.005	0.004
3	1 0	0.0	0.0
3	2 0	0.0	0.0

INPUT STATION SERVICE TRANSFORMER AND CABLE DATA

TERM	BUS	MVA	REACTANCE	X/R	TOLERANCE	CABLE VALUES (OHMS) REACTANCE	RESISTANCE	KV
2	0 1	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
2	0 2	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
3	0 1	2.00	0.01 %	6.60	7.50 %	0.0	0.0	0.0

UNIT AUXILIARY TRANSFORMER TOLERANCE USED

2-WINDING	3-WINDING
7.50 %	10.00 %

INPUT UNIT AUXILIARY TRANSFORMER DATA

WDG	TERM	MVA	% REACTANCE XHL	XHM	XLM	X/R	BREAKER CAPABILITIES (Ka) INT. LV	INT. MV	MOM. LV	MOM. MV	MOM MULT LV	MOM MULT MV
3	2 3	30.0	12.30	12.30	0.0	25.00	0.0	0.0	0.0	0.0	0.0	0.0

BREAKER TIME DATA

TERM	BUS	BUS KV	TRIPPING TIME (CYCLES)	CONTACT PARTING TIME (CYCLES)
2	1 0	4.16	5.0	3.0
2	2 0	4.16	5.0	3.0
2	3 0	4.16	5.0	3.0
2	4 0	4.16	5.0	3.0
2	0 1	0.48	2.0	2.0
2	0 2	0.48	2.0	2.0
3	1 0	4.16	5.0	3.0
3	2 0	4.16	5.0	3.0
3	0 1	0.48	2.0	2.0

STEADY STATE VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D = 1.007(PU)

VOLTAGE AT BUS

TERM	BUS	RATED BUS KV	ACTUAL BUS VOLTAGE
2	1 0	4.16	3.9092 (KV)
2	2 0	4.16	3.9092 (KV)
2	3 0	4.16	3.9092 (KV)
2	4 0	4.16	3.9092 (KV)
2	0 1	0.48	0.4286 (KV)
2	0 2	0.48	0.4347 (KV)
3	1 0	4.16	3.9870 (KV)
3	2 0	4.16	3.9870 (KV)
3	0 1	0.48	0.4600 (KV)

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.007(PU)

VOLTAGE AT BUS TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	1 0	4.16	1	3.9525 (KV)	3.6496 (KV)	3.9358 (KV)	3.5755 (KV)	98.39	89.39
2	2 0	4.16	1	3.9525 (KV)	3.6496 (KV)	3.9358 (KV)	3.5755 (KV)	98.39	89.39
2	3 0	4.16	1	3.9525 (KV)	3.6496 (KV)				
2	4 0	4.16	1	3.9525 (KV)	3.6496 (KV)				
2	0 1	0.48	1	0.4333 (KV)	0.4001 (KV)				
2	0 2	0.48	1	0.4395 (KV)	0.4058 (KV)				
3	1 0	4.16	1	3.9953 (KV)	3.9346 (KV)				
3	2 0	4.16	1	3.9953 (KV)	3.9346 (KV)				
3	0 1	0.48	1	0.4610 (KV)	0.4540 (KV)				
2	1 0	4.16	2	3.9404 (KV)	3.6968 (KV)	3.9309 (KV)	3.6455 (KV)	98.27	91.14
2	2 0	4.16	2	3.9404 (KV)	3.6968 (KV)				
2	3 0	4.16	2	3.9404 (KV)	3.6968 (KV)				
2	4 0	4.16	2	3.9404 (KV)	3.6968 (KV)				
2	0 1	0.48	2	0.4320 (KV)	0.4053 (KV)				
2	0 2	0.48	2	0.4381 (KV)	0.4111 (KV)				
3	1 0	4.16	2	3.9930 (KV)	3.9443 (KV)				
3	2 0	4.16	2	3.9930 (KV)	3.9443 (KV)				
3	0 1	0.48	2	0.4607 (KV)	0.4551 (KV)				
2	1 0	4.16	3	3.9260 (KV)	3.7933 (KV)				
2	2 0	4.16	3	3.9260 (KV)	3.7933 (KV)				

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.007(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	3 0	4.16	3	3.9260 (KV)	3.7933 (KV)				
2	4 0	4.16	3	3.9260 (KV)	3.7933 (KV)				
2	0 1	0.48	3	0.4304 (KV)	0.4159 (KV)				
2	0 2	0.48	3	0.4365 (KV)	0.4218 (KV)				
3	1 0	4.16	3	4.0668 (KV)	3.4442 (KV)				
3	2 0	4.16	3	4.0668 (KV)	3.4442 (KV)	4.0622 (KV)	3.4216 (KV)	101.56	85.54
3	0 1	0.48	3	0.4692 (KV)	0.3974 (KV)				
2	1 0	4.16	4	3.9124 (KV)	3.8900 (KV)				
2	2 0	4.16	4	3.9124 (KV)	3.8900 (KV)				
2	3 0	4.16	4	3.9124 (KV)	3.8900 (KV)				
2	4 0	4.16	4	3.9124 (KV)	3.8900 (KV)				
2	0 1	0.48	4	0.4308 (KV)	0.4132 (KV)	0.4262 (KV)	0.3886 (KV)	92.65	84.47
2	0 2	0.48	4	0.4350 (KV)	0.4325 (KV)				
3	1 0	4.16	4	3.9876 (KV)	3.9832 (KV)				
3	2 0	4.16	4	3.9876 (KV)	3.9832 (KV)				
3	0 1	0.48	4	0.4601 (KV)	0.4596 (KV)				

CASE 7 VOLTAGE DROP WHILE ON STARTUP ST.SER.TR.---SUDDEN LOCA SHUTDOWN
NPPD/CNS 154KV SOURCE VOLTS(LOW) -5.0% TAP 152.95KV

PROGRAM OBJECTIVE - VOLTAGE DROP STUDY ONLY

INPUT DATA

BASE MVA USED FOR CALCULATIONS = 1000.00

RATED KV ON TERMINAL 1 = 152.90

RATED KV ON TERMINAL 2 = 4.16

RATED KV ON TERMINAL 3 = 4.16

MAIN GENERATOR

MVA = 0.0 KV = 0.0

SUBTRANSIENT REACTANCE = 0.0 PU X/R RATIO = 0.0

TRANSIENT REACTANCE = 0.0 PU RESISTANCE = 0.0 PU

STEP-UP TRANSFORMER

MVA = 0.0 X/R RATIO = 30.00

REACTANCE = 0.0 % ON 0.0 MVA BASE

UTILITY SYSTEM

MVA = 10000.00 BASE MVA OF IMPEDANCE = 0.0

IMPEDANCE = .0 PU AT 0.0 DEG.

