ENGINEERING CHANGE NOTICE

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1. ECN 648731

Proj.
ECN

2. ECN Category (mark one) ☐ Supplemental ☒ Direct Revision ☐ Change ECN ☐ Temporary ☐ Standby ☐ Supersede ☐ Cancel/Void	3. Originator's Name, Organization, MSIN, and Telephone No. JM Hache, Engineering Services, S2-12, 373-1853 6. Project Title/No./Work Order No. Electrical Utilities Relay Settings 102711 EA00 9. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-LL-ES-004 Rev 2a	4. USQ Required? ☐ Yes ☒ No 7. Bldg./Sys./Fac. No. N/A 10. Related ECN No(s). N/A	5. Date October 19, 1998 8. Approval Designator N/A 11. Related PO No. N/A	
12a. Modification Work ☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	12b. Work Package No. N/A	12c. Modification Work Complete N/A Design Authority/Cog. Engineer Signature & Date	12d. Restored to Original Condition (Temp. or Standby ECN only) N/A Design Authority/Cog. Engineer Signature & Date	
13a. Description of Change Relays settings are changed for C7X10 and C7X14. Change document number from WHC-SD-LL-ES-004 Rev 2a, to HNF-SD-LL-ES-004 Rev 3. Document reformatted and re-paginated. Re-issue document in its entirety. Other changes made to reflect field conditions. 13b. Design Baseline Document? ☐ Yes ☒ No				
14a. Justification (mark one) Criteria Change ☒ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const ☐ Const. Error/Omission ☐ Design Error/Omission ☐ 14b. Justification Details Reconfiguration of the 100 Area Electrical Utilities Transmission and Distribution systems per HNF-2634 "100 Area Electrical Infrastructure Reconfiguration Report".				
15. Distribution (include name, MSIN, and no. of copies) RL Fritz S2-12 1 JM Hache S2-12 1 SM Baker S2-12 1 WA White A2-45 1 A Esparza S2-15 1				RELEASE STAMP DATE: STA: <i>f</i> ID: <i>2</i> OCT 27 1998 MANFORD RELEASE

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Electrical Utilities Relay Settings

JM Hache

DynCorp Tri-Cities Services, Inc., Richland, WA 99352

U.S. Department of Energy, Contract DE-AC06-96RL13200

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Abstract: This document contains the Hanford transmission and distribution system relay settings that are under the control of Electrical Utilities.

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Page 1

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Electrical Utilities Relay Settings

CHANGE CONTROL RECORD

(3) Revision

(4) Description of Change - Replace, Add, and Delete Pages

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(5) Cog. Engr.

(6) Cog. Mgr. Date

(7)

3
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C7X10,C7X14 and general update, replace entire document with Rev 3. ECN-648731

JM Hache

J.M. Hache

RL Fritz

10/19/98 *RL Fritz*

HNF-SD-LL-ES-004

ELECTRICAL UTILITIES RELAY SETTINGS

Revision 3, June 1998

Prepared for:

Dyncorp Tri-Cities Services, Inc.
P.O. Box 1400
Richland, Washington 99352

1.0 PURPOSE

This supporting document provides a listing of the protective relay settings for the Electrical Utilities transmission and distribution systems.

2.0 SCOPE

The protective relay settings listed in this document apply to the electrical transmission and distribution systems under the administrative and operational control of Dyncorp Tri-Cities Services, Inc. Electrical Utilities Group. Facility protective relay settings should be obtained from the facility and will not be maintained in this document.

3.0 SUMMARY

This document has been divided into three appendices: Schweitzer Engineering Laboratories (SEL) relays and RFL Dowtey Model 6750 (RFL) relays; Transmission Relays; and Distribution Relays. The transmission relays are on the 230-kV and 115-kV transmission systems and the distribution relays are on the 13.8-kV and 2.4-kV distribution systems.

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APPENDIX A – SEL & RFL Relay Settings

APPENDIX B – Transmission System Relay Settings

APPENDIX C – Distribution System Relay Settings

SUBSTATION	A7		CIRCUIT	A7-MIDWAY LINE		
BREAKER	A-372			(Hanford Line #A1 and Line A2-7)		
RELAY FUNCTION	Transmission line protection using the SEL relays and RFL Dowety Model 6750 ITTS relays to integrate a direct underreach, permissive overreach transfer trip scheme with the Bonneville Power Administration protective relays at OCBs A-336 (line breaker) or A-994 (bus-backup breaker). The relays also trip the A-372 line breaker locally. These settings are adequate for bypass operation at Substation A8.					
SEL 121G-5	SET #1	SET #2	CT SETTING	160:1	PT SETTING	2000-5
Property Tag #	FA25734	FA23365	POWER SUPPLY	125 Vdc	TIMECODE	IRIG-B
Relay Serial #	40067	12028	SECONDARY INPUTS	V/φ = 67L-N; Nominal Amps = 5 Amps; 60 Hz		
Firmware Version	403	109				

RELAY MASK - TYPICAL									Setting
Row #1: Relay Word Binary Representation	1ABC	2ABC	3ABC	4ABC	LOP	50H	50M	50L	80
	1	0	0	0	0	0	0	0	
Row #2: Relay Word Binary Representation	51NT	67N1	67N2	67N3	51NP	Z1P	Z2P	Z3P	C4
	1	1	0	0	0	1	0	0	
Row #3: Relay Word Binary Representation	Z2PT	Z3PT	OSB	3P50	50MF	RI	RC	DF	C8
	1	1	0	0	1	0	0	0	
Row #4: Relay Word Binary Representation	ALRM	TRIP	TC	DT	52BT	Z3X	Z2GT	Z3GT	21
	0	0	1	0	0	0	0	1	

BINARY	HEXDECIMAL
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

MASK SETTINGS

MTU	MPT	MTB	MTO	MA1	MA2	MA3	MA4	MRI	MRC
80	00	00	C0	80	40	00	00	00	00
C4	00	00	66	C4	22	00	00	00	00
C8	00	00	00	C8	00	00	00	00	00
20	00	00	00	20	00	00	00	00	00

MASK SETTING NOTES

1. MTU is set to trip the A-372 locally and not actuate an integrated transfer trip.
2. MTO is set to for trip onto fault protection. This mask will trip A-372 locally and will not actuate an integrated transfer trip.
3. MT1 is set for direct underreach transfer trip.
4. MT2 is set for permissive overreach transfer trip.
5. MPT, MTB, MA3, MA4, MRI, and MRC are not used and are to be masked to 00.

	POSITIVE SEQUENCE IMPEDANCE		ZERO SEQUENCE IMPEDANCE		LINE LENGTH*
Range	0-9999Ω PRIMARY		0-9999Ω PRIMARY		0.1-999 (MILES)
Abbrev.	R1	X1	R0	X0	LL
SETTING	2.13	10.39	12.79	34.29	12.64
Description	CT RATIO	PT RATIO	MAX TORQUE ANGLE	ENABLE FAULT LOCATOR	
Range	1-5000:1	1-10,000:1	47E - 90E	(Y or N)	
Abbrev.	CTR	PTR	MTA	LOCAT	
SETTING	160	2000	78.4	Y	
Description	RECL OPEN INT 1	RECL OPEN INT 2	RECL OPEN INT 3	RECL RESET TIME	
Range	0-10,000 cycles (1/4 cycle steps)	0-10,000 cycles (1/4 cycle steps)	0-10,000 cycles (1/4 cycle steps)	60-8,000 cycles (1/4 cycle steps)	
Abbrev.	79OI1	79OI2	79OI3	79RS	
SETTING	0	0	0	60	
Description	ZONE 1 REACH	ZONE 2 REACH	ZONE 3 REACH		
Range	0-200% of LL (0.125-64Ω SEC)	0-3200% of LL (0.125-64Ω SEC)	0-3200% of LL (0.125-64Ω SEC)		
Abbrev.	Z1%	Z2%	Z3%		
SETTING	85	125	272		
Description	ZONE 2φ & 3φ SHORT TIMER	ZONE 2φ & 3φ TIME-STEP BACKUP TIMER	ZONE 3φ & 3φ TIME-STEP BACKUP TIMER		
Range	0-60 cycles (1/4 cycle steps)	0-2000 cycles (1/4 cycle steps)	0-2000 cycles (1/4 cycle steps)		
Abbrev.	Z2SP	Z2DP	Z3DP		
SETTING	0	24	42		
Description	φ O/C LOW SET PICKUP	φ O/C MEDIUM SET PICKUP	φ O/C LOP DELAY (loss of potential)	φ O/C HIGH SET PICKUP	
Range	(0.5-40A SEC) 0.25-50,000A PRI	(0.5-40A SEC) 0.25-50,000A PRI	0-60 cycles (1/4 cycle steps)	(0.5-80A SEC) 0.25-50,000A PRI	
Abbrev.	50L	50M	50MFD	50H	
SETTING	300	1964	60	12,000	
Description	GND TIME O/C PICKUP	GND TIME O/C TIMED DIAL	GND TIME O/C CURVE SHAPE	GND TIME O/C TORQ. CONTROL	
Range	(0.25-6.3A SEC) 0.25-50,000A PRI	0.5-15A SEC (0.01 STEPS)	1, 2, 3, or 4	(Y or N)	
Abbrev.	51NP	51NTD	51NC	51NTC	
SETTING	100	4	3	Y	

Description	ZONE 1 GND INST. O/C	ZONE 2 GND INST. O/C	ZONE 3 GND INST. O/C		
Range	(0.25-48x51NP) 0.25-50,000A PRI	(0.25-48x51NP) 0.25-50,000A PRI	(0.25-48x51NP) 0.25-50,000A PRI		
Abbrev.	50N1P	50N2P	50N3P		
SETTING	2150	1090	4800		
Description	ZONE 2 GND SHORT TIMER	ZONE 2 GND TIME-STEP BACKUP TIMER	ZONE 3 GND TIME-STEP BACKUP TIMER	MINIMUM TRIP DURATION TIMER	
Range	0-60 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	
Abbrev.	Z2SG	Z2DG	Z3DG	TDUR	
SETTING	0	0	2000	9	
Description	52BT TIME DELAY	ZONE 3 DIRECTION	GND O/C NEGATIVE SEQ. POLARIZATION	GND O/C ZERO SEQ. VOLTAGE POLARIZATION	GND O/C ZERO SEQ. CURRENT POLARIZATION
Range	0.5-10,000 cycles	(F OR R)	(Y or N)	(Y or N)	(Y or N)
Abbrev.	52BT	ZONE 3	32QE	32VE	32IE
SETTING	15	F	N	Y	Y
Description	OUT-OF-STEP BLOCK FOR ZONE 1	OUT-OF-STEP BLOCK FOR ZONE 2	OUT-OF-STEP BLOCK FOR ZONE 3	OUT-OF-STEP BLOCK TIMER	LOSS-OF-POT. ENABLE
Range	(Y or N)	(Y or N)	(Y or N)	0.5-60 cycles (1/4 cycle steps)	(Y or N)
Abbrev.	OSB1	OSB2	OSB3	OSBT	LOPE
SETTING	N	N	N	30	Y
Description	SEL-121G-5 PORT #1 TIMEOUT	SEL-121G-5 PORT #2 TIMEOUT	AUTO MESSAGE TRANSMIT AUTOPORT SELECTION	# RINGS AFTER WHICH MODEM ANSWERS	
Range	(0-30 minutes)	(0-30 minutes)	PORT 1, 2 OR 3 (BOTH)	1-30	
Abbrev.	TIME1	TIME2	AUTO	RINGS	
SETTING	5	0	2	5	

Comments

SUBSTATION	A7	CIRCUIT	A7-A8-ASHE THREE TERMINAL LINE			
BREAKER	A-376		(Lines A7-9, A9-1, A1-4, A4-8)			
RELAY FUNCTION	Transmission line protection utilizing RFL Dowety Model 6750 ITTS relays to integrate a direct underreach, permissive overreach transfer trip scheme with the Bonneville Power Administration protective relays at OCBs A-401 (line breaker) or A-924 (bus-backup breaker), located at Ashe and OCB A-382 located at substation A8. The relays also trip the A-376 line breaker locally. These settings are adequate for bypass operation at Substation A8.					
SEL 121G-5	SET #1	SET #2	CT SETTING	160:1	PT SETTING	2000-5
Property Tag #	FA25724	FA23431	POWER SUPPLY	125 Vdc	TIMECODE	IRIG-B
Relay Serial #	91339002	12030	SECONDARY INPUTS	V/φ = 67L-N; NOMINAL AMPS = 5 AMPS; 60HZ		
Firmware Version	406	109				

RELAY MASK – TYPICAL									SETTING
ROW #1: RELAY WORD BINARY REPRESENTATION	1ABC	2ABC	3ABC	4ABC	LOP	50H	50M	50L	80
	1	0	0	0	0	0	0	0	
ROW #2: RELAY WORD BINARY REPRESENTATION	51NT	67N1	67N2	67N3	51NP	Z1P	Z2P	Z3P	C4
	1	1	0	0	0	1	0	0	
ROW #3: RELAY WORD BINARY REPRESENTATION	Z2PT	Z3PT	OSB	3P50	50MF	RI	RC	DF	C8
	1	1	0	0	1	0	0	0	
ROW #4: RELAY WORD BINARY REPRESENTATION	ALRM	TRIP	TC	DT	52BT	Z3X	Z2GT	Z3GT	21
	0	0	1	0	0	0	0	1	

BINARY	HEXIDEcimal
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

MASK SETTINGS										
MTU	MPT	MTB	MTO	MA1	MA2	MA3	MA4	MRI	MRC	
80	00	00	C0	80	40	00	00	00	00	
C4	00	00	66	C4	22	00	00	00	00	
C8	00	00	00	C8	00	00	00	00	00	
20	00	00	00	20	00	00	00	00	00	

MASK SETTING NOTES

1. MTU is set to trip the A-376 locally and not actuate an integrated transfer trip.
2. MTO is set to for trip onto fault protection. It will only trip A-376 locally and will not actuate an integrated transfer trip.
3. MT1 is set for direct underreach transfer trip.
4. MT2 is set for permissive overreach transfer trip.

Description	POSITIVE SEQUENCE IMPEDANCE		ZERO SEQUENCE IMPEDANCE		LINE LENGTH*
Range	0-9999Ω PRIMARY		0-9999Ω PRIMARY		0.1-999 (MILES)
Abbrev.	R1	X1	R0	X0	LL
SETTING	3.40	19.94	21.69	58.07	25.49
Description	CT RATIO	PT RATIO	MAX TORQUE ANGLE	ENABLE FAULT LOCATOR	
Range	1-5000:1	1-10,000:1	47E - 90E	(Y or N)	
Abbrev.	CTR	PTR	MTA	LOCAT	
SETTING	160	2000	80.3	Y	
Description	RECL OPEN INT 1	RECL OPEN INT 2	RECL OPEN INT 3	RECL RESET TIME	
Range	0-10,000 cycles (1/4 cycle steps)	0-10,000 cycles (1/4 cycle steps)	0-10,000 cycles (1/4 cycle steps)	60-8,000 cycles (1/4 cycle steps)	
Abbrev.	79OI1	79OI2	79OI3	79RS	
SETTING	0	0	0	60	
Description	ZONE 1 REACH	ZONE 2 REACH	ZONE 3 REACH		
Range	0-2000% of LL (0.125-64Ω SEC)	0-3200% of LL (0.125-64Ω SEC)	0-3200% of LL (0.125-64Ω SEC)		
Abbrev.	Z1%	Z2%	Z3%		
SETTING	85	210	332		
Description	ZONE 2φ & 3φ SHORT TIMER	ZONE 2φ & 3φ TIME-STEP BACKUP TIMER	ZONE 3φ & 3φ TIME-STEP BACKUP TIMER		
Range	0-60 cycles (1/4 cycle steps)	0-2000 cycles (1/4 cycle steps)	0-2000 cycles (1/4 cycle steps)		
Abbrev.	Z2SP	Z2DP	Z3DP		
SETTING	0	24	60		
Description	φ O/C LOW SET PICKUP	φ O/C MEDIUM SET PICKUP	φ O/C LOP DELAY (loss of potential)	φ O/C HIGH SET PICKUP	
Range	(0.5-40A SEC) 0.25-50,000A PRI	(0.5-40A SEC) 0.25-50,000A PRI	0-60 cycles (1/4 cycle steps)	(0.5-80A SEC) 0.25-50,000A PRI	
Abbrev.	50L	50M	50MFD	50H	
SETTING	700	1332	60	12,000	
Description	GND TIME O/C PICKUP	GND TIME O/C TIMED DIAL	GND TIME O/C CURVE SHAPE	GND TIME O/C TORQ. CONTROL	
Range	(0.25-6.3A SEC) 0.25-50,000A PRI	0.5-15A SEC (0.01 STEPS)	1, 2, 3, or 4	(Y or N)	
Abbrev.	51NP	51NTD	51NC	51NTC	
SETTING	100	3	3	Y	

Description	ZONE 1 GND INST. O/C	ZONE 2 GND INST. O/C	ZONE 3 GND INST. O/C		
Range	(0.25-48x51NP) 0.25-50,000A PRI	(0.25-48x51NP) 0.25-50,000A PRI	(0.25-48x51NP) 0.25-50,000A PRI		
Abbrev.	50N1P	50N2P	50N3P		
SETTING	1715	741	4800		
Description	ZONE 2 GND SHORT TIMER	ZONE 2 GND TIME-STEP BACKUP TIMER	ZONE 3 GND TIME-STEP BACKUP TIMER	MINIMUM TRIP DURATION TIMER	
Range	0-60 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	
Abbrev.	Z2SG	Z2DG	Z3DG	TDUR	
SETTING	0	0	2000	9	
Description	52BT TIME DELAY	ZONE 3 DIRECTION	GND O/C NEGATIVE SEQ. POLARIZATION	GND O/C ZERO SEQ. VOLTAGE POLARIZATION	GND O/C ZERO SEQ. CURRENT POLARIZATION
Range	0.5-10,000 cycles	(F OR R)	(Y or N)	(Y or N)	(Y or N)
Abbrev.	52BT	ZONE 3	32QE	32VE	32IE
SETTING	15	F	N	Y	Y
Description	OUT-OF-STEP BLOCK FOR ZONE 1	OUT-OF-STEP BLOCK FOR ZONE 2	OUT-OF-STEP BLOCK FOR ZONE 3	OUT-OF-STEP BLOCK TIMER	LOSS-OF-POT. ENABLE
Range	(Y or N)	(Y or N)	(Y or N)	0.5-60 cycles (1/4 cycle steps)	(Y or N)
Abbrev.	OSB1	OSB2	OSB3	OSBT	LOPE
SETTING	N	N	N	30	Y
Description	SEL-121G-5 PORT #1 TIMEOUT	SEL-121G-5 PORT #2 TIMEOUT	AUTO MESSAGE TRANSMIT AUTOPORT SELECTION	# RINGS AFTER WHICH MODEM ANSWERS	
Range	(0-30 minutes)	(0-30 minutes)	PORT 1, 2 OR 3 (BOTH)	1-30	
Abbrev.	TIME1	TIME2	AUTO	RINGS	
SETTING	5	0	2	5	

Comments

SUBSTATION	A8	CIRCUIT	A7-A8-ASHE 3-TERMINAL LINE
BREAKER	A-382		(Lines A7-9, A9-1, A1-4, A4-8)
RELAY FUNCTION	Transmission line protection utilizing RFL Dowety Model 6750 ITTS relays to integrate a direct underreach, permissive overreach transfer trip scheme with the Bonneville Power Administration protective relays at OCBs A-401 (line breaker) or A-924 (bus-backup breaker), located at Ashe substation and OCB A-376 located at substation A7. The relays also trip the A-382 line breaker locally. These settings are adequate for bypass operation at Substation A7.		
SEL 121G-5	SET #1	SET #2	CT SETTING
Property Tag #	FA25729	FA23577	160:1
Relay Serial #	91337024	12032	POWER SUPPLY
Firmware Version	406	109	125 Vdc
			PT SETTING
			2000-5
			TIMECODE
			IRIG-B
			SECONDARY INPUTS
			V _φ = 67L-N; NOMINAL AMPS = 5 AMPS; 60HZ

RELAY MASK - TYPICAL									SETTING
ROW #1: RELAY WORD BINARY REPRESENTATION	1ABC	2ABC	3ABC	4ABC	LOP	50H	50M	50L	80
	1	0	0	0	0	0	0	0	
ROW #2: RELAY WORD	51NT	67N1	67N2	67N3	51NP	Z1P	Z2P	Z3P	C4
	1	1	0	0	0	1	0	0	
ROW #3: RELAY WORD	Z2PT	Z3PT	OSB	3P50	50MF	RI	RC	DF	C8
	1	1	0	0	1	0	0	0	
ROW #4: RELAY WORD	ALRM	TRIP	TC	DT	52BT	Z3X	Z2GT	Z3GT	21
	0	0	1	0	0	0	0	1	

BINARY	HEXDECIMAL
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

MASK SETTINGS

MTU	MPT	MTB	MTO	MA1	MA2	MA3	MA4	MRI	MRC
80	00	00	C0	80	40	00	00	00	00
C4	00	00	66	C4	22	00	00	00	00
C8	00	00	00	C8	00	00	00	00	00
20	00	00	00	20	00	00	00	00	00

MASK SETTING NOTES

- MTU is set to trip the A-382 locally and not actuate an integrated transfer trip.
- MTO is set to for trip onto fault protection. This mask will trip A-382 locally and will not actuate an integrated transfer trip.
- MT1 is set for direct underreach transfer trip.
- MT2 is set for permissive overreach transfer trip.
- MPT, MTB, MA3, MA4, MRI, and MRC are not used and are to be masked to 00.

Description	POSITIVE SEQUENCE IMPEDANCE		ZERO SEQUENCE IMPEDANCE		LINE LENGTH*
Range	0-9999Ω PRIMARY		0-9999Ω PRIMARY		0.1-999 (MILES)
Abbrev.	R1	X1	R0	X0	LL
SETTING	1.86	13.67	12.80	34.26	16.11
Description	CT RATIO	PT RATIO	MAX TORQUE ANGLE	ENABLE FAULT LOCATOR	
Range	1-5000:1	1-10,000:1	47E-90E	(Y or N)	
Abbrev.	CTR	PTR	MTA	LOCAT	
SETTING	160	2000	82.3	Y	
Description	RECL OPEN INT 1	RECL OPEN INT 2	RECL OPEN INT 3	RECL RESET TIME	
Range	0-10,000 cycles (1/4 cycle steps)	0-10,000 cycles (1/4 cycle steps)	0-10,000 cycles (1/4 cycle steps)	60-8,000 cycles (1/4 cycle steps)	
Abbrev.	79OI1	79OI2	79OI3	79RS	
SETTING	0	0	0	60	
Description	ZONE 1 REACH	ZONE 2 REACH	ZONE 3 REACH		
Range	0-2000% of LL (0.125-64Ω SEC)	0-3200% of LL (0.125-64Ω SEC)	0-3200% of LL (0.125-64Ω SEC)		
Abbrev.	Z1%	Z2%	Z3%		
SETTING	85	226	266		
Description	ZONE 2φ & 3φ SHORT TIMER	ZONE 2φ & 3φ TIME-STEP BACKUP TIMER	ZONE 3φ & 3φ TIME-STEP BACKUP TIMER		
Range	0-60 cycles (1/4 cycle steps)	0-2000 cycles (1/4 cycle steps)	0-2000 cycles (1/4 cycle steps)		
Abbrev.	Z2SP	Z2DP	Z3DP		
SETTING	0	24	60		
Description	φ O/C LOW SET PICKUP	φ O/C MEDIUM SET PICKUP	φ O/C LOP DELAY (loss of potential)	φ O/C HIGH SET PICKUP	
Range	(0.5-40A SEC) 0.25-50,000A PRI	(0.5-40A SEC) 0.25-50,000A PRI	0-60 cycles (1/4 cycle steps)	(0.5-80A SEC) 0.25-50,000A PRI	
Abbrev.	50L	50M	50MFD	50H	
SETTING	700	2212	60	12,000	
Description	GND TIME O/C PICKUP	GND TIME O/C TIMED DIAL	GND TIME O/C CURVE SHAPE	GND TIME O/C TORQ. CONTROL	
Range	(0.25-6.3A SEC) 0.25-50,000A PRI	0.5-15A SEC (0.01 STEPS)	1, 2, 3, or 4	(Y or N)	
Abbrev.	51NP	51NTD	51NC	51NTC	
SETTING	240	2.75	3	Y	

Description	ZONE 1 GND INST. O/C	ZONE 2 GND INST. O/C	ZONE 3 GND INST. O/C		
Range	(0.25-48x51NP) 0.25-50,000A PRI	(0.25-48x51NP) 0.25-50,000A PRI	(0.25-48x51NP) 0.25-50,000A PRI		
Abbrev.	50N1P	50N2P	50N3P		
SETTING	3524	1046	4800		
Description	ZONE 2 GND SHORT TIMER	ZONE 2 GND TIME-STEP BACKUP TIMER	ZONE 3 GND TIME-STEP BACKUP TIMER	MINIMUM TRIP DURATION TIMER	
Range	0-60 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	
Abbrev.	Z2SG	Z2DG	Z3DG	TDUR	
SETTING	0	0	2000	9	
Description	52BT TIME DELAY	ZONE 3 DIRECTION	GND O/C NEGATIVE SEQ. POLARIZATION	GND O/C ZERO SEQ. VOLTAGE POLARIZATION	GND O/C ZERO SEQ. CURRENT POLARIZATION
Range	0.5-10,000 cycles	(F OR R)	(Y or N)	(Y or N)	(Y or N)
Abbrev.	52BT	ZONE 3	32QE	32VE	32IE
SETTING	15	F	N	Y	Y
Description	OUT-OF-STEP BLOCK FOR ZONE 1	OUT-OF-STEP BLOCK FOR ZONE 2	OUT-OF-STEP BLOCK FOR ZONE 3	OUT-OF-STEP BLOCK TIMER	LOSS-OF-POT. ENABLE
Range	(Y or N)	(Y or N)	(Y or N)	0.5-60 cycles (1/4 cycle steps)	(Y or N)
Abbrev.	OSB1	OSB2	OSB3	OSBT	LOPE
SETTING	N	N	N	30	Y
Description	SEL-121G-5 PORT #1 TIMEOUT	SEL-121G-5 PORT #2 TIMEOUT	AUTO MESSAGE TRANSMIT AUTOPORT SELECTION	# RINGS AFTER WHICH MODEM ANSWERS	
Range	(0-30 minutes)	(0-30 minutes)	PORT 1, 2 OR 3 (BOTH)	1-30	
Abbrev.	TIME1	TIME2	AUTO	RINGS	
SETTING	5	0	2	5	

Comments

SUBSTATION	A8	CIRCUIT	A8-MIDWAY LINE (Hanford Line #A2)			
BREAKER	A-386					
RELAY FUNCTION	Transmission line protection utilizing RFL Dowety Model 6750 ITTS relays to integrate a direct underreach, permissive overreach transfer trip scheme with the Bonneville Power Administration protective relays at OCBs A-336 (line breaker) or A-68 (bus-backup breaker), located at Midway substation. The relays also trip the A-386 line breaker locally. These settings are adequate for bypass operation at Substation A7.					
SEL 121G-5	SET #1	SET #2	CT SETTING	160:1	PT SETTING	2000-5
Property Tag #	FA25733	FA23576	POWER SUPPLY	125 Vdc	TIMECODE	IRIG-B
Relay Serial #	91337023	12031	SECONDARY INPUTS	V/φ = 67L-N; NOMINAL AMPS = 5 AMPS; 60HZ		
Firmware Version	406	109				

RELAY MASK - TYPICAL									SETTING
ROW #1: RELAY WORD BINARY REPRESENTATION	1ABC	2ABC	3ABC	4ABC	LOP	50H	50M	50L	80
	1	0	0	0	0	0	0	0	
ROW #2: RELAY WORD BINARY REPRESENTATION	51NT	67N1	67N2	67N3	51NP	Z1P	Z2P	Z3P	C4
	1	1	0	0	0	1	0	0	
ROW #3: RELAY WORD BINARY REPRESENTATION	Z2PT	Z3PT	OSB	3P50	50MF	RI	RC	DF	C8
	1	1	0	0	1	0	0	0	
ROW #4: RELAY WORD BINARY REPRESENTATION	ALRM	TRIP	TC	DT	52BT	Z3X	Z2GT	Z3GT	21
	0	0	1	0	0	0	0	1	

BINARY	HEXIDEcimal
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

MASK SETTINGS

MTU	MPT	MTB	MTO	MA1	MA2	MA3	MA4	MRI	MRC
80	00	00	C0	80	40	00	00	00	00
C4	00	00	66	C4	22	00	00	00	00
C8	00	00	00	C8	00	00	00	00	00
20	00	00	00	20	00	00	00	00	00

MASK SETTING NOTES

- MTU is set to trip the A-386 locally and not actuate an integrated transfer trip.
- MTO is set to for trip onto fault protection. This mask will trip A-386 locally and will not actuate an integrated transfer trip.
- MT1 is set for direct underreach transfer trip.
- MT2 is set for permissive overreach transfer trip.
- MPT, MTB, MA3, MA4, MRI, and MRC are not used and are to be masked to 00.