INPUT BUS ELEMENT DATA
THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS
* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY
PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB	RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	1 0	4.16	1 CWP-1A	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CWP-1B	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CSP-1A	2500.0	0.0	4.00			.900	.850	.200	5.50	0.0108	0.0149
2	1 0	4.16	1 CONP1A	800.0	0.0	4.00			.900	.850	.200	5.50	0.0609	0.0187
2	1 0	4.16	4 SUBS1A	1200.0		4.16				.850			0.0046	0.0051
2	1 0	4.16	4 SUBS1C	300.0		4.16				.850			0.1218	0.0374
2	1 0	4.16	4 BUS-1E	400.0		4.16				.850			0.0023	0.0026
2	2 0	4.16	1 CWP-1C	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CWP-1D	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CSP-1B	2500.0	0.0	4.00			.900	.850	.200	5.50	0.0108	0.0149
2	2 0	4.16	1 CONP1B	800.0	0.0	4.00			.900	.850	.200	5.50	0.0609	0.0187
2	2 0	4.16	4 SUBS1B	1000.0		4.16				.850			0.0046	0.0051
2	2 0	4.16	4 SUBS1D	300.0		4.16				.850			0.1218	0.0374
2	3 0	4.16	1 SSW-1A	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
2	3 0	4.16	1 SSW-1C	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
2	3 0	4.16	1 RHR-1A*1	1250.0	1090.0	4.00			.900	.850	.200	6.50	0.0105	0.0079
2	3 0	4.16	1 CSP-1A*2	1250.0	1090.0	4.00			.900	.850	.200	6.50	0.0105	0.0079
2	4 0	4.16	1 SSW-1B	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
2	4 0	4.16	1 SSW-1D	300.0	0.0	4.00			.900	.850	.200	6.00	0.1421	0.0436
2	4 0	4.16	1 RHR-1B*1	1250.0	1090.0	4.00			.900	.850	.200	6.50	0.0105	0.0079

INPUT BUS ELEMENT DATA
THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS
* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY
PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	4 0	4.16	1 CSP-1A*2	1250.0	1090.0	4.00		.900	.850	.200	6.50	0.0105	0.0079
3	1 0	4.16	1 RAMGST	7000.0	0.0	4.00		.900	.850	.200	5.50	0.0018	0.0025
3	2 0	4.16	1 RAMGSY*3	7000.0	0.0	4.00		.900	.850	.200	5.50	0.0018	0.0025
2	0 1	0.48	1 CRDP1A*4	250.0	0.0	0.46		.900	.850	.200	5.60	0.0068	0.0085
2	0 1	0.48	1 SACP1A	125.0	0.0	0.46		.900	.850	.200	6.50	0.0112	0.0077
2	0 1	0.48	4 MCC-K	600.0		0.48			.850			0.0010	0.0015
2	0 1	0.48	4 MCC-L	475.0		0.48			.850			0.0025	0.0026
2	0 1	0.48	4 MCC-M	500.0		0.48			.850			0.0025	0.0031
2	0 1	0.48	4 MCC-N	240.0		0.48			.850			0.0036	0.0045
2	0 1	0.48	4 MCC-P	430.0		0.48			.850			0.0036	0.0045
2	0 1	0.48	4 MCC0GI	235.0		0.48			.850			0.0058	0.0059
2	0 2	0.48	1 CRDP1B	250.0	0.0	0.46		.900	.850	.200	5.60	0.0048	0.0085
2	0 2	0.48	1 SACP1B	125.0	0.0	0.46		.900	.850	.200	6.50	0.0112	0.0077
2	0 2	0.48	4 MCC-T	100.0		0.48			.850			0.0016	0.0016
2	0 2	0.48	4 MCC-S	480.0		0.48			.850			0.0021	0.0027
2	0 2	0.48	4 MCC-U	400.0		0.48			.850			0.0032	0.0033
2	0 2	0.48	4 MCC-V	200.0		0.48			.850			0.0089	0.0092
2	0 2	0.48	4 MCC-W	320.0		0.48			.850			0.0046	0.0047
2	0 2	0.48	4 MCC-MR	200.0		0.48			.850			0.0090	0.0112
3	0 1	0.48	4 FAKE	1.0		0.48			.850			0.0	0.0

INPUT BUS REACTOR DATA

TERM	BUS	REACTANCE(OHMS)	RESISTANCE(OHMS)
2	1 0	0.0	0.0
2	2 0	0.0	0.0
2	3 0	0.005	0.004
2	4 0	0.005	0.004
3	1 0	0.0	0.0
3	2 0	0.0	0.0

INPUT STATION SERVICE TRANSFORMER AND CABLE DATA

						CABLE VALUES (OHMS)		
TERM	BUS	MVA	REACTANCE	X/R	TOLERANCE	REACTANCE	RESISTANCE	KV
2	0 1	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
2	0 2	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
3	0 1	2.00	0.01 %	6.60	7.50 %	0.0	0.0	0.0

UNIT AUXILIARY TRANSFORMER TOLERANCE USED

2-WINDING	3-WINDING
7.50 %	10.00 %

INPUT UNIT AUXILIARY TRANSFORMER DATA

			% REACTANCE				BREAKER CAPABILITIES (KA) INT.		MOM.		MOM MULT	
WDG	TERM	MVA	XHL	XHM	XLM	X/R	LV	MV	LV	MV	LV	MV
3	2 3	30.0	12.30	12.30	0.0	25.00	0.0	0.0	0.0	0.0	0.0	0.0

BREAKER TIME DATA

TERM	BUS	BUS KV	TRIPPING TIME (CYCLES)	CONTACT PARTING TIME (CYCLES)
2	1 0	4.16	5.0	3.0
2	2 0	4.16	5.0	3.0
2	3 0	4.16	5.0	3.0
2	4 0	4.16	5.0	3.0
2	0 1	0.48	2.0	2.0
2	0 2	0.48	2.0	2.0
3	1 0	4.16	5.0	3.0
3	2 0	4.16	5.0	3.0
3	0 1	0.48	2.0	2.0

STEADY STATE VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D = 1.007(PU)

VOLTAGE AT BUS

TERM	BUS	RATED BUS KV	ACTUAL BUS VOLTAGE
2	1 0	4.16	3.8371 (KV)
2	2 0	4.16	3.837 (KV)
2	3 0	4.16	3.8337 (KV)
2	4 0	4.16	3.8337 (KV)
2	0 1	0.48	0.4207 (KV)
2	0 2	0.48	0.4267 (KV)
3	1 0	4.16	3.9735 (KV)
3	2 0	4.16	3.9735 (KV)
3	0 1	0.48	0.4585 (KV)

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.007(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	1 0	4.16	1	3.8659 (KV)	3.5806 (KV)				
2	2 0	4.16	1	3.8659 (KV)	3.5806 (KV)				
2	3 0	4.16	1	3.8638 (KV)	3.5688 (KV)	3.8607 (KV)	3.5514 (KV)	96.52	88.79
2	4 0	4.16	1	3.8638 (KV)	3.5688 (KV)	3.8607 (KV)	3.5514 (KV)	96.52	88.79
2	0 1	0.48	1	0.4239 (KV)	0.3926 (KV)				
2	0 2	0.48	1	0.4299 (KV)	0.3981 (KV)				
3	1 0	4.16	1	3.9788 (KV)	3.9228 (KV)				
3	2 0	4.16	1	3.9788 (KV)	3.9228 (KV)				
3	0 1	0.48	1	0.4591 (KV)	0.4526 (KV)				
2	1 0	4.16	2	3.8659 (KV)	3.5806 (KV)				
2	2 0	4.16	2	3.8659 (KV)	3.5806 (KV)				
2	3 0	4.16	2	3.8638 (KV)	3.5688 (KV)	3.8607 (KV)	3.5514 (KV)	96.52	88.79
2	4 0	4.16	2	3.8638 (KV)	3.5688 (KV)	3.8607 (KV)	3.5514 (KV)	96.52	88.79
2	0 1	0.48	2	0.4239 (KV)	0.3926 (KV)				
2	0 2	0.48	2	0.4299 (KV)	0.3981 (KV)				
3	1 0	4.16	2	3.9788 (KV)	3.9228 (KV)				
3	2 0	4.16	2	3.9788 (KV)	3.9228 (KV)				
3	0 1	0.48	2	0.4591 (KV)	0.4526 (KV)				
2	1 0	4.16	3	3.8544 (KV)	3.7189 (KV)				
2	2 0	4.16	3	3.8544 (KV)	3.7189 (KV)				