Description	POSITIVE SEQUENCE IMPEDANCE		ZERO SEQUENCE IMPEDANCE		LINE LENGTH*
Range	0-9999Ω PRIMARY		0-9999Ω PRIMARY		0.1-999 (MILES)
Abbrev.	R1	X1	R0	X0	LL
SETTING	.88	8.54	6.90	18.42	9.94
Description	CT RATIO	PT RATIO	MAX TORQUE ANGLE	ENABLE FAULT LOCATOR	
Range	1-5000:1	1-10,000:1	47E- 90E	(Y or N)	
Abbrev.	CTR	PTR	MTA	LOCAT	
SETTING	160	2000	84.6	Y	
Description	RECL OPEN INT 1	RECL OPEN INT 2	RECL OPEN INT 3	RECL RESET TIME	
Range	0-10,000 cycles (1/4 cycle steps)	0-10,000 cycles (1/4 cycle steps)	0-10,000 cycles (1/4 cycle steps)	60-8,000 cycles (1/4 cycle steps)	
Abbrev.	79OI1	79OI2	79OI3	79RS	
SETTING	0	0	0	60	
Description	ZONE 1 REACH	ZONE 2 REACH	ZONE 3 REACH		
Range	0-2000% of LL (0.125-64Ω SEC)	0-3200% of LL (0.125-64Ω SEC)	0-3200% of LL (0.125-64Ω SEC)		
Abbrev.	Z1%	Z2%	Z3%		
SETTING	85	125	335		
Description	ZONE 2φ & 3φ SHORT TIMER	ZONE 2φ & 3φ TIME-STEP BACKUP TIMER	ZONE 3φ & 3φ TIME-STEP BACKUP TIMER		
Range	0-60 cycles (1/4 cycle steps)	0-2000 cycles (1/4 cycle steps)	0-2000 cycles (1/4 cycle steps)		
Abbrev.	Z2SP	Z2DP	Z3DP		
SETTING	0	24	42		
Description	φ O/C LOW SET PICKUP	φ O/C MEDIUM SET PICKUP	φ O/C LOP DELAY (loss of potential)	φ O/C HIGH SET PICKUP	
Range	(0.5-40A SEC) 0.25-50,000A PRI	(0.5-40A SEC) 0.25-50,000A PRI	0-60 cycles (1/4 cycle steps)	(0.5-80A SEC) 0.25-50,000A PRI	
Abbrev.	50L	50M	50MFD	50H	
SETTING	500	2228	60	12,000	
Description	GND TIME O/C PICKUP	GND TIME O/C TIMED DIAL	GND TIME O/C CURVE SHAPE	GND TIME O/C TORQ. CONTROL	
Range	(0.25-6.3A SEC) 0.25-50,000A PRI	0.5-15A SEC (0.01 STEPS)	1, 2, 3, or 4	(Y or N)	
Abbrev.	51NP	51NTD	51NC	51NTC	
SETTING	100	4	3	Y	

Description	ZONE 1 GND INST. O/C	ZONE 2 GND INST. O/C	ZONE 3 GND INST. O/C		
Range	(0.25-48x51NP) 0.25-50,000A PRI	(0.25-48x51NP) 0.25-50,000A PRI	(0.25-48x51NP) 0.25-50,000A PRI		
Abbrev.	50N1P	50N2P	50N3P		
SETTING	2700	1701	4800		
Description	ZONE 2 GND SHORT TIMER	ZONE 2 GND TIME-STEP BACKUP TIMER	ZONE 3 GND TIME-STEP BACKUP TIMER	MINIMUM TRIP DURATION TIMER	
Range	0-60 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	0-2,000 cycles (1/4 cycle steps)	
Abbrev.	Z2SG	Z2DG	Z3DG	TDUR	
SETTING	0	0	2000	9	
Description	52BT TIME DELAY	ZONE 3 DIRECTION	GND O/C NEGATIVE SEQ. POLARIZATION	GND O/C ZERO SEQ. VOLTAGE POLARIZATION	GND O/C ZERO SEQ. CURRENT POLARIZATION
Range	0.5-10,000 cycles	(F OR R)	(Y or N)	(Y or N)	(Y or N)
Abbrev.	52BT	ZONE 3	32QE	32VE	32IE
SETTING	15	F	N	Y	Y
Description	OUT-OF-STEP BLOCK FOR ZONE 1	OUT-OF-STEP BLOCK FOR ZONE 2	OUT-OF-STEP BLOCK FOR ZONE 3	OUT-OF-STEP BLOCK TIMER	LOSS-OF-POT. ENABLE
Range	(Y or N)	(Y or N)	(Y or N)	0.5-60 cycles (1/4 cycle steps)	(Y or N)
Abbrev.	OSB1	OSB2	OSB3	OSBT	LOPE
SETTING	N	N	N	30	Y
Description	SEL-121G-5 PORT #1 TIMEOUT	SEL-121G-5 PORT #2 TIMEOUT	AUTO MESSAGE TRANSMIT AUTOPORT SELECTION	# RINGS AFTER WHICH MODEM ANSWERS	
Range	(0-30 minutes)	(0-30 minutes)	PORT 1, 2 OR 3 (BOTH)	1-30	
Abbrev.	TIME1	TIME2	AUTO	RINGS	
SETTING	5	0	2	5	

Comments

SUBSTATION A2, A4, AND A9 SEL 121G-5 RELAY SETTINGS

ALL REMAINING SEL RELAYS LOCATED AT SUBSTATIONS A2, A4 AND A9 ARE TO HAVE THEIR MASK SETTINGS SET TO 00, AND DE-ENERGIZED. THE LINE PROTECTION RELAYS AT THESE SUBSTATIONS HAS BEEN RETIRED IN PLACE.

SEL 121G-5 relays retired in place: OCB A322, A326, A342, A346, A379, A388, A392, and A396.

RFL STATION CONFIGURATION VERIFICATION

Circuit card jumpers (strapping) must be established to adapt the station to the specific requirements of the installation. This document identifies the jumper configuration for the RFL stations. The RFL relay will be used to accomplish two applications; direct underreach and permissive overreach transfer tripping of transmission line relaying. This dual purpose application requires the configuration of the digital and redundant digital logic cards to be different.

The main digital logic card will be configured for the Permissive Relay Trip (PRT) function; permissive overreach transfer trip. When a choice between system dependability and security is provided, dependability will be chosen.

The redundant digital logic card will be configured for the Direct Relay Trip (DRT) function; direct underreach transfer trip. When a choice between system dependability and security is provided, security will be chosen.

The following pages contain a table for each circuit card and the position of each jumper. The last table contains a listing of the frequency and tone levels for each station.

REFERENCES

VI 19188 - RFL Downtey Model 6750 ITTS Instruction Manual.

DEFINITIONS

Dependability - That facet of reliability that relates to the degree of certainty that a relay or relay system will operate correctly.

Security - That facet of reliability that relates to the degree of certainty that a relay or relay system will not operate incorrectly.

MAIN ANALOG LOGIC CARD (Card 67A LOGIC-63)

Jumper	Key Words	DYNCORP Position	Function
1	AM Noise Control	A	<p><u>Position A</u> - AM Noise detection will not cause blocking in the event of a steady state difference in subchannel levels.</p> <p><u>Position B</u> - AM Noise detection will cause blocking in the event of a steady state difference in subchannel levels.</p> <p><i>Position A is selected because system dependability is increased.</i></p>
2	FM Noise Control	A	<p><u>Position A</u> - FM Noise detection will not cause blocking in the event of a steady state difference in subchannel levels.</p> <p><u>Position B</u> - FM Noise detection will cause blocking in the event of a steady state difference in subchannel levels.</p> <p><i>Position A is selected because system dependability is increased.</i></p>
3	High Level Window Detector	A	<p><u>Position A</u> - When either subchannel exceeds the predetermined limits, a out-of-limits indication will be generated.</p> <p><u>Position B</u> - When subchannel B exceeds the predetermined limits, a out-of-limits indication will be generated.</p> <p><u>Position C</u> - When subchannel A exceeds the predetermined limits, a out-of-limits indication will be generated.</p> <p><i>Position A is selected because system dependability is increased.</i></p>
4	Low Level Window Detector	A	<p><u>Position A</u> - An out of limits indication will be generated when either subchannel exceeds the predetermined limit.</p> <p><u>Position B</u> - An out of limits indication will be generated when subchannel B exceeds the predetermined limit.</p> <p><u>Position C</u> - When subchannel A exceeds the predetermined limits, a out-of-limits indication will be generated.</p> <p><i>Position A is selected because system dependability is increased. (BPA uses different positions for jumpers 3 and 4, due to past settings on like RFL units and not due to dependability or security requirements).</i></p>
5	Guard Detection	A	<p><u>Position A</u> - A guard signal can be detected and indicated during low level conditions.</p> <p><u>Position B</u> - A guard signal detection will be prevented during low-level conditions.</p> <p><i>Position A is selected because system dependability is increased.</i></p>

MAIN (DIGITAL) LOGIC CARD JUMPERS (Card 67A LOGIC-63)

Jumper	Key Words	DYNCORP Position	Function
1	Jumpers 1 through 4 determine whether trip and/or guard are required on each subchannel.	A	<p>Jumpers 1 through 4 determine whether trip and/or guard are required on each subchannel. Jumper 1 controls trip on subchannel A, Jumper 2 controls trip on subchannel B, Jumper 3 controls guard on subchannel A, and Jumper 4 controls guard on subchannel B. If one of these jumpers is placed in position A, the signal it controls is required; the signal is not required if the jumper is placed in position B.</p> <p><i>One subchannel is used to establish separate tones for each subchannel. Notice that the jumpers on the redundant digital logic card are different.</i></p> <p><i>Select jumpers such that only one subchannel for trip or guard. Therefore, Jumper 2 is placed in position B and Jumper 4 is placed in position B.</i></p>
2		B	
3		A	
4		B	
5	Timer Control	A	<p><u>Position A</u> - Timers for guard-before-trip and trip-after-guard are enabled.</p> <p><u>Position B</u> - Timers for for guard-before-trip and trip-after-guard are disabled.</p> <p><i>Use the Main Digital Logic Card as the PRT card. Therefore the guard-before-trip must be enabled per telephone conversation with Bob Perkins of RFL Dowty.</i></p>
6	Guard Control	A	<p><u>Position A</u> - A guard signal is required to be present on both suchannels unless Jumper 3 or 4 are set to position B.</p> <p><u>Position B</u> - A guard signal is required to be present on only one subchannel.</p> <p><i>Selection is irrelevant because Jumper 3 has been set to position B. Therefore, select the default position A (default). A guard signal need only to be present on one subchannel to set the criteria for a guard.</i></p>
7	Pre-Trip Control	A	<p><u>Position A</u> - A valid guard signal is required to precede only the first trip.</p> <p><u>Position B</u> - A valid guard signal is required to precede each trip.</p> <p><i>Position A is selected because it is not desirable to have a time delay (300ms 6 guard before trip timer) that may interfere with the autoreclosing system. A valid guard signal will be required to precede only the first trip.</i></p>

MAIN (DIGITAL) LOGIC CARD JUMPERS (Card 67A LOGIC-63)

Jumper	Key Words	DYNCORP Position	Function
8	Noise Detection Control	A	<p><u>Position A</u> - A valid guard signal is required to enable noise detection for the block timer; a valid trip will override.</p> <p><u>Position B</u> - A valid guard signal is not required for noise detection.</p> <p><i>Position A is selected because system dependability is increased. A valid guard signal enables noise detection for the block timer; a valid trip will override. Noise or low signal will block the trip output, but a valid trip signal will override the noise detector.</i></p>
9	Trip-Hold Timer Control	A	<p><u>Position A</u> - A guard signal will override of the trip-hold timer.</p> <p><u>Position B</u> - The trip-hold timer will be allowed to time out before the return of a guard signal can be acknowledged. This position is selected in systems using a flasher.</p> <p><i>The installed system does not use a flasher, therefore select Position A. Guard signal will override the trip-hold timer. When a return from trip to guard is recognized, the trip-hold timer will cease to hold the trip output.</i></p>
10	Permissive Trip Control	A	<p><u>Position A</u> - Use this position when any application is used except permissive trip.</p> <p><u>Position B</u> - Use this position only for permissive trip applications.</p> <p><i>Select Position A because the direct-transfer-trip logic card will have an application that includes other schemes than just permissive transfer trip applications.</i></p>
11	Bipolar Noise Detection Control	B	<p><u>Position A</u> - Enable the bipolar noise detector.</p> <p><u>Position B</u> - Disable the bipolar noise detector.</p> <p><i>Select Position B to disable the bipolar noise detector. This is a recommended setting for the permissive-transfer-trip logic card of permissive-transfer-trip systems.</i></p>
12	Unblocking Control	A	<p><u>Position A</u> - Use this position for any application except unblocking.</p> <p><u>Position B</u> - Use this position only for unblocking applications, where a loss of guard signal will provide a trip.</p> <p><i>Select Position A, because our application is a scheme other than blocking use.</i></p>
13	Direct-Transfer Trip Control	B	<p><u>Position A</u> - Use this position to cancel out the permissive-transfer trip output when a direct-transfer trip occurs.</p> <p><u>Position B</u> - Use this position to cause a trip when both the direct-trip output and permissive-trip output occurs.</p> <p><i>Select Position B so that a direct-trip and permissive-trip output will trip when a direct-transfer trip occurs.</i></p>

REDUNDANT DIGITAL LOGIC CARD JUMPERS (Card 67A LOGIC-64)

Jumper	Key Words	DYNCORP Position	Function
1	Jumpers 1 through 4 determine whether trip and/or guard are required on each subchannel.	B	<p>Jumpers 1 through 4 determine whether trip and/or guard are required on each subchannel. Jumper 1 controls trip on subchannel A, Jumper 2 controls trip on subchannel B, Jumper 3 controls guard on subchannel A, and Jumper 4 controls guard on subchannel B. If one of these jumpers is placed in position A, the signal it controls is required; the signal is not required if the jumper is placed in position B.</p> <p><i>One subchannel is used to establish separate tones for each subchannel. Notice that the jumpers on the main digital logic card are different.</i></p> <p><i>Select jumpers such that only one subchannel for trip or guard. Therefore, Jumper 2 is placed in position B and Jumper 4 is placed in position B.</i></p>
2		A	
3		B	
4		A	
5	Timer Control	B	<p><u>Position A</u> - Timers for guard-before-trip and trip-after-guard are enabled.</p> <p><u>Position B</u> - Timers for for guard-before-trip and trip-after-guard are disabled.</p> <p><i>Use the Redundant Digital Logic Card as the DRT card. Therefore the guard-before-trip must not be enabled per telephone conversation with Bob Perkins of RFL Dowty. Select Position B.</i></p>
6	Guard Control	A	<p><u>Position A</u> - A guard signal is required to be present on both suchannels unless Jumper 3 or 4 are set to position B.</p> <p><u>Position B</u> - A guard signal is required to be present on only one subchannel.</p> <p><i>Selection is irrelevant because Jumper 3 has been set to position B. Therefore, select the default position, position A. A guard signal need only to be present on one subchannel to set the criteria for a guard.</i></p>
7	Pre-Trip Control	A	<p><u>Position A</u> - A valid guard signal is required to precede only the first trip.</p> <p><u>Position B</u> - A valid guard signal is required to precede each trip.</p> <p>Position A is selected because it is not desirable to have a time delay (300ms 6 guard before trip timer) that may interfere with the autoreclosing system. A valid guard signal will be required to precede only the first trip.</p>

REDUNDANT DIGITAL LOGIC CARD JUMPERS (Card 67A LOGIC-64)

Jumper	Key Words	DYNACORP Position	Function
8	Noise Detection Control	B	<p><u>Position A</u> - A valid guard signal is required to enable noise detection for the block timer; a valid trip will override.</p> <p><u>Position B</u> - A valid guard signal is not required for noise detection.</p> <p><i>Position B is selected because security is increased. Because this is the card utilizing the DRT, security is preferred over dependability.</i></p>
9	Trip-Hold Timer Control	A	<p><u>Position A</u> - A guard signal will override of the trip-hold timer.</p> <p><u>Position B</u> - The trip-hold timer will be allowed to time out before the return of a guard signal can be acknowledged. This position is selected in systems using a flasher.</p> <p><i>The installed system does not use a flasher, therefore select Position A. Guard signal will override the trip-hold timer. When a return from trip to guard is recognized, the trip-hold timer will cease to hold the trip output.</i></p>
10	Permissive Trip Control	A	<p><u>Position A</u> - Use this position when any application is used except permissive trip.</p> <p><u>Position B</u> - Use this position only for permissive trip applications.</p> <p><i>Select Position A because the direct-transfer-trip logic card will have an application that includes other schemes than just permissive transfer trip applications.</i></p>
11	Bipolar Noise Detection Control	B	<p><u>Position A</u> - Enable the bipolar noise detector.</p> <p><u>Position B</u> - Disable the bipolar noise detector.</p> <p><i>Select Position B to disable the bipolar noise detector. This is a recommended setting for the permissive-transfer-trip logic card of permissive-transfer-trip systems.</i></p>
12	Unblocking Control	A	<p><u>Position A</u> - Use this position for any application except unblocking.</p> <p><u>Position B</u> - Use this position only for unblocking applications, where a loss of guard signal will provide a trip.</p> <p><i>Select Position A, because our application is a scheme other than blocking use.</i></p>
13	Direct-Transfer Trip Control	B	<p><u>Position A</u> - Use this position to cancel out the permissive-transfer trip output when a direct-transfer trip occurs.</p> <p><u>Position B</u> - Use this position to cause a trip when both the direct-trip output and permissive-trip output occurs.</p> <p><i>Select Position B so that a direct-trip and permissive-trip output will trip when a direct-transfer trip occurs.</i></p>

TRANSMITTER CARD JUMPERS (Card 67 TRANS)

Jumper Position	Key Words	DYNCORP Position	Function		
B	Subchannel A	B	See below for function description. <i>This position is used because BPA utilizes the same operating frequencies.</i>		
F	Subchannel B	F			
Channel Spacing (Hz)	Frequency Shift (Hz)	Operating Frequencies (Hz)			
		Subchannel	Center	Trip	Guard
680	±150	A	1615	1465	1765
		B	2295	2445	2145

INTERFACE CARD JUMPERS (Card 67A Inter-1)

Jumper	Key Words	DYNCORP Position	Function
A	Transmit Level/ Configuration Selection	-10 DBM	Jumpers A through E select the maximum transmit output level and determine whether two-wire or four-wire connections are to be made to the communication circuit. <i>The RFL system is a four wire operation with a maximum output level of -10 dBm.</i>
B		4W	
C		4W	
D		OUT	
E		OUT	
F	Signal Multiplexing	DIR	Jumper F is the receive circuit. Only one transmitter or receiver can be connected to the line. <i>Jumper F is selected in the DIR position because only one RFL 6750 will be connected to the line.</i>
G	Single/Dual Trip Selection	ST	Jumpers G and H set the interface card for single trip position (ST) or dual trip (DT). <i>Select position ST for each jumper for proper operation.</i>
H		ST	
K	Signal Multiplexing	IN	Jumper K is the transmit circuit. Only one transmitter or receiver can be connected to the line. <i>Jumper K is selected in the IN position because only one RFL 6750 will be connected to the line.</i>

RECEIVER CARD JUMPERS (Card 67B REC LO)

Jumper	Key Words	DYNCORP Position	Function
1	Trip Boost	F	Jumper must be in position F (fast) when trip boost is not being used. <i>Because we are not using trip boost, place the Jumper in Position F.</i>

RECEIVER CARD JUMPERS (Card 67B REC HI)

Jumper	Key Words	DYNCORP Position	Function
1	Trip Boost	F	Jumper must be in position F (fast) when trip boost is not being used. <i>Because we are not using trip boost, place the Jumper in Position F.</i>

FS/AM DETECTOR CARD JUMPERS (Card 67FS/AM)

Jumper	DYNCORP Position	Function
A	USED	These jumpers are factory soldered connection points. Jumpers are installed to route input signals to the four detector circuits on this card. For most applications, jumpers will be installed in positions A, D, F, and G.
B	NOT USED	
C	NOT USED	
D	USED	
E	NOT USED	
F	USED	
G	USED	
H	NOT USED	

SIGNAL LEVEL INDICATOR/MONITOR CARD JUMPERS (Card 67A LEVEL IND)

Jumper	Key Words	DYNCORP Position	Function
1	Monitor Section Input Coupling	DIR	Place the jumpers in the DIR position to directly couple the input signal.
2		DIR	
3	First Stage Monitor Section Gain Control	5 dB	Jumpers can be set for 20, 30, 40 or 50 dB. <i>Installed jumper position overall gain is 20 dB. Jumper selection was determined based on the recommendations of BCSR IRM Telecommunications (reference cc:mail from Alfred Cornelius to Wayne Akerson on 5/6/92 and 5/7/92).</i>
4		15 dB	
5	Indicator Section Meter Enabling	A	Position A will enable the meter Position B will disable the meter. <i>Select Position B to enable the meter.</i>
6	Indicator Section Input Coupling	A	The indicator section can accept up to four different inputs. An input is enabled with it jumper is placed in position A, and disabled when the jumper is in position B. <i>Select A to enable each indicator input.</i>
7		A	
8		A	
9		A	

BREAKER: A-372

Main Analog Logic Card - 67A LOGIC-63

JUMPER	1	2	3	4	5
POSITION	A	A	A	A	A

Main Digital Logic Card - 67A LOGIC-63

JUMPER	1	2	3	4	5	6	7	8	9	10	11	12	13
POSITION	A	B	A	B	A	A	A	A	A	A	B	A	B

Redundant Digital Logic Card - 67A LOGIC-64

JUMPER	1	2	3	4	5	6	7	8	9	10	11	12	13
POSITION	B	A	B	A	B	A	A	B	A	A	B	A	B

Transmitter Card - 67 TRANS

JUMPER	Ch. A	Ch. B
POSITION	B	F

Interface Card - 67A Inter-1

JUMPER	A	B	C	D	E	F	G	H	K
POSITION	-10 dBm	4W	4W	OUT	OUT	DIR	ST	ST	IN

Low Receiver Card - 67B REC LO

JUMPER	1
POSITION	F

High Receiver Card - 67B REC HI

JUMPER	1
POSITION	F

FS/AM Detector Card - 67FS/AM

JUMPER	A	B	C	D	E	F	G	H
POSITION	USED	NOT USED	NOT USED	USED	NOT USED	USED	USED	NOT USED

Signal Level Card - 67A LEVEL IND

JUMPER	1	2	3	4	5	6	7	8	9
POSITION	DIR	DIR	5 dBm	15 dBm	A	A	A	A	A

BREAKER: A-376

Main Analog Logic Card - 67A LOGIC-63

JUMPER	1	2	3	4	5
POSITION	A	A	A	A	A

Main Digital Logic Card - 67A LOGIC-63

JUMPER	1	2	3	4	5	6	7	8	9	10	11	12	13
POSITION	A	B	A	B	A	A	A	A	A	A	B	A	B

Redundant Digital Logic Card - 67A LOGIC-64

JUMPER	1	2	3	4	5	6	7	8	9	10	11	12	13
POSITION	B	A	B	A	B	A	A	B	A	A	B	A	B

Transmitter Card - 67 TRANS

JUMPER	Ch. A	Ch. B
POSITION	B	F

Interface Card - 67A Inter-1

JUMPER	A	B	C	D	E	F	G	H	K
POSITION	-10 dBm	4W	4W	OUT	OUT	DIR	ST	ST	IN

Low Receiver Card - 67B REC LO

JUMPER	1
POSITION	F

High Receiver Card - 67B REC HI

JUMPER	1
POSITION	F

FS/AM Detector Card - 67FS/AM

JUMPER	A	B	C	D	E	F	G	H
POSITION	USED	NOT USED	NOT USED	USED	NOT USED	USED	USED	NOT USED

Signal Level Card - 67A LEVEL IND

JUMPER	1	2	3	4	5	6	7	8	9
POSITION	DIR	DIR	5 dBm	15 dBm	A	A	A	A	A

BREAKER: A-382

Main Analog Logic Card - 67A LOGIC-63

JUMPER	1	2	3	4	5
POSITION	A	A	A	A	A

Main Digital Logic Card - 67A LOGIC-63

JUMPER	1	2	3	4	5	6	7	8	9	10	11	12	13
POSITION	A	B	A	B	A	A	A	A	A	A	B	A	B

Redundant Digital Logic Card - 67A LOGIC-64

JUMPER	1	2	3	4	5	6	7	8	9	10	11	12	13
POSITION	B	A	B	A	B	A	A	B	A	A	B	A	B

Transmitter Card - 67 TRANS

JUMPER	Ch. A	Ch. B
POSITION	B	F

Interface Card - 67A Inter-1

JUMPER	A	B	C	D	E	F	G	H	K
POSITION	-10 dBm	4W	4W	OUT	OUT	DIR	ST	ST	IN

Low Receiver Card - 67B REC LO

JUMPER	1
POSITION	F

High Receiver Card - 67B REC HI

JUMPER	1
POSITION	F

FS/AM Detector Card - 67FS/AM

JUMPER	A	B	C	D	E	F	G	H
POSITION	USED	NOT USED	NOT USED	USED	NOT USED	USED	USED	NOT USED

Signal Level Card - 67A LEVEL IND

JUMPER	1	2	3	4	5	6	7	8	9
POSITION	DIR	DIR	5 dBm	15 dBm	A	A	A	A	A

BREAKER: A-386

Main Analog Logic Card - 67A LOGIC-63

JUMPER	1	2	3	4	5
POSITION	A	A	A	A	A

Main Digital Logic Card - 67A LOGIC-63

JUMPER	1	2	3	4	5	6	7	8	9	10	11	12	13
POSITION	A	B	A	B	A	A	A	A	A	A	B	A	B

Redundant Digital Logic Card - 67A LOGIC-64

JUMPER	1	2	3	4	5	6	7	8	9	10	11	12	13
POSITION	B	A	B	A	B	A	A	B	A	A	B	A	B

Transmitter Card - 67 TRANS

JUMPER	Ch. A	Ch. B
POSITION	B	F

Interface Card - 67A Inter-1

JUMPER	A	B	C	D	E	F	G	H	K
POSITION	-10 dBm	4W	4W	OUT	OUT	DIR	ST	ST	IN

Low Receiver Card - 67B REC LO

JUMPER	1
POSITION	F

High Receiver Card - 67B REC HI

JUMPER	1
POSITION	F

FS/AM Detector Card - 67FS/AM

JUMPER	A	B	C	D	E	F	G	H
POSITION	USED	NOT USED	NOT USED	USED	NOT USED	USED	USED	NOT USED

Signal Level Card - 67A LEVEL IND

JUMPER	1	2	3	4	5	6	7	8	9
POSITION	DIR	DIR	5 dBm	15 dBm	A	A	A	A	A

FREQUENCY/TONE LEVELS

OCB	Tone Levels	Guard T1-Ch A	Trip T1-Ch A	Guard T2-Ch B	Trip T2-Ch B
A372	HZ	1765	1465	2145	2445
	dBm	-16.96	-16.81	-17.20	-17.16
A376	HZ	1765	1464	2145	2444
	dBm	-17.26	-17.10	-17.37	-17.24
A382	HZ	1764	1464	2144	2444
	dBm	-17.82	-17.77	-18.13	-17.77
A386	HZ	17.64	1464	2144	2445
	dBm	-17.46	-17.50	-17.78	-17.80

SUBSTATION A-7

No	Service	Relay Label	Relay Type	Ct/Pt Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
1 2	230-kV Backup Line Relays A-372 SET #1 and SET #2	21-72-AB-BC-CA	SEL	1200-5A Conn. 800-5A 2000-IV	SEL-121-G	See The Settings for SEL-121-G Relays		New Set #2 Relay Was Installed by CENRTC 213EOA
3 4	230-kV Backup Line Relays A-376 SET #1 and SET #2	21-76-AB-BC-CA	SEL	1200-5A Conn. 800-5A 2000-IV	SEL-121-G	See The Settings for SEL-121-G Relays		New Set #2 Relay Was Installed by CENRTC 213EOA
5 6 7 8 9	Relay Numbers Are No Longer Used							
10 11 12 13 14	Relay Numbers Are No Longer Used							
15 16 17 18	Relay Numbers Are No Longer Used							
19	Hot Line Supervising Relay A-372	HL-72	G.E. NGV	2000/IV	12NGV13A18A	120V AC, Drop-Out 60-90V Pick-Up Is Less than 110% of Drop-Out Volts.	Pick-Up = 99V AC Drop-Out = 90V AC	
20	Hot Line Supervising Relay A-376	HL-76	G.E. NGV	2000/IV	12NGV13A18A	20V AC, Drop-Out 60-90V Pick-Up Is Less than 110% of Drop-Out Volts.	Pick-Up = 99V AC Drop-Out = 90V AC	

SUBSTATION A-7

No.	Service	Relay Label	Relay Type	Ct/Pt Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
21	Synch. Check Relay A-372	72-SYNC	W. CVE-I	2000/IV	292B353A34	20V AC, Drop-Out 60-90V Pick-Up Is Less Than 110% of Drop-Out Volts.	Closing Angle = 40 Degrees T.L. = 0.5 to close the contact 0.5 seconds with 0 Degree Angle Diff.	
22	Synch. Check Relay A-374	74-SYNC	W. CVE-I	2000/IV	292B353A34	120V, 20-40-60 Degree Closing Angle Adjustment, ICS = 0.2A, SPST-CC, Adjustable Closing Time.	Closing Angle = 40 Degrees T.L. = 0.5 to close the contact 0.5 seconds with 0 Degree Angle Diff.	
23	Synch. Check Relay A-376	76-SYNC	W. CVE-I	2000/IV	292B353A34	120V, 20-40-60 Degree Closing Angle Adjustment, ICS = 0.2A, SPST-CC, Adjustable Closing Time.	Closing Angle = 40 Degrees T.L. = 0.5 to close the contact 0.5 seconds with 0 Degree Angle Diff.	
24	Breaker Failure Relay A-372	BFR-72	W. SBF-I	1200-5A Conn. 800-5A	1529F93A05	B.F. Timer = 25-175 ms Control Timer = 150-250 ms Phase O/C = 0.5-13.5A Ground O/C = 0.5-13.5A Target and Seal-In = 0.2/2.0A	B.F. Timer = 133 ms Control Timer = 166 ms Phase O/C = 0.5A Ground O/C = 0.5A Target and Seal-In = 0.2A	
25	Breaker Failure Relay A-374	BFR-74	W. SBF-I	1200-5A Conn. 800-5A	1529F93A05	B.F. Timer = 25-175 ms Control Timer = 150-250 ms Phase O/C = 0.5-13.5A Ground O/C = 0.5-13.5A Target and Seal-In = 0.2/2.0A	B.F. Timer = 133 ms Control Timer = 166 ms Phase O/C = 0.5A Ground O/C = 0.5A Target and Seal-In = 0.2A	
26	Breaker Failure Relay A-376	BFR-76	W. SBF-I	1200-5A Conn. 800-5A	1529F93A05	B.F. Timer = 25-175 ms Control Timer = 150-250 ms Phase O/C = 0.5-13.5A Ground O/C = 0.5-13.5A Target and Seal-In = 0.2/2.0A	B.F. Timer = 133 ms Control Timer = 166 ms Phase O/C = 0.5A Ground O/C = 0.5A Target and Seal-In = 0.2A	
27	230-kV Backup Ground Relay A-372	67GB-72	G.E. JBCG	1200-5A Conn. 800A 1150-IV	12JBCG53K11Y	Time O/C = 1.5-6.0A Dir. Inst. O/C = 10-40A Non-Dir. Inst. O/C = 2-8A Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	T/O/C Tap = 1.5A, TD = 4 Dir. Inst. O/C = 15A Non-Dir. Inst. O/C = 8A Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	REV 1J