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.007(PU)

VOLTAGE AT BUS TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	3 0	4.16	3	3.8510 (KV)	3.7156 (KV)				
2	4 0	4.16	3	3.8510 (KV)	3.7156 (KV)				
2	0 1	0.48	3	0.4226 (KV)	0.4077 (KV)				
2	0 2	0.48	3	0.4285 (KV)	0.4135 (KV)				
3	1 0	4.16	3	4.0537 (KV)	3.4332 (KV)				
3	2 0	4.16	3	4.0537 (KV)	3.4332 (KV)	4.0492 (KV)	3.4107 (KV)	101.23	85.27
3	0 1	0.48	3	0.4677 (KV)	0.3961 (KV)				
2	1 0	4.16	4	3.8405 (KV)	3.8181 (KV)				
2	2 0	4.16	4	3.8405 (KV)	3.8181 (KV)				
2	3 0	4.16	4	3.8371 (KV)	3.8147 (KV)				
2	4 0	4.16	4	3.8371 (KV)	3.8147 (KV)				
2	0 1	0.48	4	0.4229 (KV)	0.4055 (KV)	0.4184 (KV)	0.3814 (KV)	90.95	82.91
2	0 2	0.48	4	0.4270 (KV)	0.4245 (KV)				
3	1 0	4.16	4	3.9741 (KV)	3.9698 (KV)				
3	2 0	4.16	4	3.9741 (KV)	3.9698 (KV)				
3	0 1	0.48	4	0.4585 (KV)	0.4581 (KV)				

CASE A VOLTAGE DROP WHILE ON STARTUP ST.SER.TR.---PLANT NORMAL OPERATION
NPPD/CNS 161KV SOURCE VOLTS(HIGH) -5.0% TAP 152.95KV

PROGRAM OBJECTIVE - VOLTAGE DROP STUDY ONLY

INPUT DATA

BASE MVA USED FOR CALCULATIONS = 1000.00

RATED KV ON TERMINAL 1 = 152.90

RATED KV ON TERMINAL 2 = 4.16

RATED KV ON TERMINAL 3 = 4.16

MAIN GENERATOR

MVA = 0.0 KV = 0.0

SUBTRANSIENT REACTANCE = 0.0 PU X/R RATIO = 0.0

TRANSIENT REACTANCE = 0.0 PU RESISTANCE = 0.0 PU

STEP-UP TRANSFORMER

MVA = 0.0 X/R RATIO = 30.00

REACTANCE = 0.0 % ON 0.0 MVA BASE

UTILITY SYSTEM

MVA = 10000.00 BASE MVA OF IMPEDANCE = 0.0

IMPEDANCE = .0 PU AT 0.0 DEG.

INPUT BUS ELEMENT DATA

THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS

* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY

PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB	RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	1 0	4.16	1 CWP-1A*1	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CWP-1B	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CAP-1A*2	2500.0	0.0	4.00			.900	.850	.200	5.50	0.0108	0.0149
2	1 0	4.16	1 CONP1A	800.0	0.0	4.00			.900	.850	.200	5.50	0.0609	0.0187
2	1 0	4.16	4 SUBS1A	1200.0		4.16				.850			0.0046	0.0051
2	1 0	4.16	4 SUBS1C	300.0		4.16				.850			0.1218	0.0374
2	1 0	4.16	4 BUS-1E	400.0		4.16				.850			0.0023	0.0026
2	2 0	4.16	1 CWP-1C*1	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CWP-1D	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CAP-1B	2500.0	0.0	4.00			.900	.850	.200	5.50	0.0108	0.0149
2	2 0	4.16	1 CONP1B	800.0	0.0	4.00			.900	.850	.200	5.50	0.0609	0.0187
2	2 0	4.16	4 SUBS1B	1000.0		4.16				.850			0.0046	0.0051
2	2 0	4.16	4 SUBS1D	300.0		4.16				.850			0.1218	0.0374
2	3 0	4.16	1 FAKE	1.0	0.0	4.00			.900	.850	.200	6.50	0.0	0.0
2	4 0	4.16	1 FAKE	1.0	0.0	4.00			.900	.850	.200	6.50	0.0	0.0
3	1 0	4.16	1 RRMGST	7000.0	0.0	4.00			.900	.850	.200	5.50	0.0018	0.0025
3	2 0	4.16	1 RRMGST*3	7000.0	0.0	4.00			.900	.850	.200	5.50	0.0018	0.0025
2	0 1	0.48	1 CROP1A*4	250.0	0.0	0.46			.900	.850	.200	5.60	0.0068	0.0085
2	0 1	0.48	1 SACP1A	125.0	0.0	0.46			.900	.850	.200	6.50	0.0112	0.0077
2	0 1	0.48	4 MCC-K	600.0		0.48				.850			0.0010	0.0015

INPUT BUS ELEMENT DATA
THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS
* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY
PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB	RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	0 1	0.48	4 MCC-L	475.0		0.48				.850			0.0025	0.0026
2	0 1	0.48	4 MCC-M	500.0		0.48				.850			0.0025	0.0031
2	0 1	0.48	4 MCC-N	240.0		0.48				.850			0.0036	0.0045
2	0 1	0.48	4 MCC-P	430.0		0.48				.850			0.0036	0.0045
2	0 1	0.48	4 MCCOGI	235.0		0.48				.850			0.0058	0.0059
2	0 2	0.48	1 CROP18	250.0	0.0	0.46			.900	.850	.200	5.50	0.0066	0.0085
2	0 2	0.48	1 SACP18	125.0	0.0	0.46			.900	.850	.200	6.50	0.0112	0.0077
2	0 2	0.48	4 MCC-T	100.0		0.48				.850			0.0016	0.0016
2	0 2	0.48	4 MCC-S	480.0		0.48				.850			0.0021	0.0027
2	0 2	0.48	4 MCC-U	400.0		0.48				.850			0.0032	0.0033
2	0 2	0.48	4 MCC-V	200.0		0.48				.850			0.0089	0.0092
2	0 2	0.48	4 MCC-W	320.0		0.48				.850			0.0046	0.0047
2	0 2	0.48	4 MCC-MR	200.0		0.48				.850			0.0090	0.0112
3	0 1	0.48	4 FAKE	1.0		0.48				.850			0.0	0.0

INPUT BUS REACTOR DATA

TERM	BUS	REACTANCE(OHMS)	RESISTANCE(OHMS)
2	1 0	0.0	0.0
2	2 0	0.0	0.0
2	3 0	0.005	0.004
2	4 0	0.005	0.004
3	1 0	0.0	0.0
3	2 0	0.0	0.0

INPUT STATION SERVICE TRANSFORMER AND CABLE DATA

						CABLE VALUES (OHMS)		
TERM	BUS	MVA	REACTANCE	X/R	TOLERANCE	REACTANCE	RESISTANCE	KV
2	0 1	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
2	0 2	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
3	0 1	2.00	0.01 %	6.60	7.50 %	0.0	0.0	0.0