SUBSTATION A-7

No	Service	Relay Label	Relay Type	Ct/Pt Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
28	230-kV Backup Ground Relay A-376	67GB-76	G.E. JBCG	1200-5A Conn. 800-5A 1150-IV	I2JBCG53K11Y 1A	Time O/C = 1.5-6.0A Dir. Inst. O/C = 10-40A Non-Dir. Inst. O/C = 2-8A Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	T/O/C Tap = 4A, TD = 5.5 Dir. Inst. O/C = Block Non-Dir. Inst. O/C = 8A Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	REV 1J
29 30	Relay Numbers are No Longer Used							
31 32 33	230-kV Bus No. 1 Diff. Relays	87B1-TH-A-B-C	G.E. PVD	1200-5	I2PVD11C1A	120V, 60 Hz, 87L = 75-500V, 87H = 2-50A, Single-Phase, Target and Seal-In = 0.2/2.0A	87L = 200 Volts 87H = 2.0 Amps Target and Seal-In = 0.2 A	
34 35 36	230-kV Bus No. 2 Diff. Relays	87B2-TH-A-B-C	G.E. PVD	1200-5	I2PVD11C1A	120V, 60 Hz, 87L = 75-500V, 87H = 2-50A, Single-Phase, Target and Seal-In = 0.2/2.0A	87L = 200 Volts 87H = 2.0 Amps Target and Seal-In = 0.2 A	
37 38 39	230-kV Bank No. 1 Diff. Relays	87TL1-A-B-C	B.E. BE1-87T	600-5 400A H.V. 2000-5 L.V.	A1EA1JDO5SF	Two Winding Restraints, Adjustable Taps, Adjustable Sensitivity Adjustable Slope	H.V. (Input 2) Tap = 2.0A L.V. (Input 1) Tap = 3.7A Slope = 25% Unrestrained Trip = 12A Target = 0.2A	New Relay CENRTC 2F3EOA
40 41 42	230-kV Bank No. 2 Diff. Relays	87TL2-A-B-C	B.E. BE1-87T	600-5 400A H.V. 2000-5 L.V.	A1EA1JDO5SF	Two Winding Restraints, Adjustable Taps, Adjustable Sensitivity Adjustable Slope	H.V. (Input 2) Tap = 2.0A L.V. (Input 1) Tap = 3.7A Slope = 25% Unrestrained Trip = 12A Target = 0.2A	New Relay CENRTC 2F3EOA
43 44 45	230-kV Bank No. 1 O/C. Relays	50/51-TH1-A-B-C	W. CO-9	800-5	264C901A03	Time O/C = 0.5-2.5A Inst. O/C = 2.0-48A	Tap = 1A T.D. = 4.0 Inst = 6A	1.35 Seconds @ 4A
46 47 48	230-kV Bank No. 2 O/C. Relays	50/51-TH2-A-B-C	W. CO-9	800-5	264C901A03	Time O/C = 0.5-2.5A Inst. O/C = 2.0-48A	Tap = 1A T.D. = 4.0 Inst = 6A	
49	Auto-Reclosing Relay A-372	79-72	G.E. ACR	-	I2ACR11B14A8		Single-Shot Reclosing After 6.0 Seconds.	1.35 Seconds @ 4A

SUBSTATION A-7

No.	Service	Relay Label	Relay Type	Ct/Pt Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
50	Auto-Reclosing Relay A-376	79-76	G.E. ACR	-	12ACR11B14A8		Single-Shot Reclosing After 4.0 Seconds.	1.35 Seconds @ 4A
51	230-kV Bank No. 1 Neutral O/C. Relay	51G-TH1	G.E. IAC	600-5	12IAC53B803A	Time O/C = 0.5-4.0A Inst. O/C = 2.0-16A	Time O/C Tap = 2.0A T.L. = 3 Inst. O/C = Blocked.	
52	230-kV Bank No. 2 Neutral O/C. Relay	51G-TH2	G.E. IAC	600-5	12IAC53B803A	Time O/C = 0.5-4.0A Inst. O/C = 2.0-16A	Time O/C Tap = 2.0A T.L. = 3 Inst. O/C = Blocked.	
53	Zig-Zag Grounding Bank Neutral O/C Alarm Relay Bank No. 1	50G-GT1	G.E. PJC	600-5	12PJC11A1A	Inst. O/C = 0.5-2.5A	Inst = 0.5A 60 Amps Primary Alarm Only	0.5 Seconds @ 16A
54	Zig-Zag Grounding Bank Neutral O/C Alarm Relay Bank No. 2	50G-GT2	G.E. PJC	600-5	12PJC11A1A	Inst. O/C = 0.5-2.5A	Inst = 0.5A 60 Amps Primary Alarm Only	0.5 Seconds @ 16A
55 56 57	Zig-Zag Grounding Bank O/C Relays Bank No. 1	51-GT1-A-B-C	G.E. IAC	400-5	12IAC51A1A	Time O/C = 4.0-16A Target and Seal-In = 0.2/2.0A	Tap = 4.0A T.D. = 1.0 Target and Seal-In = 0.2A	
58 59 60	Zig-Zag Grounding Bank O/C Relays Bank No. 2	51-GT2-A-B-C	G.E. IAC	400-5	12IAC51A1A	Time O/C = 4.0-16A Target and Seal-In = 0.2/2.0A	Tap = 4.0A T.D. = 1.0 Target and Seal-In = 0.2A	
61	Zig-Zag Grounding Bank Neutral O/C Relay Bank No. 1	51GB-GT1	G.E. IAC	1200-5A Conn. 600-5A	12IAC77B803A	Time O/C = 0.5-4.0A Target and Seal-In = 0.2/2.0A	Tap = 2.5A T.D. = 10 Target and Seal-In = 0.2A	0.6 Seconds @ 12A

SUBSTATION A-7

No.	Service	Relay Label	Relay Type	Ct/Pt Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
62	Zig-Zag Grounding Bank Neutral O/C Relay Bank No. 2	51GB-GT2	G.E. IAC	I200-5A Conn. 600-5A	I21AC77B803A	Time O/C = 0.5-4.0A Target and Seal-In = 0.2/2.0A	Tap = 2.5A T.D. = 10 Target and Seal-In = 0.2A	0.6 Seconds @ 12A

SUBSTATION A-8

No	Service	Relay Label	Relay Type	CT/PT Ratio	Model or Serial No.	Relay Characteristics	Relay Settings	Remarks
1 2	230-kV Backup Line Relays A-382 Set #1 and #2	21-82-AB-BC-CA	SEL	1200-5A Conn. 800-5A 2000-IV	SEL-121-G	See the Settings for SEL-121-G Relays		New Set #2 Relay was installed by CENRTC 2F3E0A
3 4	230-kV Backup Line Relays A-386 Set #1 and #2	21-86-AB-BC-CA	SEL	1200-5A Conn. 800-5A 2000-IV	SEL-121-G	See the Settings for SEL-121-G Relays		New Set #2 Relay was installed by CENRTC 2F3E0A
5 6	Relay Numbers Are No Longer Used							
7 8 9	230-kV Backup Line Relays A-388	21-88-AB-BC-CA	SEL	1200-5A Conn. 800-5A 2000-IV	SEL-121-G	See the Settings for SEL-121-G Relays	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
10 11	Relay Numbers Are No Longer Used							
12	230-kV Carrier Tripping Relay A-388	21M-88	G.E. CEY	1200-5A Conn. 800-5A 2000-IV	12CEY52A3D	MHO Unit = 0.5-15 OHM Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
13 14	Relay Numbers Are No Longer Used							
15	230-kV Carrier Starting Relay A-388	68-88	G.E. CEB	1200-5A Conn. 800-5A 2000-IV	12CEB52A9D	MHO Unit = 0.5-15 OHM Off Set MHO = 0-0.25 OHM Max Torque Angle = 75 Degree Target and Seal-In = 0.2/2.0A	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
16 17	Relay Numbers Are No Longer Used							
18	Fault Detector A-388	FD-88	W. KC-4	1200-5A Conn. 800-5A	293B004A14	Phase O/C = 2.0-8.0A Ground O/C = 1.0-4.0A Target and Seal-In = 0.2/2.0A	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.

SUBSTATION A-8

No	Service	Relay Label	Relay Type	CT/PT Ratio	Model or Serial No.	Relay Characteristics	Relay Settings	Remarks
19 20 21 22 23	Relay Numbers Are No Longer Used							
24	230-kV Carrier Auxiliary Relay A-388	85-88	G.E. BCA	-	I2BCA11AV2A	I25V DC, R-RH-MX-GD2X Units, R Coil 300mA, Target = 1.0A	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
25 26	Relay Numbers Are No Longer Used							
27	230-kV Carrier Auxiliary Relay A-388	85X-88	G.E. NAA	-	I2NAA22L12A	I25V DC, RA Coil 300mA.	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
28	Hot Line Supervising Relay A-382	HL-82	G.E. NGV	2000/IV	I2NGV13A18A	I20V AC, Drop-Out 60-90V Pick-Up is Less than 110% of Drop-Out Volts.	Pick-UP = 99V AC Drop-Out = 90V AC	
29	Hot Line Supervising Relay A-386	HL-86	G.E. NGV	2000/IV	I2NGV13A18A	I20V AC, Drop-Out 60-90V Pick-Up is Less than 110% of Drop-Out Volts.	Pick-UP = 99V AC Drop-Out = 90V AC	
30	Hot Line Supervising Relay A-388	HL-88	G.E. NGV	2000/IV	I2NGV13A18A	I20V AC, Drop-Out 60-90V Pick-Up is Less than 110% of Drop-Out Volts.	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
31	Synch. Check Relay A-382	82-Sync	W. CVE-I	2000/IV	292B353A34	I20V, 20-40-60 Degree Closing Angle Adjustment, ICS = 0.2A, SPST-CC, Adjustable Closing Time.	Closing Angle = 40 Degrees T.L. = 0.5 to close the contact 0.5 sec. with 0 degree angle diff.	
32	Synch. Check Relay A-384	84-Sync	W. CVE-I	2000/IV	292B353A34	I20V, 20-40-60 Degree Closing Angle Adjustment, ICS = 0.2A, SPST-CC, Adjustable Closing Time.	Closing Angle = 40 Degrees T.L. = 0.5 to close the contact 0.5 sec., with 0 degree angle diff.	

SUBSTATION A-8

No.	Service	Relay Label	Relay Type	CT/PT Ratio	Model or Serial No.	Relay Characteristics	Relay Settings	Remarks
33	Synch. Check Relay A-386	86-Sync	W. CVE-I	2000/IV	292B353A34	120V, 20-40-60 Degree Closing Angle Adjustment, ICS = 0.2A, SPST-CC, Adjustable Closing Time.	Closing Angle = 40 Degrees T.L. = 0.5 to close the contact 0.5 sec., with 0 degree angle diff.	
34	Synch. Check Relay A-388	88-Sync	W. CVE-I	2000/IV	292B353A34	120V, 20-40-60 Degree Closing Angle Adjustment, ICS = 0.2A, SPST-CC, Adjustable Closing Time.	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
35	Breaker Failure Relay A-382	BFR-82	W. SBF-I	1200-5A Conn. 800-5A	1529F93A05	B.F. Timer = 25-175 ms Control Timer = 150-250 ms Phase O/C = 0.5-13.5A Ground O/C = 0.5-13.5A Target and Seal-In = 0.2/2.0A	B.F. Timer = 133 ms Control Timer = 166 ms Phase O/C = 0.5A Ground O/C = 0.5A Target and Seal-In = 0.2A	
36	Breaker Failure Relay A-384	BFR-84	W. SBF-I	1200-5A Conn. 800-5A	1529F93A05	B.F. Timer = 25-175 ms Control Timer = 150-250 ms Phase O/C = 0.5-13.5A Ground O/C = 0.5-13.5A Target and Seal-In = 0.2/2.0A	B.F. Timer = 133 ms Control Timer = 166 ms Phase O/C = 0.5A Ground O/C = 0.5A Target and Seal-In = 0.2A	
37	Breaker Failure Relay A-386	BFR-86	W. SBF-I	1200-5A Conn. 800-5A	1529F93A05	B.F. Timer = 25-175 ms Control Timer = 150-250 ms Phase O/C = 0.5-13.5A Ground O/C = 0.5-13.5A Target and Seal-In = 0.2/2.0A	B.F. Timer = 133 ms Control Timer = 166 ms Phase O/C = 0.5A Ground O/C = 0.5A Target and Seal-In = 0.2A	
38	Breaker Failure Relay A-388	BFR-88	W. SBF-I	1200-5A Conn. 800-5A	1529F93A05	B.F. Timer = 18-175 ms Control Timer = 150-250 ms Phase O/C = 0.5-13.5A Ground O/C = 0.5-13.5A Target and Seal-In = 0.2/2.0A	B.F. Timer = 133 ms Control Timer = 166 ms Phase O/C = 0.5A Ground O/C = 0.5A Target and Seal-In = 0.2A	
39	230-kV Backup Ground Relay A-382	67GB-82	G.E. JBCG	1200-5A Conn. 800-5A 1150-IV	12JBCG53K11Y	Time O/C = 1.5-6.0A Dir. Inst. O/C = 10-40A Non-Dir. Inst. O/C = 2-8A Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	T/O/C Tap = 4A, TD = 3.0 Dir. Inst. O/C = 21A Non-Dir. Inst. O/C = 4.0A Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	

SUBSTATION A-8

No	Service	Relay Label	Relay Type	CT/PT Ratio	Model or Serial No.	Relay Characteristics	Relay Settings	Remarks
40	230-kV Backup Ground Relay A-386	67GB-86	G.E. JBCG	I200-5A Conn. 800-5A I150-IV	I2JBCG53K11Y	Time O/C = 1.5-6.0A Dir. Inst. O/C = 10-40A Non-Dir. Inst. O/C = 2-8A Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	T/O/C Tap = 4A, TD = 3.0 Dir. Inst. O/C = 21A Non-Dir. Inst. O/C = 4.0A Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	
41	230-kV Backup Ground Relay A-388	67GB-88	G.E. JBCG	I200-5A Conn. 800-5A I150-IV	I2JBCG53M4Y 1A	Time O/C = 1.5-6.0A Dir. Inst. O/C = 2-8A Non-Dir. Inst. O/C = 6-150A Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
42	Relay Numbers Are No Longer Used							
44	230-kV Carrier Ground Relay A-388	67G-88	G.E. CLPG	I200-5A Conn. 800-5A I150-IV	I2CLPGI2C19A	G1 = .8-3.2A, G2 = 1-4A/2-8A GD = 3.6-57.6VA Max Torque Angle = 80 Degree Seal-In = 2.0A Target = 1.0A	Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
45	Relay Number Is No Longer Used							
46 47 48	230-kV Bus No. 1 Diff. Relays	87B1-TH-A-B-C	G.E. PVD	I200-5	I2PVD21B1A	I20V, 60Hz, 87L = 75-500V, 87H = 2-50A, Single-Phase, Target and Seal-In = 0.2/2.0A	87L = 200 Volts 87H = 2.0A Target and Seal-In = 0.2A 87L on High Tap 87H on Low Tap	
49 50 51	230-kV Bus No. 2 Diff. Relays	87B2-TH-A-B-C	G.E. PVD	I200-5	I2PVD21B1A	I20V, 60Hz, 87L = 75-500V, 87H = 2-50A, Single-Phase, Target and Seal-In = 0.2/2.0A	87L = 200 Volts 87H = 2.0A Target and Seal-In = 0.2A 87L on High Tap 87H on Low Tap	
52 53 54	230-kV Bank No. 1 Diff. Relays	87TL1-A-B-C	W. HU-1	600-5 400A H.V. 2000-5 L.V.	290B346A10	Three Winding Restraints, 2.9-8.7A Taps, 30% Slope Non-Adjustable [Slope] Target and Seal-In = 0.2/2.0A	H.V. Tap = 4.6A [Bottom Block] L.V. Tap = 8.7A [Top and Middle Blocks] 30% Slope Target and Seal-In = 0.2A	Replaced 4mf Cap. Cph. Out. Then Replaced Relay Out.