UNIT AUXILIARY TRANSFORMER TOLERANCE USED

2-WINDING	3-WINDING
7.50 %	10.00 %

INPUT UNIT AUXILIARY TRANSFORMER DATA

			% REACTANCE				BREAKER CAPABILITIES (KA)					
							INT.		MOM.		MOM MULT	
WDG	TERM	MVA	XHL	XHM	XLM	X/R	LV	MV	LV	MV	LV	MV
3	2 3	30.0	12.30	12.30	0.0	25.00	0.0	0.0	0.0	0.0	0.0	0.0

BREAKER TIME DATA

TERM	BUS	BUS KV	TRIPPING TIME (CYCLES)	CONTACT PARTING TIME (CYCLES)
2	1 0	4.16	5.0	3.0
2	2 0	4.16	5.0	3.0
2	3 0	4.16	5.0	3.0
2	4 0	4.16	5.0	3.0
2	0 1	0.48	2.0	2.0
2	0 2	0.48	2.0	2.0
3	1 0	4.16	5.0	3.0
3	2 0	4.16	5.0	3.0
3	0 1	0.48	2.0	2.0

STEADY STATE VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D = 1.053(PU)

VOLTAGE AT BUS

TERM	BUS	RATED BUS KV	ACTUAL BUS VOLTAGE
2	1 0	4.16	4.1151 (KV)
2	2 0	4.16	4.1151 (KV)
2	3 0	4.16	4.1151 (KV)
2	4 0	4.16	4.1151 (KV)
2	0 1	0.48	0.4512 (KV)
2	0 2	0.48	0.4576 (KV)
3	1 0	4.16	4.1883 (KV)
3	2 0	4.16	4.1883 (KV)
3	0 1	0.48	0.4833 (KV)

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSFORMER V/D =1.053(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	1 0	4.16	1	4.1558 (KV)	3.8388 (KV)	4.1382 (KV)	3.7608 (KV)	103.46	94.02
2	2 0	4.16	1	4.1558 (KV)	3.8388 (KV)	4.1382 (KV)	3.7608 (KV)	103.46	94.02
2	3 0	4.16	1	4.1558 (KV)	3.8388 (KV)				
2	4 0	4.16	1	4.1558 (KV)	3.8388 (KV)				
2	0 1	0.48	1	0.4556 (KV)	0.4209 (KV)				
2	0 2	0.48	1	0.4621 (KV)	0.4268 (KV)				
3	1 0	4.16	1	4.1962 (KV)	4.1329 (KV)				
3	2 0	4.16	1	4.1962 (KV)	4.1329 (KV)				
3	0 1	0.48	1	0.4842 (KV)	0.4769 (KV)				
2	1 0	4.16	2	4.1444 (KV)	3.8895 (KV)	4.1345 (KV)	3.8355 (KV)	103.36	95.89
2	2 0	4.16	2	4.1444 (KV)	3.8895 (KV)				
2	3 0	4.16	2	4.1444 (KV)	3.8895 (KV)				
2	4 0	4.16	2	4.1444 (KV)	3.8895 (KV)				
2	0 1	0.48	2	0.4544 (KV)	0.4264 (KV)				
2	0 2	0.48	2	0.4608 (KV)	0.4325 (KV)				
3	1 0	4.16	2	4.1939 (KV)	4.1433 (KV)				
3	2 0	4.16	2	4.1939 (KV)	4.1433 (KV)				
3	0 1	0.48	2	0.4839 (KV)	0.4781 (KV)				
2	1 0	4.16	3	4.1310 (KV)	3.9931 (KV)				
2	2 0	4.16	3	4.1310 (KV)	3.9931 (KV)				

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.053(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	3 0	4.16	3	4.1310 (KV)	3.9931 (KV)				
2	4 0	4.16	3	4.1310 (KV)	3.9931 (KV)				
2	0 1	0.48	3	0.4529 (KV)	0.4378 (KV)				
2	0 2	0.48	3	0.4593 (KV)	0.4440 (KV)				
3	1 0	4.16	3	4.2639 (KV)	3.6119 (KV)				
3	2 0	4.16	3	4.2639 (KV)	3.6119 (KV)	4.2591 (KV)	3.5882 (KV)	106.48	89.71
3	0 1	0.48	3	0.4920 (KV)	0.4168 (KV)				
2	1 0	4.16	4	4.1182 (KV)	4.0947 (KV)				
2	2 0	4.16	4	4.1182 (KV)	4.0947 (KV)				
2	3 0	4.16	4	4.1182 (KV)	4.0947 (KV)				
2	4 0	4.16	4	4.1182 (KV)	4.0947 (KV)				
2	0 1	0.48	4	0.4535 (KV)	0.4349 (KV)	0.4486 (KV)	0.4090 (KV)	97.52	88.92
2	0 2	0.48	4	0.4579 (KV)	0.4553 (KV)				
3	1 0	4.16	4	4.1888 (KV)	4.1843 (KV)				
3	2 0	4.16	4	4.1888 (KV)	4.1843 (KV)				
3	0 1	0.48	4	0.4833 (KV)	0.4828 (KV)				

CASE 9 VOLTAGE DROP WHILE ON STARTUP ST.SER.TR.---SUDDEN LOCA SHUTDOWN
NPPD/CNS 161KV SOURCE VOLTS(HIGH) -5.0% TAP 152.95KV

PROGRAM OBJECTIVE - VOLTAGE DROP STUDY ONLY

INPUT DATA

BASE MVA USED FOR CALCULATIONS = 1000.00

RATED KV ON TERMINAL 1 = 152.90

RATED KV ON TERMINAL 2 = 4.16

RATED KV ON TERMINAL 3 = 4.16

MAIN GENERATOR

MVA = 0.0 KV = 0.0

SUBTRANSIENT REACTANCE = 0.0 PU X/R RATIO = 0.0

TRANSIENT REACTANCE = 0.0 PU RESISTANCE = 0.0 PU

STEP-UP TRANSFORMER

MVA = 0.0 X/R RATIO = 30.00

REACTANCE = 0.0 % ON 0.0 MVA BASE

UTILITY SYSTEM

MVA = 10000.00 BASE MVA OF IMPEDANCE = 0.0

IMPEDANCE = .0 PU AT 0.0 DEG.