SUBSTATION A-B

No	Service	Relay Label	Relay Type	CT/PT Ratio	Model or Serial No.	Relay Characteristics	Relay Settings	Remarks
55 56 57	230-kV Bank No. 2 Diff. Relays	87TL2-A-B-C	W. HU-1	600-5 400A H.V. 2000-5 L.V.	290B346A10	Three Winding Restraints, 2.9-8.7A Taps, 30% Slope Non-Adjustable [Slope] Target and Seal-In = 0.2/2.0A	H.V. Tap = 4.6A [Bottom Block] L.V. Tap = 8.7A [Top and Middle Blocks] 30% Slope Target and Seal-In = 0.2A	
58 59 60	230-kV Bank No. 1 O/C. Relays	50/51-TH1-A-B-C	W. CO-9	800-5	264C901A03	Time O/C = 0.5-2.5A Inst. O/C = 2.0-48A	Tap = 1A T.D. = 8 Inst. = 6A	1.7 Seconds @ 6A
61 62 63	230-kV Bank No. 2 O/C. Relays	50/51-TH2-A-B-C	W. CO-9	800-5	264C901A03	Time O/C = 0.5-2.5A Inst. O/C = 2.0-48A	Tap = 1A T.D. = 8 Inst. = 6A	1.7 Seconds @ 6A
64	Auto-Reclosing Relay A-382	79-82	G.E. AC-1	-	6070601-G1R		Single-shot reclosing after 6.0 seconds.	
65	Auto-Reclosing Relay A-386	79-86	G.E. AC-1	-	6070601-G1R		Single-shot reclosing after 6.0 seconds.	
66	Auto-Reclosing Relay A-388	79-88	G.E. NLR	-			Relay has been removed from service as part of CENRTC Project #2F3E0A	Relay is no longer in service.
67	230-kV Bank No. 1 Neutral O/C. Relay	51G-TH1	G.E. IAC	600-5	121ACS3B803A	Time O/C = 0.5-4.0A Inst. O/C = 2.0-16A	Time O/C Tap = 2.0A T.L. = 3 Inst. O/C = Blocked.	0.62 Seconds @ 12A
68	230-kV Bank No. 2 Neutral O/C. Relay	51G-TH2	G.E. IAC	600-5	121ACS3B803A	Time O/C = 0.5-4.0A Inst. O/C = 2.0-16A	Time O/C Tap = 2.0A T.L. = 3 Inst. O/C = Blocked.	0.62 Seconds @ 12A
69	Zig-Zag Grounding Bank Neutral O/C Alarm Relay Bank No. 1	50G-GT1	G.E. PJC	600-5	12PJC11D1R	Inst. O/C = 0.5-2.0A	Inst = 0.5A 60 Amps Primary Alarm Only	
600 -5	Zig-Zag Grounding Bank Neutral O/C Alarm Relay Bank No. 2	50G-GT2	G.E. PJC		12PJC11E1A	Inst. O/C = 0.5-2.0A	Inst = 0.5A 60 Amps Primary Alarm Only	

SUBSTATION A-8

No	Service	Relay Label	Relay Type	CT/PT Ratio	Model or Serial No.	Relay Characteristics	Relay Settings	Remarks
400-5	Zig-Zag Grounding Bank O/C Relays Bank No. 1	51-GT1-A-B-C	G.E. IAC		I21AC53B2R	Time O/C = 1.5-6.0A Target and Seal-In = 0.2/2.0A	Tap = 4.0A T.D. = 2 Target and Seal-In = 0.2A No Inst. Setting	0.3 Sec. @ 40A
74 75 76	Zig-Zag Grounding Bank O/C Relays Bank No. 2	51-GT2-A-B-C	G.E. IAC	400-5	I21AC53B1A	Time O/C = 4.0-16A Target and Seal-In = 0.2/2.0A	Tap = 4.0A T.D. = 2 Target and Seal-In = 0.2A Inst = Blocked	0.42 Seconds @ 24A
77	Zig-Zag Grounding Bank Neutral O/C Relay Bank No. 1	51GB-GT1	G.E. IAC	I200-5 600A	I21AC77B803A	Time O/C = 0.5-4.0A Target and Seal-In = 0.2/2.0A	Tap = 2.5A T.D. = 10 Target and Seal-In = 0.2A	17 Seconds @ 5A
78	Zig-Zag Grounding Bank Neutral O/C Relay Bank No. 2	51GB-GT2	G.E. IAC	I200-5 600A	I21AC77B803A	Time O/C = 0.5-4.0A Target and Seal-In = 0.2/2.0A	Tap = 2.5A T.D. = 10 Target and Seal-In = 0.2A	17 Seconds @ 5A
79	Sudden Pressure							

SUBSTATION B3-54

300 AREA

No	Service	Relay Table	Relay Type	CT/PT Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
1 2 3	115-kV Back-Up Line Relays Benton B1116	21- 1B-2B- 3B-BEN	G.E. SLY	1200-5 1000/IV	12SLY81A2D 12SLY81A2D 12SLY81A4D	2D MHO Unit = 0.1-4 Ohm 4D MHO Unit = 0.75-30 Ohm Max Torque Angle = 85 Degree Target and Seal-In = 0.6/2.0A	1st Zone = 1.03 Ohm, 39% Tap 2nd Zone = 1.67 Ohm, 23% Tap 3rd Zone = 26.4 Ohm, 11% Tap Max Torque Angle = 85 Degree Target and Seal-In = 2.0A	Min. Reach Taps 0.4 Ohm [1B-2B Units] 3.0 Ohm [3B-Unit]
4 5 6	115-kV Back-Up Line Relays W.B. B1107	21- 1B-2B- 3B- W.B.	G.E. SLY	1200-5 1000/IV	12SLY81A2D 12SLY81A2D 12SLY81A4D	2D MHO Unit = 0.1-4 Ohm 4D MHO Unit = 0.75-30 Ohm Max Torque Angle = 85 Degree Target and Seal-In = 0.6/2.0A	1st Zone = 1.03 Ohm, 55% Tap 2nd Zone = 1.672 Ohm, 27% Tap 3rd Zone = 5.58 Ohm, 49% Tap Max Torque Angle = 85 Degree Target and Seal-In = 2.0A	Min. Reach Taps 0.4 Ohm [1B-2B Units] 3.0 Ohm [3B-Unit]
7 9 11	115-kV Primary Line Relays Benton B1116	21- 1P-2P- 3P-BEN	G.E. CEY	1200-5 1000/IV	12CEY51A3D 12CEY52A3D 12CEY52A2D	51A3D MHO Unit = .375-15 Ohm 52A3D MHO Unit = .5-15 Ohm 52A2D MHO Unit = 1-30 Ohm Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	1ST Zone = 1.03 Ohm, 71% TAP 2nd Zone = 1.672 Ohm, 88% TAP 3rd Zone = 26.4 Ohm, 11% TAP Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	Min Reach 0.75 Ohm 51- A3D; 1.5 Ohm 52A3D; 3 Ohm 52A2D
8 10 12	115-kV Primary Line Relays W.B. B1107	21- 1P-2P- 3P- W.B.	G.E. CEY	1200-5 1000/IV	12CEY51A3D 12CEY52A3D 12CEY52A2D	51A3D MHO Unit = .375-15 Ohm 52A3D MHO Unit = .5-15 Ohm 52A2D MHO Unit = 1-30 Ohm Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	1ST ZONE = 0.725 Ohm, 49% TAP 2nd Zone = 1.457 Ohm, 99% TAP 3rd Zone = 5.58 Ohm, 46% TAP Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	Min. Reach Tap 0.375 Ohm 5-1A3; 1.5 Ohm 52A3D; 3 Ohm 52A2D
13	Synch. Check Relay Benton B1116	BEN- SYNC	G.E. IJS	1000/IV	12IJS52D3A	115V, 20- 30- 40- 60-degree closing angle adjustment, adjustable closing time.	Closing Angle = 20 Degree T.L. = 1.0 to close the contact in less than 3 seconds with 0 degree angle diff.	
14	Synch. Check Relay Tie B1113	TIE- SYNC	G.E. IJS	1000/IV	12IJS52D3A	115V, 20- 30- 40- 60-degree closing angle adjustment, adjustable closing time.	Closing Angle = 20 Degree T.L. = 1.0 to close the contact in less than 3 seconds with 0 degree angle diff.	
15	Synch. Check Relay W.B. B1107	W.B.- SYNC	G.E. IJS	1000/IV	12IJS52D3A	115V, 20- 30- 40- 60-degree closing angle adjustment, adjustable closing time.	Closing Angle = 20 Degree T.L. = 1.0 to close the contact in less than 3 seconds with 0 degree angle diff.	
16 18	U/V Relays Benton B1116	27-1 27-2 BEN	G.E. NGV	1000/IV	12NGV11B15A	120V AC, Drop-Out 70-100V pick-up is less than 110% of drop-out volts.	Pick-Up = 99V AC DROP- OUT = 90V AC	

SUBSTATION B3-S4

300 AREA

No.	Service	Relay Table	Relay Type	CT/PT Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
17 19	U/Y Relays W.B. B1107	27-1 27-2 W.B.	G.E. NGV	1000/1V	I2NGV11B15A	120V AC, drop-out 70-100V pick-up is less than 110% of drop-out volts.	Pick-Up = 99V AC Drop-Out = 90V AC	
20	Fault Detector Breaker Fail. Scheme Bank-1	FD- BFR- T1	G.E. NHC	600-5	I2NHC11A1A	3-Phase, 1.0A Fixed Settings Target = 0.2/2.0A	3-Phase, 1.0A Fixed Settings [120A Primary] Target = 0.2 A	
21	Fault Detector Breaker Fail. Scheme Bank-2	FD- BFR- T2	G.E. NHC		I2NHC11A1A	3-Phase, 1.0A Fixed Settings Target = 0.2/2.0A	Removed from Service \$ Reference ECN 602514 Reference ECN 602515	Removed from Service
22	Fault Detector Breaker Fail. Scheme Bank-3	FD- BFR- T3	G.E. NHC		I2NHC11A1A	3-Phase, 1.0A Fixed Settings Target = 0.2/2.0A	Removed from Service \$ Reference ECN 602514 Reference ECN 602515	Removed from Service
23	Fault Detector Breaker Fail. Scheme Bank-6	FD- BFR- T6	G.E. NHC	1200-5	I2NHC11A1A	3-Phase, 1.0A Fixed Settings Target = 0.2/2.0A	3-Phase, 1.0A Fixed Settings [240A Primary] Target = 0.2 A	
24	Fault Detector Breaker Fail. Scheme Bank-7	FD- BFR- T7	G.E. NHC	1200-5	I2NHC11A1A	3-Phase, 1.0A Fixed Settings Target = 0.2/2.0A	3-Phase, 1.0A Fixed Settings [240A Primary] Target = 0.2 A	
25	Fault Detector Breaker Fail. Scheme Benton B1116	FD- BFR- BEN	W.	600-5	293B004A14	Phase O/C = 2.0-8.0A Ground O/C = 1.0-4.0A Target and Seal-In = 0.2/2.0A	Phase O/C = 4.0A Ground O/C = 1.0A Target and Seal-In = 0.2A	
26	Fault Detector Breaker Fail. Scheme W.B. B1107	FD- BFR- W.B.	W. KC-4	600-5	293B004A14	Phase O/C = 2.0-8.0A Ground O/C = 1.0-4.0A Target and Seal-In = 0.2/2.0A	Phase O/C = 4.0A Ground O/C = 1.0A Target and Seal-In = 0.2A	
27	Circuit Switcher Trip Blocking Bank-1	SO- T1	G.E. PJC	600-5	I2PJC32B78A	Inst. O/C = 20-80 A Target and Seal-In = 0.2/2.0A	Inst. O/C = 50 A 6000 A Primary Target and Seal-In = 0.2A	
28	Circuit Switcher Trip Blocking Bank-2	SO- T2	G.E. PJC		I2PJC32B78A	Inst. O/C = 20-80 A Target and Seal-In = 0.2/2.0A	Removed from Service Reference ECN 602514 Reference ECN 602515	Removed from Service
29	Circuit Switcher Trip Blocking Bank-3	SO- T3	G.E. PJC		I2PJC32B78A	Inst. O/C = 20-80 A Target and Seal-In = 0.2/2.0A	Removed from Service Reference ECN 602514 Reference ECN 602515	Removed from Service

SUBSTATION B3-S4

300 AREA

No.	Service	Relay Table	Relay Type	CT/PT Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
30	Circuit Switcher Trip Blocking Bank-6	50-T6	G.E. PJC	I200-5	I2PJ32B78A	Inst. O/C = 20-80 A Target and Seal-In = 0.2/2.0A	Inst. O/C = 25 A 6000 A Primary Target and Seal-In = 0.2A	
31	Circuit Switcher Trip Blocking Bank-7	50-T7	G.E. PJC	I200-5	I2PJ32B78A	Inst. O/C = 20-80 A Target and Seal-In = 0.2/2.0A	Inst. O/C = 25 A 6000 A Primary Target and Seal-In = 0.2A	
32	Fault Detector for Primary Dist. Relays Benton B1116	FD-PRI-BEN	G.E. PJC	I200-5	I2PJ32C34A	Inst. O/C = 1-4 A Target and Seal-In = 0.2/2.0A	Inst. O/C = 1.2 A 288 A Primary Target and Seal-In = 2.0A	
33	Fault Detector for Primary Dist. Relays W.B. B1107	FD-PRI-W.B.	G.E. PJC	I200-5	I2PJ32C34A	Inst. O/C = 1-4 A Target and Seal-In = 0.2/2.0A	Inst. O/C = 1.8 A 432 A Primary Target and Seal-In = 2.0A	
34	Fault Detector for B.U. Dist. Relays Benton B1116	FD-B.U.-BEN	G.E. PJC	I200-5	I2PJ32C34A	Inst. O/C = 1-4 A Target and Seal-In = 0.2/2.0A	Inst. O/C = 1.2 A 288 A Primary Target and Seal-In = 2.0A	
35	Fault Detector for B.U. Dist. Relays W.B. B1107	FD-B.U.-W.B.	G.E. PJC	I200-5	I2PJ32C34A	Inst. O/C = 1-4 A Target and Seal-In = 0.2/2.0A	Inst. O/C = 1.8 A 432 A Primary Target and Seal-In = 2.0A	
36 37 38	115-kV Bank No. 1 O/C. Relays	51-T1	G.E. IAC	600-5	I2IAC77A801A	Time O/C = 0.5-4 A Target and Seal-In = 0.2/2.0A	Time O/C = 2 A T.D. = 6 Target and Seal-In = 0.2A	1.15 sec @ 10 A
39 40 41	115-kV Bank No. 2 O/C. Relays	51-T2	G.E. IAC	I200-5	I2IAC77A801A	Time O/C = 0.5-4 A Target and Seal-In = 0.2/2.0A	Time O/C = 0.5 A T.D. = 6 Target and Seal-In = 0.2A	0.35 sec @ 5.0 A
42 43 44	115-kV Bank No. 3 O/C. Relays	51-T3	G.E. IAC	600-5	I2IAC77A801A	Time O/C = 0.5-4 A Target and Seal-In = 0.2/2.0A	Time O/C = 2 A T.D. = 6 Target and Seal-In = 0.2A	0.33 sec @ 10 A
45 46 47	115-kV Bank No. 6 O/C. Relays	51-T6	G.E. IAC	I200-5	I2IAC77A801A	Time O/C = 0.5-4 A Target and Seal-In = 0.2/2.0A	Time O/C = 0.5 A T.D. = 6 Target and Seal-In = 0.2A	0.35 sec @ 5.0 A

SUBSTATION B3-S4

300 AREA

No	Service	Relay Table	Relay Type	CT/PT Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
48 49 50	115-kV Bank No. 7 O/C. Relays	51- T7	G.E. IAC	I200-5	I21AC77A801A	Time O/C = 0.5-4 A Target and Seal-In = 0.2/2.0A	Time O/C = 0.5 A T.D. = 6 Target and Seal-In = 0.2A	0.35 sec @ 5.0 A
51 52 53	115-kV Bank No. 2 B.U. O/C. Relays	51B- T2	G.E. IAC	I200-5	I21AC77A801A	Time O/C = 0.5-4 A Target and Seal-In = 0.2/2.0A	Time O/C = 0.5 A T.D. = 6 Target and Seal-In = 0.2A	0.35 sec @ 5.0 A
54	Timer for Primary Dist. Relays Benton B1116	62P- BEN	G.E. SAM	-	I2SAM16A12A	2nd Zone = 0.05-3 Seconds 3rd Zone = 0.05-3 Seconds	2nd Zone = 0.30 Seconds 3rd Zone = 2 Seconds	
55	Timer for Primary Dist. Relays W.B. B1107	62P- W.B.	G.E. SAM	-	I2SAM16A12A	2nd Zone = 0.05-3 Seconds 3rd Zone = 0.05-3 Seconds	2nd Zone = 0.30 Seconds 3rd Zone = 1.5 Seconds	
56	Timer for B.U. Dist. Relays Benton B1116	62B- BEN	G.E. SAM	-	I2SAM16A12A	2nd Zone = 0.05-3 Seconds 3rd Zone = 0.05-3 Seconds	2nd Zone = 0.30 Seconds 3rd Zone = 2 Seconds	
57	Timer for B.U. Dist. Relays W.B. B1107	62B- W.B.	G.E. SAM	-	I2SAM16A12A	2nd Zone = 0.05-3 Seconds 3rd Zone = 0.05-3 Seconds	2nd Zone = 0.30 Seconds 3rd Zone = 1.5 Seconds	
58	Timer for Breaker Fail. Scheme Bank-1	62- BFR-T1	G.E. SAM	-	I2SAM11A22A	Timer Range = 0.05-3 Seconds	Time = 0.2 Seconds	
59	Timer for Breaker Fail. Scheme Bank-2	62- BFR-T2	G.E. SAM	-	I2SAM11A22A	Timer Range = 0.05-3 Seconds	Removed from Service Reference ECN 602514 Reference ECN 602515	Removed from Service
60	Timer for Breaker Fail. Scheme Bank-3	62- BFR-T3	G.E. SAM	-	I2SAM11A22A	Timer Range = 0.05-3 Seconds	Removed from Service Reference ECN 602514 Reference ECN 602515	Removed from Service
61	Timer for Breaker Fail. Scheme Bank-6	62- BFR-T6	G.E. SAM	-	I2SAM11A22A	Timer Range = 0.05-3 Seconds	Time = 0.2 Seconds	
62	Timer for Breaker Fail. Scheme Bank-7	62- BFR-T7	G.E. SAM	-	I2SAM11A22A	Timer Range = 0.05-3 Seconds	Timer = 0.2 Seconds	
63	Timer for Breaker Fail. Scheme Benton B1116	62- BFR- BEN	G.E. SAM	-	G.E. Special Relay 0178A8954GP3	Timer 2 = 0.03-1 Seconds Timer 3 = 0.03-1 Seconds	Timer 2 = 0.165 Seconds Timer 3 = 0.165 Seconds	Make sure to check Contact position post-maint.

SUBSTATION B3-S4

300 AREA

No	Service	Relay Table	Relay Type	CT/PT Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
64	Timer for Breaker Fail. Scheme W.B. B1107	62-BFR-W.B.	G.E. SAM	-	G.E. Special Relay 0178A8954GP3	Timer 2 = 0.03-1 Seconds Timer 3 = 0.03-1 Seconds	Timer 2 = 0.165 Seconds Timer 3 = 0.165 Seconds	Make sure to check Contact position post-maint.
65	115-kV PRIMARY Ground Relay Benton B1116	67GP-BEN	G.E. JBCG	1200-5 1000/IV	12JBCG53M2Y	Time O/C = 0.5-12A Dir. Inst. O/C = 10-80A Non-Dir. Inst. O/C = 6-150A Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	T/O/C TAP = 0.5A, T.L. = 4.25 Dir. Inst. O/C = 29A Non-Dir. Inst. O/C = 8.5A Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	0.61 sec @ 5.0 A
66	115-kV PRIMARY Ground Relay W.B. B1107	67GP-W.B.	G.E. JBCG	1200-5 1000/IV	12JBCG53M2Y	Time O/C = 0.5-12A Dir. Inst. O/C = 10-80A Non-Dir. Inst. O/C = 6-150A Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	T/O/C TAP = 0.5A, T.L. = 4 Dir. Inst. O/C = 13A Non-Dir. Inst. O/C = 6.0A Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	0.45 sec @ 10.0 A
67	115-kV Backup Ground Relay Benton B1116	67GB BEN	G.E. JBCG	1200-5 1000/IV	12JBCG53M2Y	Time O/C = 0.5-12A Dir. Inst. O/C = 10-80A Non-Dir. Inst. O/C = 6-150A Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	T/O/C TAP = 0.5A, T.L. = 4.25 Dir. Inst. O/C = 29A Non-Dir. Inst. O/C = 8.5A Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	0.61 sec @ 5.0 A
68	115-kV Backup Ground Relay W.B. B1107	67GB-W.B.	G.E. JBCG	1200-5 1000/IV	12JBCG53M2Y	Time O/C = 0.5-12A Dir. Inst. O/C = 10-80A Non-Dir. Inst. O/C = 6-150A Max Torque Angle = 60 Degree Target and Seal-In = 0.2/2.0A	T/O/C TAP = 0.5A, T.L. = 4 Dir. Inst. O/C = 13A Non-Dir. Inst. O/C = 6A Max Torque Angle = 60 Degree Target and Seal-In = 2.0A	0.45 sec @ 10.0 A
69	Automatic Reclosing Relay Benton B1116	79-BEN	G.E. NSR	-	12NSR21G2A		Single-Shot Reclosing After 1.5 Seconds	
70	Auto. Reclosing Relay W.B. B1107	79-W.B.	G.E. NSR	-	12NSR21G2A		Single-Shot Reclosing After 1.5 Seconds	
71 72 73	115-kV Bus No. 1 DIFF. Relays	87B1-A-B-C	G.E. PVD	1200-5	12PVD21D1A	120V, 60 Hz, 87L = 75-500V, 87H = 2-50A, Single-Phase, Target and Seal-In = 0.2/2.0A	87L = 500 Volts 87H = 40 Amps Target and Seal-In = 0.2 A	Set Tap @ 87L = High 87H = Low

SUBSTATION B3-S4

300 AREA

No	Service	Relay Table	Relay Type	CT/PT Ratio	Model or Style No.	Relay Characteristics	Relay Settings	Remarks
74 75 76	115-kV Bus No. 2 DIFF. Relays	87B2- A-B-C	G.E. PVD	1200-5	12PVD21D1A	120V, 60 Hz, 87L = 75-500V, 87H = 2-50A, Single-Phase, Target and Seal-In = 0.2/2.0A	87L = 255 VOLTS 87H = 4.0 AMPS Target and Seal-In = 0.2 A	Set Tap @ 87L = High 87H = Low
77 78 79	Transformer Diff. Relay Bank-1	87- T1	G.E. BDD	200-5 H.V. 1000-5 L.V.	12BDD16B11A	Three Winding Restraints, 2.9-8.7A Taps, 15-25-40% Sensitivity Adjustments [Slope],	H.V. TAP = 2.9A L.V. TAP = 8.7A SLOPE = 25%	
80 81 82	Transformer Diff. Relay Bank-3	87- T3	G.E. BDD	100-5 H.V. 1500-5 L.V.	12BDD16B11A	Three Winding Restraints, 2.9-8.7A Taps, 15-25-40% Sensitivity Adjustments [Slope],	H.V. TAP = 5.0A L.V. TAP = 5.0A SLOPE = 25%	
83 84 85	Transformer Diff. Relay Bank-6	87- T6	G.E. BDD	200-5 H.V. 2000-5 L.V.	12BDD16B11A	Three Winding Restraints, 2.9-8.7A Taps, 15-25-40% Sensitivity Adjustments [Slope],	H.V. TAP = 3.2A L.V. TAP = 8.7A SLOPE = 25%	
86 87 88	Transformer Diff. Relay Bank-7	87- T7	G.E. BDD	200-5 H.V. 2000-5 L.V.	12BDD16B11A	Three Winding Restraints, 2.9-8.7A Taps, 15-25-40% Sensitivity Adjustments [Slope],	H.V. TAP = 3.2A L.V. TAP = 8.7A SLOPE = 25%	

100KW AREA

[illegible]

SUBSTATION A-8 251W

Service	Breaker or Cubicle No.	CKT FLI Amps	CT Ratio	Phase Or Ground	Mfr	Type	Model or Style No.	Time O/C Range	Inst Range	Tap	Primary Amps	Time Dial	Test Amps	Time in Sec.	Inst	Primary Amps
Incoming Breaker Bus No. 1	C8X100	785	1200-5	Phase	ABB	CO-11	265C047A07	1-12	6-144	6	1400	5	36	0.9	-	-
Incoming Breaker Bus No. 2	C8X200	785	1200-5	Phase	ABB	CO-11	265C047A07	0.5-2.5	-	0.8	192	8	6.4	0.9	-	-
Bus Tie Breaker	C8X100	785	1200-5	Ground	ABB	CO-11	265C047A07	1-12	6-144	6	1400	5	36	0.9	-	-
Line C8L1 Feeder to Bligs	C8X1		300-5	Ground	ABB	CO-11	265C047A07	0.5-2.5	-	0.8	192	8	6.4	0.9	-	-
791Z 234-57				Ground	ABB	CO-11	265C047A07	1-12	6-144	5	1200	4	20	1.5	-	-
Line C8L1 Feeder to Bligs	C8X2		300-5	Phase	ABB	CO-11	265C047A07	0.5-2.5	-	0.6	180	6	6	0.5	-	-
791Z 234-57				Ground	ABB	CO-11	265C047A07	1-12	6-144	10	600	4	30	2.8	40	2400
Line C8L1 Feeder to Bligs	C8X3		300-5	Phase	ABB	CO-11	265C047A07	0.5-2.5	-	1.5	90	2	7.5	0.5	-	-
2240A, 221T, 252W, 202S				Ground	ABB	CO-11	265C047A07	1-12	6-144	10	600	4	30	2.8	40	2400
Line C8L1 Feeder to Bligs	C8X4		300-5	Phase	ABB	CO-11	265C047A07	0.5-2.5	-	1.5	90	2	7.5	0.5	-	-
792A 218-272BW				Ground	ABB	CO-11	265C047A07	1-12	6-144	10	600	4	30	2.8	40	2400
Line C8L1 Feeder to Bligs	C8X5		300-5	Phase	ABB	CO-11	265C047A07	0.5-2.5	-	1.5	90	2	7.5	0.5	-	-
252E 252N, 241AN, 221B				Ground	ABB	CO-11	265C047A07	1-12	6-144	10	600	4	30	2.8	40	2400
Line C8L1 Feeder to Bligs	C8X7		300-5	Phase	ABB	CO-11	265C047A07	0.5-2.5	-	1.5	90	2	7.5	0.5	-	-
2101N, 255B, 252E, 221B				Ground	ABB	CO-11	265C047A07	1-12	6-144	10	600	4	30	2.8	40	2400
Line C8L8 Feeder	C8X8		300-5	Phase	ABB	CO-11	265C047A07	0.5-2.5	-	1.5	90	6	7.5	1.5	-	-
702A				Ground	ABB	CO-11	265C047A07	1-12	6-144	10	600	4	30	2.8	40	2400
Line C8L9 Feeder to PUD, BWIP	C8X9		300-5	Phase	ABB	CO-11	265C047A07	0.5-2.5	-	1.5	90	2	7.5	0.5	-	-
Line C8L15 Feeder	C8X15		300-5	Ground	ABB	CO-11	265C047A07	0.5-2.5	-	1.5	90	2	7.5	0.5	-	-
13.8 kV Bus Differential			2000-5	Phase	ABB	CO-11	265C047A07	1-12	6-144	12	600	7	48	2.7	80	4800
Bus No. 1				Ground	ABB	CO-11	265C047A07	0.5-2.5	-	2.0	120	2.5	10	0.6	-	-
13.8 kV Bus Differential			2000-5	Ground	ABB	KAB	6668037A12									
Bus No. 2					ABB	KAB	6668037A22									
Reclosing Relays					ABB	ACN										
C8X1-2-3-4-5-6-7-8-9-15																
Neg. Sequence and Low-Voltage Relay Bus No. 2					ABB	CIQ	293B146A09									

87L = 75 Volts; 87H = 3 Amps

87L = 75 Volts; 87H = 3 Amps

Single-Shot Reclosing After 15 Seconds (Motor connected 120 Vac)