INPUT BUS ELEMENT DATA
THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS
* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY
PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB SES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	1 0	4.16	1 CWP-1A	1750.0	0.0	4.00		.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CWP-1B	1750.0	0.0	4.00		.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CRP-1A	2500.0	0.0	4.00		.900	.850	.200	5.50	0.0108	0.0149
2	1 0	4.16	1 CONP1A	800.0	0.0	4.00		.900	.850	.200	5.50	0.0609	0.0187
2	1 0	4.16	4 SUBS1A	1200.0		4.16			.850			0.0046	0.0051
2	1 0	4.16	4 SUBS1C	300.0		4.16			.850			0.1218	0.0374
2	1 0	4.16	4 AUS-1E	400.0		4.16			.850			0.0023	0.0026
2	2 0	4.16	1 CWP-1C	1750.0	0.0	4.00		.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CWP-1D	1750.0	0.0	4.00		.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CRP-1B	2500.0	0.0	4.00		.900	.850	.200	5.50	0.0108	0.0149
2	2 0	4.16	1 CONP1B	800.0	0.0	4.00		.900	.850	.200	5.50	0.0609	0.0187
2	2 0	4.16	4 SUBS1B	1000.0		4.16			.850			0.0046	0.0051
2	2 0	4.16	4 SUBS1D	300.0		4.16			.850			0.1218	0.0374
2	3 0	4.16	1 SSW-1A	300.0	0.0	4.00		.900	.850	.200	6.00	0.1421	0.0436
2	3 0	4.16	1 SSW-1C	300.0	0.0	4.00		.900	.850	.200	6.00	0.1421	0.0436
2	3 0	4.16	1 RHR-1A*1	1250.0	1090.0	4.00		.900	.850	.200	6.50	0.0105	0.0079
2	3 0	4.16	1 CSP-1A*2	1250.0	1090.0	4.00		.900	.850	.200	6.50	0.0105	0.0079
2	4 0	4.16	1 SSW-1B	300.0	0.0	4.00		.900	.850	.200	6.00	0.1421	0.0436
2	4 0	4.16	1 SSW-1D	300.0	0.0	4.00		.900	.850	.200	6.00	0.1421	0.0436
2	4 0	4.16	1 RHR-1B*1	1250.0	1090.0	4.00		.900	.850	.200	6.50	0.0105	0.0079

INPUT BUS ELEMENT DATA
THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS
* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY
PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	4 0	4.16	1 CSP-1B*2	1250.0	1090.0	4.00		.900	.850	.200	6.50	0.0105	0.0079
3	1 0	4.16	1 RRMGST	7000.0	0.0	4.00		.900	.850	.200	5.50	0.0018	0.0025
3	2 0	4.16	1 RRMGST*3	7000.0	0.0	4.00		.900	.850	.200	5.50	0.0018	0.0025
2	0 1	0.48	1 CROP1A*4	250.0	0.0	0.46		.900	.850	.200	5.60	0.0068	0.0085
2	0 1	0.48	1 SACP1A	125.0	0.0	0.46		.900	.850	.200	6.50	0.0112	0.0077
2	0 1	0.48	4 MCC-K	600.0		0.48			.850			0.0010	0.0015
2	0 1	0.48	4 MCC-L	475.0		0.48			.850			0.0025	0.0026
2	0 1	0.48	4 MCC-M	500.0		0.48			.850			0.0025	0.0031
2	0 1	0.48	4 MCC-N	240.0		0.48			.850			0.0036	0.0045
2	0 1	0.48	4 MCC-P	430.0		0.48			.850			0.0036	0.0045
2	0 1	0.48	4 MCCOGI	235.0		0.48			.850			0.0058	0.0059
2	0 2	0.48	1 CROP1B	250.0	0.0	0.46		.900	.850	.200	5.60	0.0068	0.0085
2	0 2	0.48	1 SACP1B	125.0	0.0	0.46		.900	.850	.200	6.50	0.0112	0.0077
2	0 2	0.48	4 MCC-T	100.0		0.48			.850			0.0016	0.0016
2	0 2	0.48	4 MCC-S	480.0		0.48			.850			0.0021	0.0027
2	0 2	0.48	4 MCC-U	400.0		0.48			.850			0.0032	0.0033
2	0 2	0.48	4 MCC-V	200.0		0.48			.850			0.0089	0.0092
2	0 2	0.48	4 MCC-W	320.0		0.48			.850			0.0046	0.0047
2	0 2	0.48	4 MCC-WR	200.0		0.48			.850			0.0090	0.0112
3	0 1	0.48	4 FAKE	1.0		0.48			.850			0.0	0.0

INPUT BUS REACTOR DATA

TERM	BUS	REACTANCE(OHMS)	RESISTANCE(OHMS)
2	1 0	0.0	0.0
2	2 0	0.0	0.0
2	3 0	0.005	0.004
2	4 0	0.005	0.004
3	1 0	0.0	0.0
3	2 0	0.0	0.0

INPUT STATION SERVICE TRANSFORMER AND CABLE DATA

						CABLE VALUES (OHMS)		
TERM	BUS	MVA	REACTANCE	X/R	TOLERANCE	REACTANCE	RESISTANCE	KV
2	0 1	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
2	0 2	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
3	0 1	2.00	0.01 %	6.60	7.50 %	0.0	0.0	0.0

UNIT AUXILIARY TRANSFORMER TOLERANCE USED

2-WINDING	3-WINDING
7.50 %	10.00 %

INPUT UNIT AUXILIARY TRANSFORMER DATA

			% REACTANCE				BREAKER CAPABILITIES (KA)					
							INT.		MOM.		MOM MULT	
WDG	TERM	MVA	XHL	XHM	XLM	X/R	LV	MV	LV	MV	LV	MV
3	2 3	30.0	12.30	12.30	0.0	25.00	0.0	0.0	0.0	0.0	0.0	0.0

BREAKER TIME DATA

TERM	BUS	BUS KV	TRIPPING TIME (CYCLES)	CONTACT PARTING TIME (CYCLES)
2	1 0	4.16	5.0	3.0
2	2 0	4.16	5.0	3.0
2	3 0	4.16	5.0	3.0
2	4 0	4.16	5.0	3.0
2	0 1	0.48	2.0	2.0
2	0 2	0.48	2.0	2.0
3	1 0	4.16	5.0	3.0
3	2 0	4.16	5.0	3.0
3	0 1	0.48	2.0	2.0

STEADY STATE VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D = 1.053(PU)

VOLTAGE AT BUS

TERM	BUS	RATED BUS KV	ACTUAL BUS VOLTAGE
2	1 0	4.16	4.0477 (KV)
2	2 0	4.16	4.0477 (KV)
2	3 0	4.16	4.0441 (KV)
2	4 0	4.16	4.0441 (KV)
2	0 1	0.48	0.4438 (KV)
2	0 2	0.48	0.4501 (KV)
3	1 0	4.16	4.1755 (KV)
3	2 0	4.16	4.1755 (KV)
3	0 1	0.48	0.4818 (KV)

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.053(PU)

VOLTAGE AT BUS TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	1 0	4.16	1	4.0746 (KV)	3.7762 (KV)				
2	2 0	4.16	1	4.0746 (KV)	3.7762 (KV)				
2	3 0	4.16	1	4.0724 (KV)	3.7637 (KV)	4.0691 (KV)	3.7454 (KV)	101.73	93.64
2	4 0	4.16	1	4.0724 (KV)	3.7637 (KV)	4.0691 (KV)	3.7454 (KV)	101.73	93.64
2	0 1	0.48	1	0.4467 (KV)	0.4140 (KV)				
2	0 2	0.48	1	0.4531 (KV)	0.4199 (KV)				
3	1 0	4.16	1	4.1805 (KV)	4.1222 (KV)				
3	2 0	4.16	1	4.1805 (KV)	4.1222 (KV)				
3	0 1	0.48	1	0.4824 (KV)	0.4756 (KV)				
2	1 0	4.16	2	4.0746 (KV)	3.7762 (KV)				
2	2 0	4.16	2	4.0746 (KV)	3.7762 (KV)				
2	3 0	4.16	2	4.0724 (KV)	3.7637 (KV)	4.0691 (KV)	3.7454 (KV)	101.73	93.64
2	4 0	4.16	2	4.0724 (KV)	3.7637 (KV)	4.0691 (KV)	3.7454 (KV)	101.73	93.64
2	0 1	0.48	2	0.4467 (KV)	0.4140 (KV)				
2	0 2	0.48	2	0.4531 (KV)	0.4199 (KV)				
3	1 0	4.16	2	4.1805 (KV)	4.1222 (KV)				
3	2 0	4.16	2	4.1805 (KV)	4.1222 (KV)				
3	0 1	0.48	2	0.4824 (KV)	0.4756 (KV)				
2	1 0	4.16	3	4.0640 (KV)	3.9236 (KV)				
2	2 0	4.16	3	4.0640 (KV)	3.9236 (KV)				

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.053(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	3 0	4.16	3	4.0604 (KV)	3.9201 (KV)				
2	4 0	4.16	3	4.0604 (KV)	3.9201 (KV)				
2	0 1	0.48	3	0.4456 (KV)	0.4302 (KV)				
2	0 2	0.48	3	0.4519 (KV)	0.4363 (KV)				
3	1 0	4.16	3	4.2514 (KV)	3.6015 (KV)				
3	2 0	4.16	3	4.2514 (KV)	3.6015 (KV)	4.2467 (KV)	3.5779 (KV)	106.17	89.45
3	0 1	0.48	3	0.4905 (KV)	0.4156 (KV)				
2	1 0	4.16	4	4.0509 (KV)	4.0275 (KV)				
2	2 0	4.16	4	4.0509 (KV)	4.0275 (KV)				
2	3 0	4.16	4	4.0473 (KV)	4.0239 (KV)				
2	4 0	4.16	4	4.0473 (KV)	4.0239 (KV)				
2	0 1	0.48	4	0.4461 (KV)	0.4278 (KV)	0.4413 (KV)	0.4023 (KV)	95.93	87.46
2	0 2	0.48	4	0.4504 (KV)	0.4478 (KV)				
3	1 0	4.16	4	4.1761 (KV)	4.1716 (KV)				
3	2 0	4.16	4	4.1761 (KV)	4.1716 (KV)				
3	0 1	0.48	4	0.4819 (KV)	0.4813 (KV)				

CASE 10 VOLTAGE DROP WHILE ON MAIN GENERATOR---PLANT ON HOT STANDBY
NPPD/CNS 22.05KV SOURCE VOLTS(HIGH) 0% TAP 21KV

PROGRAM OBJECTIVE - VOLTAGE DROP STUDY ONLY

INPUT DATA

BASE MVA USED FOR CALCULATIONS = 1000.00

RATED KV ON TERMINAL 1 = 210.00

RATED KV ON TERMINAL 2 = 4.16

RATED KV ON TERMINAL 3 = 4.16

MAIN GENERATOR

MVA = 983.00 KV = 22.0

SUBTRANSIENT REACTANCE = 0.27100 PU X/R RATIO = 4.05

TRANSIENT REACTANCE = 0.40700 PU RESISTANCE = 0.05580 PU

STEP-UP TRANSFORMER

MVA = 900.00 X/R RATIO = 46.20

REACTANCE = 11.55 % ON 900.00 MVA BASE

UTILITY SYSTEM

MVA = 10000.00 BASE MVA OF IMPEDANCE = 0.0

IMPEDANCE = .0 PU AT 0.0 DEG.

INPUT BUS ELEMENT DATA

THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS

* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY

PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR (6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB	RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	1 0	4.16	1 CWP-1A*1	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CBP-1A*2	2500.0	0.0	4.00			.900	.850	.200	5.50	0.0108	0.0149
2	1 0	4.16	1 CONP1A	800.0	0.0	4.00			.900	.850	.200	5.50	0.0609	0.0187
2	1 0	4.16	4 SUBS1A	1200.0		4.16				.850			0.0046	0.0051
2	1 0	4.16	4 SUBS1C	300.0		4.16				.850			0.1218	0.0374
2	1 0	4.16	4 BUS-1E	400.0		4.16				.850			0.0025	0.0026
2	2 0	4.16	1 CWP-1C*1	1750.0	0.0	4.00			.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	4 SUBS1B	1000.0		4.16				.850			0.0046	0.0051
2	2 0	4.16	4 SUBS1D	300.0		4.16				.850			0.1218	0.0374
2	3 0	4.16	1 FAKE	1.0	0.0	4.00			.900	.850	.200	6.50	0.0	0.0
2	4 0	4.16	1 FAKE	1.0	0.0	4.00			.900	.850	.200	6.50	0.0	0.0
3	1 0	4.16	1 RRMGST*3	7000.0	0.0	4.00			.900	.850	.200	5.50	0.0018	0.0025
3	2 0	4.16	1 RRMGST	7000.0	0.0	4.00			.900	.850	.200	5.50	0.0018	0.0025
2	0 1	0.48	4 SUBS1F	480.0		0.48				.850			0.0	0.0
2	0 2	0.48	4 SUBS1G	150.0		0.48				.850			0.0	0.0
3	0 1	0.48	4 FAKE	1.0		0.48				.850			0.0	0.0

INPUT BUS REACTOR DATA

TERM	BUS	REACTANCE(OHMS)	RESISTANCE(OHMS)
2	1 0	0.0	0.0
2	2 0	0.0	0.0
2	3 0	0.005	0.004
2	4 0	0.005	0.004
3	1 0	0.0	0.0
3	2 0	0.0	0.0

INPUT STATION SERVICE TRANSFORMER AND CABLE DATA

TERM	BUS	MVA	REACTANCE	X/R	TOLERANCE	CABLE VALUES (OHMS) REACTANCE	RESISTANCE	KV
2	0 1	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
2	0 2	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
3	0 1	0.01	0.0 %	6.60	7.50 %	0.0	0.0	0.0

UNIT AUXILIARY TRANSFORMER TOLERANCE USED

2-WINDING	3-WINDING
7.50 %	10.00 %

INPUT UNIT AUXILIARY TRANSFORMER DATA

WDG	TERM	MVA	% REACTANCE XHL	XHM	XLM	X/R	BREAKER CAPABILITIES (KA) INT. LV	INT. MV	MOM. LV	MOM. MV	MOM MULT LV	MOM MULT HV
3	2 3	30.0	12.50	10.00	0.0	25.00	0.0	0.0	0.0	0.0	0.0	0.0

BREAKER TIME DATA

TERM	BUS	BUS KV	TRIPPING TIME (CYCLES)	CONTACT PARTING TIME (CYCLES)
2	1 0	4.16	5.0	3.0
2	2 0	4.16	5.0	3.0
2	3 0	4.16	5.0	3.0
2	4 0	4.16	5.0	3.0
2	0 1	0.48	2.0	2.0
2	0 2	0.48	2.0	2.0
3	1 0	4.16	5.0	3.0
3	2 0	4.16	5.0	3.0
3	0 1	0.48	2.0	2.0

STEADY STATE VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D = 1.050(PU)

VOLTAGE AT BUS

TERM	BUS	RATED BUS KV	ACTUAL BUS VOLTAGE
2	1 0	4.16	4.2297 (KV)
2	2 0	4.16	4.2297 (KV)
2	3 0	4.16	4.2297 (KV)
2	4 0	4.16	4.2297 (KV)
2	0 1	0.48	0.4839 (KV)
2	0 2	0.48	0.4867 (KV)
3	1 0	4.16	4.2309 (KV)
3	2 0	4.16	4.2309 (KV)
3	0 1	0.48	0.4882 (KV)