Voltage Tap = 93 V; Polar Unit = 5%; Time Dial = 6

*Blocked

Service	Breaker or Cubicle No.	hp or KVA	CKT FLI Amps	CT Ratio	Phase or Ground	Mfr	Type	Model or Style No.	Time O/C Range	Inst Range	Tap	Primary Amps	Time Dial	Inst	Primary Amps	Setting Notes
Incoming Breaker Bank No. 1	C3X100 F/R	12 MVA	500	1000-5	Phase	G.E.	IAC	I2IACS3A101A	4-16	-	4	800	9	-	-	
					Ground	G.E.	IAC	I2IAC77B803A	0.5-4	2-16	4	800	10	*	-	
Incoming Breaker Bank No. 2	C3X200 F/R	6 MVA	250	600-5	Phase	G.E.	IAC	I2IACS3A101A	4-16	-	5	600	10	-	-	
					Ground	G.E.	IAC	I2IAC77B803A	0.5-4	2-16	4	480	10	*	-	
Incoming Breaker Bank No. 3	C3X300 F/R	12 MVA	500	1500-5	Phase	G.E.	IAC	I2IACS3A2A	1.5-6	-	3	900	10	-	-	
					Ground	G.E.	IAC	I2IAC77B803A	0.5-4	2-16	3	900	10	*	-	
C3L1	C3X1			600-5	Phase	G.E.	IAC	I2IACS3B104A	4-16	-	4	480	9	-	-	Coordinate 200E fuse
					Ground	G.E.	IAC	I2IAC77B803A	0.5-4	2-16	4	480	7	*	-	
C3L2	C3X2			600-5	Phase	G.E.	IAC	I2IACS3B104A	4-16	-	4	480	9	-	-	Coordinate 200E fuse
					Ground	G.E.	IAC	I2IAC77B803A	0.5-4	2-16	4	480	7	*	-	
C3L3	C3X3			600-5	Phase	G.E.	IAC	I2IACS3B104A	4-16	-	4	480	9	-	-	Coordinate 200E fuse
					Ground	G.E.	IAC	I2IAC77B803A	0.5-4	2-16	4	480	7	*	-	
C3L4	C3X4			600-5	Phase	G.E.	IAC	I2IACS3B811A	1.5-12	10-80	4	480	9	*	-	Coordinate 200E fuse
					Ground	G.E.	IAC	I2IAC77B803A	0.5-4	2-16	4	480	7	*	-	
C3L5 Emergency Backup to FFTF	C3X5			300-5	Phase	G.E.	IAC	I2IACS3B2R	1.5-12	10-40	6	360	10	30	1800	Automatic Reclose
					Ground	G.E.	IAC	I2IAC77B803A	0.5-4	2-16	2	120	5	20	1200	
C3L6	C3X6			600-5	Phase	G.E.	IAC	I2IACS3B811A	1.5-12	10-80	4	480	9	*	-	Coordinate 200E fuse
					Ground	G.E.	IAC	I2IACS3B811A	1.5-12	10-80	4	480	2	*	-	
C3L7	C3X7			600-5	Phase	G.E.	IFC	I2IFC3B1A	1-12	6-150	4	480	9	*	-	Coordinate 200E fuse
					Ground	G.E.	IFC	I2IFC77B2A	0.5-4	2-50	4	480	7	*	-	
C3L8	C3X8			300-5	Phase	G.E.	IFC	I2IFC3B1A	1-12	6-150	8	480	9	*	-	Coordinate 200E Fuse
					Ground	G.E.	IFC	I2IFC77B2A	0.5-4	2-50	4	240	10	*	-	
Directional O/CRLY Incoming Breaker Bank No. 1				1000-5 14400-120V	Phase	G.E.	IBC	I2IBCS1E7A	4-16	-	4	800	1			
				Ground												
Directional O/CRLY Incoming Breaker Bank No. 2				600-5 14400-120V	Phase	G.E.	IBC	I2IBCS1E7A	4-16	-	4	480	1			
				Ground												
Ground Backup O/C Relay Bank No. 1					Phase	G.E.	IAC	I2IAC77B803A~	0.5-4	2-16	4		7			
					Ground											
Ground Backup O/C Relay Bank No. 3					Phase	G.E.	IAC	I2IAC77B803A~	0.5-4	2-16	4		7			
					Ground											

SUBSTATION B3-S4

300 AREA

Service	Breaker or Cubicle No.	hp or KVA	CKT FLI Amps	CT Ratio	Phase or Ground	Mfr	Type	Model or Style No.	Time O/C Range	Inst Range	Tap	Primary Amps	Time Dial	Inst	Primary Amps	Setting Notes
Bus Differential Relays Bus No. 1 [Front]				2000-5	West. Ca, Single-Phase, 60-Hz, Constant Percentage Differential, 10% Slope. Style # 1271001A						Fixed Setting, Min. Trip Amp. = 0.18A @ 10% Slope.					
Bus Differential Relays Bus No. 2 [Rear]				2000-5	West. Ca, Single-Phase, 60-Hz, Constant Percentage Differential, 10% Slope. Style # 1271001A						Fixed Setting, Min. Trip Amp. = 0.18A @ 10% Slope.					
Bus U/V. Relays Bus No. 1 [Front]					27-1, 27-2, Bus-1, West. CV, 120-V AC, 60-Hz 50-140 V. Tap Range. Style # 1545600						60-V. Tap, Time Dial = 10					
BUS U/V. Relays Bus No. 2 [Rear]					27-1, 27-2, Bus-2, West. CV, 120-V AC, 60-Hz 50-140 V. Tap Range. Style # 1545600						60-V. Tap, Time Dial = 10					
Recloser on Line C3XS	C3XS					G.E.	ACR	12ACR11B14A								

* Instantaneous element is blocked.

Substation C3-3
300 Area

Service	Breaker or Cubicle No.	CT Ratio	Phase or Ground	Mfr	Type	Model or Style No.	Time O/C Range	Inst Range	Tap	Primary Amps	Time Dial	Inst.	Primary Amps	Setting Notes
Incoming Breaker C3L3	C3X91 F/R	600-5	Phase	G.E.	IAC	I2IAC53A2A	1.5 - 6	-	3	360	4	-	-	
			Ground	W.	CO	I338968A	0.5 - 2.5	10 - 40	2	240	0.5	-	-	
Incoming Breaker C3L4	C3X92 F/R	1500-5	Phase	G.E.	IAC	I2IAC53A2A	1.5 - 6	-	1	300	4	-	-	
			Ground	W.	CO	I271197A	0.5 - 2.5	-	0.8	240	0.5	-	-	
Incoming Breaker C3L6	C3X97 F/R	600-5	Phase	G.E.	IAC	I2IAC53B811A	1.5 - 12	10 - 80	3	360	4	*	-	
			Ground	G.E.	IAC	I2IAC53B811A	1.5 - 12	10 - 80	2	240	0.5	*	-	
Feeder to C3-511 [3621D]	C3X90	200-5	Phase	G.E.	IAC	I2IAC53B127A	4 - 16	20 - 80						Relay has been deactivated.
			Ground	W.	CO	I338968A	0.5 - 2.5	10 - 40						Relay has been deactivated.
Feeder to C3-59 [337]	C3X94	200-5	Phase	G.E.	IAC	I2IAC53B26A	1.5 - 6	20 - 80						Relay has been deactivated.
			Ground	W.	CO	I338968A	0.5 - 2.5	10 - 40						Relay has been deactivated.
Feeder to C3-59 [337]	C3X95	200-5	Phase	G.E.	IAC	I2IAC53B26A	1.5 - 6	20 - 80						Relay has been deactivated.
			Ground	W.	CO	I338968A	0.5 - 2.5	10 - 40						Relay has been deactivated.
Feeder to C3-59 [337]	C3X96	200-5	Phase	G.E.	IAC	I2IAC53B26A	1.5 - 6	20 - 80						Relay has been deactivated.
			Ground	W.	CO	I338968A	0.5 - 2.5	10 - 40						Relay has been deactivated.
Feeder to C3-4 (EETF), C3-513 [FMIT]	C3X98	300-5	Phase	G.E.	IAC	I2IAC53B104A	4 - 16	20 - 80						Relay has been deactivated.
			Ground	W.	CO	I338968A	0.5 - 2.5	10 - 40						Relay has been deactivated.
Feeder to C3-56 [331]	C3X99	200-5	Phase	G.E.	IAC	I2IAC53B811A	1.5 - 12	20 - 80						Relay has been deactivated.
			Ground	W.	CO	I338968A	0.5 - 2.5	10 - 40						Relay has been deactivated.
13.8-kV Bus Differential Bus No. 1 Rear Bus		2000-5		W.	CA-6	I543525								
13.8-kV Bus Differential Bus No. 2 Front Bus		2000-5		W.	CA-6	I543525								
Incoming Breaker Directional O/C C3L6	C3X97F/R	600-5	Phase	G.E.	IBC	I2IBC53K3Y1A	4 - 16	20 - 80						Relay has been deactivated.
			Ground	W.	IRQ-9	774B238A14	2 - 6	10 - 40						Relay has been deactivated.
Incoming Breaker Directional O/C C3L3	C3X91F/R	600-5	Phase	G.E.	IBC	I2IBC53K2A	1.5 - 6	-						Relay has been deactivated.
			Ground											Relay has been deactivated.
Incoming Breaker Directional O/C 3CL4	C3X92F/R	1500-5	Phase	W.	IRQ-9	774B238A14	2 - 6	10 - 40						Relay has been deactivated.
			Ground											Relay has been deactivated.

- INSTANTANEOUS ELEMENT IS BLOCKED
- OVERCURRENT RELAYS ON C3X90, C3X95, C3X98 & C3X99 HAVE BEEN DEACTIVATED. PROTECTION FOR THESE FEEDERS IS PROVIDED BY THE MAIN INCOMER BREAKERS. REFERENCE WHC-SD-TI-013
- DIRECTIONAL OVERCURRENT RELAYS ON C3X91, C3X92, AND C3X97 HAVE BEEN DEACTIVATED

SUBSTATION C3-S4
300 AREA

Service	Breaker or Cubicle No.	CT Ratio	Phase or Ground	Mfr	Type	Model or Style No.	Time O/C Range	Inst Range	Tap	Primary Amps	Time Dial	Inst	Primary Amps
Incoming Breaker [C3L1]	C3X131	600-5	Phase	G.E.	IFC	I21FC53B1A	1-12	6-150			Relay has been deactivated		
			Ground	G.E.	IFC	I21FC53B2A	0.5-4.0	2-50			Relay has been deactivated		
Incoming Breaker [C3L2]	C3X138	600-5	Phase	G.E.	IFC	I21FC53B1A	1-12	6-150			Relay has been deactivated		
			Ground	G.E.	IFC	I21FC53B2A	0.5-4.0	2-50			Relay has been deactivated		
Incoming Breaker [C3L3]	C3X139	600-5	Phase	G.E.	IFC	I21FC53B1A	1-12	6-150			Relay has been deactivated		
			Ground	G.E.	IFC	I21FC53B2A	0.5-4.0	2-50			Relay has been deactivated		
Bus Tie Breaker	C3X135	600-5	Phase	G.E.	IFC	I21FC53B1A	1-12	6-150			Relay has been deactivated		
			Ground	G.E.	IFC	I21FC53B2A	0.5-4.0	2-50			Relay has been deactivated		
Feeder to C3L133	C3X133	200-5	Phase	G.E.	IFC	I21FC53B1A	1-12	6-150	8	200	5	*	-
			Ground	G.E.	IFC	I21FC53B2A	0.5-4.0	2-50	3	120	2	*	-
Feeder to C3L137	C3X137	200-5	Phase	G.E.	IFC	I21FC53B1A	1-12	6-150	8	200	5	*	-
			Ground	G.E.	IFC	I21FC53B2A	0.5-4.0	2-50	3	120	2	*	-
Spare Feeder Breaker	C3X132	600-5	Phase	G.E.	IFC	I21FC53B1A	1-12	6-150	-	-	-	-	-
			Ground	G.E.	IFC	I21FC53B2A	0.5-4.0	2-50	-	-	-	-	-
Feeder to C3I134	C3X134	600-5	Phase	G.E.	IFC	I21FC53B1A	1-12	6-150	3	360	4	*	-
			Ground	G.E.	IFC	I21FC53B2A	0.5-4.0	2-50	1	120	2	*	-
Feeder to C3I136	C3X136	600-5	Phase	G.E.	IFC	I21FC53B1A	1-12	6-150	3	360	4	*	-
			Ground	G.E.	IFC	I21FC53B2A	0.5-4.0	2-50	1	120	2	*	-
13.8-kV Bus Differential Relays Bus Nos. 1 and 2	1B and 7B	1200-5	Bus	G.E.	PVD	I2PVD21B1A	87L = 150 Volts Target = 0.2 A						
			Diff.	G.E.	PVD	I2PVD21B1A							

* Blocked instantaneous element.

Note: Overcurrent relays on breakers C3X131, C3X135, C3X138, and C3X139 have been deactivated. Switchgear protection is provided by the relays at the B3-S4 and C3-S4 differential relays. Reference WHC-SD-LL-TI-013.

2.4 KV RELAY SETTINGS

SUBSTATION C8-S1

200W AREA; 252-W BLDG.

Service	Breaker or Cubicle No.	hp or KVA	CKT FLI Amps	CT Ratio	Phase or Ground	Mfr	Type	Model or Style No.	Time O/C Range	Inst Range	Tap	Primary Amps	Time Dial	Test Amps	Time In Sec.	Inst	Primary Amps
Incoming Breaker Bus No. 1	E8X4	3125 KVA	752	1000-5	PHASE	G.E.	IAC	I2IACS1B802A	2-16	0.5-40	6	1200	5	24	2.1	*	-
					GROUND	-	-	-	-	-	-	-	-	-	-	-	-
Incoming Breaker Bus No. 2	E8X6	3125 KVA	752	1000-5	PHASE	G.E.	IAC	I2IACS1B802A	2-16	0.5-40	6	1200	5	24	2.1	*	-
					GROUND	-	-	-	-	-	-	-	-	-	-	-	-
Bus Tie Breaker	E8X5			1000-5	PHASE	G.E.	IAC	I2IACS1B802A	2-16	0.5-40	6	1200	5	24	2.1	*	-
					GROUND	-	-	-	-	-	-	-	-	-	-	-	-
Feeder to Bldgs. 282-W/283-W	E8X1			500-5	PHASE	G.E.	IAC	I2IACS1B806A	2-16	10-80	10	1000	2	30	1	*	-
					GROUND	-	-	-	-	-	-	-	-	-	-	-	-
Feeder to Bldgs. 282-W/283-W	E8X9			400-5	PHASE	G.E.	IAC	I2IACS1B806A	2-16	10-80	12	960	2	36	1	*	-
					GROUND	-	-	-	-	-	-	-	-	-	-	-	-
Feeder to Emergency Power House	E8X3			500-5	PHASE	G.E.	IAC	I2IACS1B806A	2-16	10-80	5	500	5	20	2.1	*	-
					GROUND	-	-	-	-	-	-	-	-	-	-	-	-
Feeder to Emergency Power House	E8X8			500-5	PHASE	G.E.	IAC	I2IACS1B806A	2-16	10-80	5	500	5	20	2.1	*	-
					GROUND	-	-	-	-	-	-	-	-	-	-	-	-

* Block All Inst. Elements

2.4-kV RELAY SETTINGS**SUBSTATION C8-S3****200E AREA; 252-E BLDG.**

Service	Breaker or Cubicle No	hp or Kva	CKT FLI Amps	CT Ratio	Phase or Ground	Mfr	Type	Model or Style No.	Time O/C Range	Inst Range	Tap	Primary Amps	Time Dial	Test Amps	Time In Sec.	Inst	Primary Amps
Incoming Breaker Bus No. 1	E8X56	2500 3125	601 752	1000-5	Phase	G.E.	IAC	I21ACS1B802A	2-16	0.5-40	6	1200	5	24	2.1	*	-
					Ground	-	-	-	-	-	-	-	-	-	-	-	-
Incoming Breaker Bus No. 2	E8X54	2500 3125	601 752	1000-5	Phase	G.E.	IAC	I21ACS1B802A	2-16	0.5-40	6	1200	5	24	2.1	*	-
					Ground	-	-	-	-	-	-	-	-	-	-	-	-
Bus Tie Breaker	E8X55			1000-5	Phase	G.E.	IAC	I21ACS1B802A	2-16	0.5-40	6	1200	5	24	2.1	*	-
					Ground	-	-	-	-	-	-	-	-	-	-	-	-
Feeder to Bldgs. 282-E /283-E	E8X51			400-5	Phase	G.E.	IAC	I21ACS1B808A	2-16	10-80	6	480	5	24	2	*	-
					Ground	-	-	-	-	-	-	-	-	-	-	-	-
Feeder to Bldg. 282-E	E8X52			400-5	Phase	G.E.	IAC	I21ACS1B808A	2-16	10-80	12	960	2	36	1	*	-
					Ground	-	-	-	-	-	-	-	-	-	-	-	-
Feeder to 284-E Power House	E8X59			300-5	Phase	G.E.	IAC	I21ACS1B806A	2-16	10-80	4	240	4	20	1.3	33.3	1998
					Ground	-	-	-	-	-	-	-	-	-	-	-	-
Feeder to Bldg. 282-E	E8X57			300-5	Phase	G.E.	IAC	I21ACS1B806A	2-16	10-80	16	960	2	48	1	*	-
					Ground	-	-	-	-	-	-	-	-	-	-	-	-

* Block Inst. Elements