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.050(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	1 0	4.16	1	4.2675 (KV)	3.9432 (KV)	4.2494 (KV)	3.8631 (KV)	106.23	96.58
2	2 0	4.16	1	4.2675 (KV)	3.9432 (KV)	4.2494 (KV)	3.8631 (KV)	106.23	96.58
2	3 0	4.16	1	4.2675 (KV)	3.9432 (KV)				
2	4 0	4.16	1	4.2675 (KV)	3.9432 (KV)				
2	0 1	0.48	1	0.4882 (KV)	0.4511 (KV)				
2	0 2	0.48	1	0.4911 (KV)	0.4538 (KV)				
3	1 0	4.16	1	4.2378 (KV)	4.1784 (KV)				
3	2 0	4.16	1	4.2378 (KV)	4.1784 (KV)				
3	0 1	0.48	1	0.4890 (KV)	0.4821 (KV)				
2	1 0	4.16	2	4.2568 (KV)	3.9961 (KV)	4.2466 (KV)	3.9407 (KV)	106.17	98.52
2	2 0	4.16	2	4.2568 (KV)	3.9961 (KV)				
2	3 0	4.16	2	4.2568 (KV)	3.9961 (KV)				
2	4 0	4.16	2	4.2568 (KV)	3.9961 (KV)				
2	0 1	0.48	2	0.4870 (KV)	0.4571 (KV)				
2	0 2	0.48	2	0.4899 (KV)	0.4599 (KV)				
3	1 0	4.16	2	4.2358 (KV)	4.1883 (KV)				
3	2 0	4.16	2	4.2358 (KV)	4.1883 (KV)				
3	0 1	0.48	2	0.4888 (KV)	0.4833 (KV)				
2	1 0	4.16	3	4.2434 (KV)	4.1172 (KV)				
2	2 0	4.16	3	4.2434 (KV)	4.1172 (KV)				

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.050(PU)

VOLTAGE AT BUS TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	3 0	4.16	3	4.2434 (KV)	4.1172 (KV)				
2	4 0	4.16	3	4.2434 (KV)	4.1172 (KV)				
2	0 1	0.48	3	0.4854 (KV)	0.4710 (KV)				
2	0 2	0.48	3	0.4883 (KV)	0.4738 (KV)				
3	1 0	4.15	3	4.2909 (KV)	3.7424 (KV)	4.2861 (KV)	3.7179 (KV)	107.15	92.95
3	2 0	4.16	3	4.2909 (KV)	3.7424 (KV)				
3	0 1	0.48	3	0.4951 (KV)	0.4318 (KV)				

CASE 11 VOLTAGE DROP WHILE ON MAIN GENERATOR---PLANT NORMAL OPERATION
NPPD/CNS 21.6KV SOURCE VOLTS(LOW) 0% TAP 21KV

PROGRAM OBJECTIVE - VOLTAGE DROP STUDY ONLY

INPUT DATA

BASE MVA USED FOR CALCULATIONS = 1000.00

RATED KV ON TERMINAL 1 = 210.00

RATED KV ON TERMINAL 2 = 4.16

RATED KV ON TERMINAL 3 = 4.16

MAIN GENERATOR

MVA = 983.00 KV = 22.0

SUBTRANSIENT REACTANCE = 0.27100 PU X/R RATIO = 4.05

TRANSIENT REACTANCE = 0.40700 PU RESISTANCE = 0.05580 PU

STEP-UP TRANSFORMER

MVA = 900.00 X/R RATIO = 46.20

REACTANCE = 11.55 % ON 900.00 MVA BASE

UTILITY SYSTEM

MVA = 10000.00 BASE MVA OF IMPEDANCE = 0.0

IMPEDANCE = .0 PU AT 0.0 DEG.

INPUT BUS ELEMENT DATA
THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS
* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY
PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	REACT
2	1 0	4.16	1 CWP-1A*1	1750.0	0.0	4.00		.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CWP-1B	1750.0	0.0	4.00		.900	.850	.200	5.00	0.0300	0.0334
2	1 0	4.16	1 CWP-1A*2	2500.0	0.0	4.00		.900	.850	.200	5.50	0.0108	0.0149
2	1 0	4.16	1 COMP1A	800.0	0.0	4.00		.900	.850	.200	5.50	0.0609	0.0187
2	1 0	4.16	4 SUBS1A	1200.0		4.16			.850			0.0046	0.0051
2	1 0	4.16	4 SUBS1C	300.0		4.16			.850			0.1218	0.0374
2	1 0	4.16	4 BUS-1E	400.0		4.16			.850			0.0023	0.0026
2	2 0	4.16	1 CWP-1C*1	1750.0	0.0	4.00		.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CWP-1D	1750.0	0.0	4.00		.900	.850	.200	5.00	0.0300	0.0334
2	2 0	4.16	1 CWP-1B	2500.0	0.0	4.00		.900	.850	.200	5.50	0.0108	0.0149
2	2 0	4.16	1 COMP1B	800.0	0.0	4.00		.900	.850	.200	5.50	0.0609	0.0187
2	2 0	4.16	4 SUBS1B	1000.0		4.16			.850			0.0046	0.0051
2	2 0	4.16	4 SUBS1D	300.0		4.16			.850			0.1218	0.0374
2	3 0	4.16	1 FAKE	1.0	0.0	4.00		.900	.850	.200	6.50	0.0	0.0
2	4 0	4.16	1 FAKE	1.0	0.0	4.00		.900	.850	.200	6.50	0.0	0.0
3	1 0	4.16	1 RR4GST	7000.0	0.0	4.00		.900	.850	.200	5.50	0.0018	0.0025
3	2 0	4.16	1 RR4GST*3	7000.0	0.0	4.00		.900	.850	.200	5.50	0.0018	0.0025
2	0 1	0.48	1 CRDP1A*4	250.0	0.0	0.46		.900	.850	.200	5.60	0.0068	0.0085
2	0 1	0.48	1 SACP1A	125.0	0.0	0.46		.900	.850	.200	6.50	0.0112	0.0077
2	0 1	0.48	4 MCC-K	600.0		0.48			.850			0.0010	0.0015

INPUT BUS ELEMENT DATA
THE VALUES LISTED BELOW ARE ACTUAL INPUT AND NECESSARY ASSUMPTIONS
* IDENTIFIES THE STARTING MOTOR FOR VOLTAGE DROP STUDY
PROGRAM IDENTIFICATION - MOTOR(1),STATIC LOAD (4),GENERATOR(6)

TERM	BUS	BUS KV	IDENT	NAMEPLATE HP/KVA	BRAKE HP	RATED KV	X SUB	RES	EFF	R PF	S PF	LR/FLC	CABLE(OHMS) RES	CABLE(OHMS) REACT
2	0 1	0.48	4 MCC-L	475.0		0.48				.850			0.0025	0.0026
2	0 1	0.48	4 MCC-M	500.0		0.48				.850			0.0025	0.0031
2	0 1	0.48	4 MCC-N	240.0		0.48				.850			0.0036	0.0045
2	0 1	0.48	4 MCC-P	430.0		0.48				.850			0.0036	0.0045
2	0 1	0.48	4 MCCOGI	235.0		0.48				.850			0.0058	0.0059
2	0 2	0.48	1 CPOP1B	250.0	0.0	0.46			.900	.850	.200	5.60	0.0068	0.0085
2	0 2	0.48	1 SACP1B	125.0	0.0	0.46			.900	.850	.200	6.50	0.0112	0.0077
2	0 2	0.48	4 MCC-T	100.0		0.48				.850			0.0016	0.0016
2	0 2	0.48	4 MCC-S	480.0		0.48				.850			0.0021	0.0027
2	0 2	0.48	4 MCC-U	400.0		0.48				.850			0.0032	0.0033
2	0 2	0.48	4 MCC-V	200.0		0.48				.850			0.0089	0.0092
2	0 2	0.48	4 MCC-W	320.0		0.48				.850			0.0046	0.0047
2	0 2	0.48	4 MCC-MP	200.0		0.48				.850			0.0090	0.0112
3	0 1	0.48	4 FAKE	1.0		0.48				.0			0.0	0.0

INPUT BUS REACTOR DATA

TERM	BUS	REACTANCE(OHMS)	RESISTANCE(OHMS)
2	1 0	0.0	0.0
2	2 0	0.0	0.0
2	3 0	0.005	0.004
2	4 0	0.005	0.004
3	1 0	0.0	0.0
3	2 0	0.0	0.0

INPUT STATION SERVICE TRANSFORMER AND CABLE DATA

TERM	BUS	MVA	REACTANCE	X/R	TOLERANCE	CABLE VALUES (OHMS) REACTANCE	RESISTANCE	KV
2	0 1	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
2	0 2	2.00	5.75 %	6.60	7.50 %	0.00	0.00	4.16
3	0 1	2.00	0.01 %	6.60	7.50 %	0.0	0.0	0.0

UNIT AUXILIARY TRANSFORMER TOLERANCE USED

2-WINDING	3-WINDING
7.50 %	10.00 %

INPUT UNIT AUXILIARY TRANSFORMER DATA

WDG	TERM	MVA	% REACTANCE XHL	XHM	XLM	X/R	BREAKER CAPABILITIES (KA) INT. LV	INT. MV	MOM. LV	MOM. MV	MOM MULT LV	MOM MULT MV
3	2 3	30.0	12.50	10.00	0.0	25.00	0.0	0.0	0.0	0.0	0.0	0.0

BREAKER TIME DATA

TERM	BUS	BUS KV	TRIPPING TIME (CYCLES)	CONTACT PARTING TIME (CYCLES)
2	1 0	4.16	5.0	3.0
2	2 0	4.16	5.0	3.0
2	3 0	4.16	5.0	3.0
2	4 0	4.16	5.0	3.0
2	0 1	0.48	2.0	2.0
2	0 2	0.48	2.0	2.0
3	1 0	4.16	5.0	3.0
3	2 0	4.16	5.0	3.0
3	0 1	0.48	2.0	2.0

STEADY STATE VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D = 1.030(PU)

VOLTAGE AT BUS

TERM	BUS	RATED BUS KV	ACTUAL BUS VOLTAGE
2	1 0	4.16	4.0106 (KV)
2	2 0	4.16	4.0106 (KV)
2	3 0	4.16	4.0106 (KV)
2	4 0	4.16	4.0106 (KV)
2	0 1	0.48	0.4397 (KV)
2	0 2	0.48	0.4450 (KV)
3	1 0	4.16	4.1215 (KV)
3	2 0	4.16	4.1215 (KV)
3	0 1	0.48	0.4756 (KV)

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.030(PU)

VOLTAGE AT BUS TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	1 0	4.16	1	4.0534 (KV)	3.7384 (KV)	4.0363 (KV)	3.6625 (KV)	100.91	91.56
2	2 0	4.16	1	4.0534 (KV)	3.7384 (KV)	4.0363 (KV)	3.6625 (KV)	100.91	91.56
2	3 0	4.16	1	4.0534 (KV)	3.7384 (KV)				
2	4 0	4.16	1	4.0534 (KV)	3.7384 (KV)				
2	0 1	0.48	1	0.4444 (KV)	0.4099 (KV)				
2	0 2	0.48	1	0.4507 (KV)	0.4157 (KV)				
3	1 0	4.16	1	4.1289 (KV)	4.0728 (KV)				
3	2 0	4.16	1	4.1289 (KV)	4.0728 (KV)				
3	0 1	0.48	1	0.4764 (KV)	0.4699 (KV)				
2	1 0	4.16	2	4.0414 (KV)	3.7881 (KV)	4.0317 (KV)	3.7355 (KV)	100.79	93.39
2	2 0	4.16	2	4.0414 (KV)	3.7881 (KV)				
2	3 0	4.16	2	4.0414 (KV)	3.7881 (KV)				
2	4 0	4.16	2	4.0414 (KV)	3.7881 (KV)				
2	0 1	0.48	2	0.4431 (KV)	0.4153 (KV)				
2	0 2	0.48	2	0.4494 (KV)	0.4212 (KV)				
3	1 0	4.16	2	4.1268 (KV)	4.0819 (KV)				
3	2 0	4.16	2	4.1268 (KV)	4.0819 (KV)				
3	0 1	0.48	2	0.4762 (KV)	0.4710 (KV)				
2	1 0	4.16	3	4.0254 (KV)	3.8972 (KV)				
2	2 0	4.16	3	4.0254 (KV)	3.8972 (KV)				

VOLTAGE DROP RESULTS

VOLTAGE AT HV TERMINAL OF AUX TRANSF FOR V/D =1.030(PU)

VOLTAGE AT BUS

TERM	BUS	KV	V/D CASE	BUS VOLTAGE RUNNING LOAD	BUS VOLTAGE STARTING LOAD	VOLTAGE AT MOTOR TERMINAL RUNNING LOAD	VOLTAGE AT MOTOR TERMINAL STARTING LOAD	PERCENTAGE RUN	PERCENTAGE START
2	3 0	4.16	3	4.0254 (KV)	3.8972 (KV)				
2	4 0	4.16	3	4.0254 (KV)	3.8972 (KV)				
2	0 1	0.48	3	0.4413 (KV)	0.4273 (KV)				
2	0 2	0.48	3	0.4476 (KV)	0.4333 (KV)				
3	1 0	4.16	3	4.1834 (KV)	3.6486 (KV)				
3	2 0	4.16	3	4.1834 (KV)	3.6486 (KV)	4.1797 (KV)	3.6247 (KV)	104.47	90.62
3	0 1	0.48	3	0.4827 (KV)	0.4210 (KV)				
2	1 0	4.16	4	4.0138 (KV)	3.9904 (KV)				
2	2 0	4.16	4	4.0138 (KV)	3.9904 (KV)				
2	3 0	4.16	4	4.0138 (KV)	3.9904 (KV)				
2	4 0	4.16	4	4.0133 (KV)	3.9904 (KV)				
2	0 1	0.48	4	0.4420 (KV)	0.4238 (KV)	0.4372 (KV)	0.3986 (KV)	95.05	86.65
2	0 2	0.48	4	0.4463 (KV)	0.4437 (KV)				
3	1 0	4.16	4	4.1221 (KV)	4.1180 (KV)				
3	2 0	4.16	4	4.1221 (KV)	4.1180 (KV)				
3	0 1	0.48	4	0.4756 (KV)	0.4752 (KV)				

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