

three inches = one foot
one and one half inches = one foot
one inch = one foot
three quarters inch = one foot
one half inch = one foot
three eighths inch = one foot
one eighth inch = one foot
one quarter inch = one foot

13.8 kV NORMAL / EMERGENCY STANDBY POWER SYSTEM:

GENERAL:

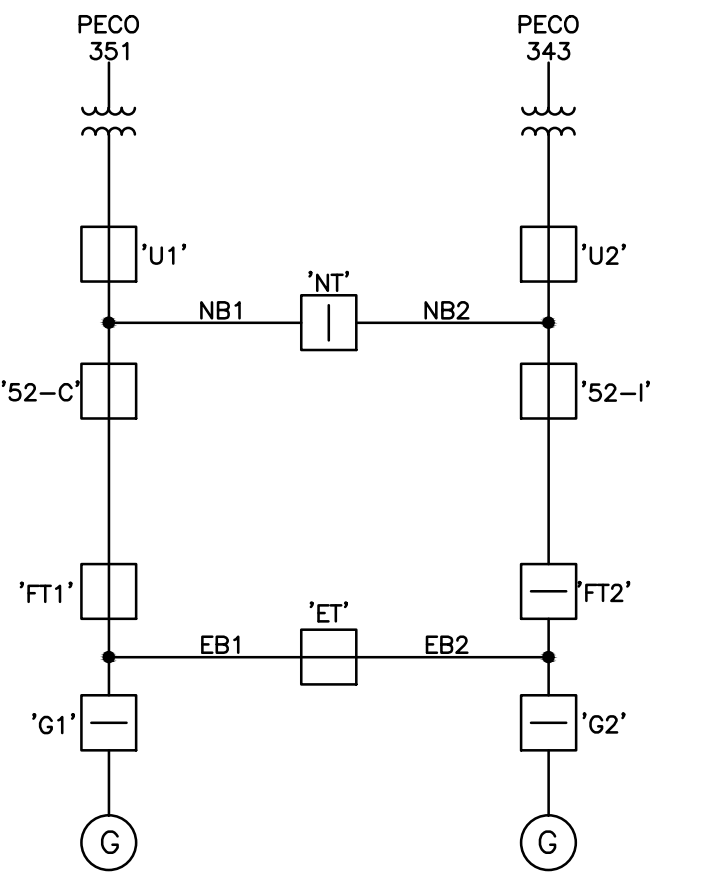
1. THE OPERATION DESCRIPTIONS AND MIMIC BUS DIAGRAMS ILLUSTRATE DESIGN FUNCTION OF THE NORMAL / EMERGENCY STANDBY POWER SYSTEM.
2. INSTALLATION SHALL COMPLY WITH REQUIREMENTS OF NFPA 110, 99, AND NEC.
3. THE EPSS SHALL NOT BE PARALLELED WITH THE NORMAL POWER SYSTEM. ALL TRANSITIONS SHALL BE "BREAK" BEFORE "MAKE".
4. ON UNPLANNED OUTAGES THE SYSTEM SHALL RESPOND AUTOMATICALLY TO RESTORE FIRST THE EPSS THEN THE NORMAL DISTRIBUTION.
5. PLANNED OUTAGES, RESTORATION, AND EXERCISE PERIODS SHOULD ALWAYS BE FIRST COORDINATED WITH THE SERVING UTILITY.
6. UPON LOSS OF A GENERATOR OR EXCEEDING 110% OF THE TOTAL RUNNING GENERATOR CAPACITY, LOADS SHALL BE SHED BY OPENING THE CLOSED FEEDER TIE, 'FT1' OR 'FT2', IMMEDIATELY TO PROTECT EPSS LOADS. UPON RESTORATION OF BOTH GENERATORS, FULL STANDBY OPERATION CAN BE RESUMED.

CONCEPT OF OPERATION:

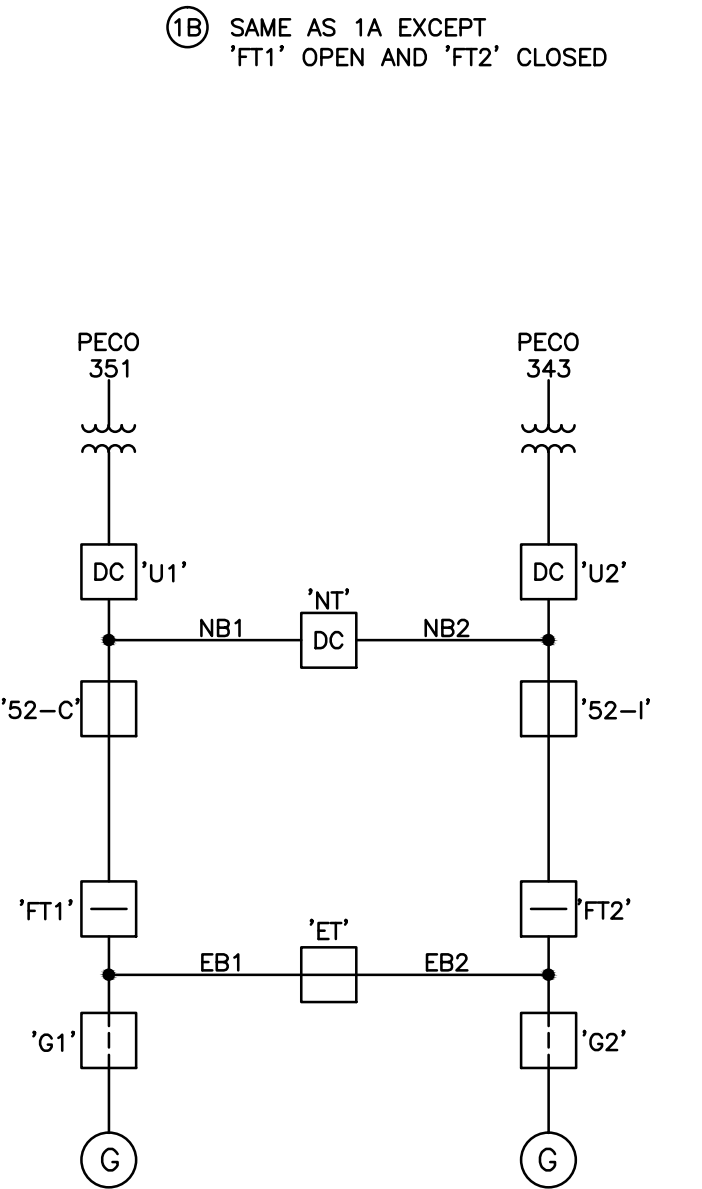
1. NORMAL DISTRIBUTION IS SUPPLIED FROM THE DOUBLE-ENDED NORMAL BUS, 'NB1' AND 'NB2'. NORMAL DISTRIBUTION IS NORMALLY SPLIT ('NT' OPEN), BUT CAN BE COMBINED ('NT' CLOSED) AND SUPPLIED BY EITHER UTILITY.
2. EMERGENCY DISTRIBUTION IS SUPPLIED FROM THE DOUBLE-ENDED EMERGENCY BUS, 'EB1' AND 'EB2'. THE EMERGENCY BUS IS ALWAYS HOT, SUPPLYING THE EMERGENCY DISTRIBUTION SYSTEM AT ALL TIMES. UNDER NORMAL CONDITIONS THE EMERGENCY BUS IS SUPPLIED FROM THE NORMAL BUS VIA THE FEEDER TIES, EITHER 'FT1' OR 'FT2', WITH THE EMERGENCY BUS TIE ('ET') CLOSED.
3. PROGRAMMED SYSTEM CONFIGURATIONS FALL INTO 5 OPERATIONAL MODES, WITH EACH MODE HAVING VARIANTS BASED ON WHICH FEEDER TIE IS USED TO CONNECT NORMAL AND EMERGENCY BUSES AND WHICH UTILITIES AND GENERATORS ARE SUPPLYING. MODE DESIGNATIONS ARE SHOWN IN DETAIL 2/E-603 AND ARE CODED AS FOLLOWS: THE FIRST DIGIT IS A NUMBER WHICH INDICATES THE BASIC CONFIGURATION, 1 THROUGH 5. THE SECOND DIGIT IS A LETTER WHICH INDICATES WHICH FEEDER TIE BREAKER IS SHUT TO INTERCONNECT THE NORMAL AND EMERGENCY BUSES, 'A' FOR 'FT1', 'B' FOR 'FT2'. THE THIRD DIGIT, WHICH ONLY APPLIES TO MODE 5____ (GENERATOR EXERCISE) CONFIGURATIONS, INDICATES WHICH GENERATOR OR GENERATORS ARE EMPLOYED.
4. SYSTEM CONFIGURATION MODES 1A THROUGH 3B COMPRISE THE SIX AVAILABLE CONFIGURATIONS WHERE UTILITY POWER SUPPLIES ALL LOADS.
5. UPON LOSS OF BOTH UTILITIES, GENERATORS SUPPLY FIRST THE EMERGENCY BUS ONLY (FIRST AVAILABLE GENERATOR), THEN WITH BOTH GENERATORS SUPPLYING, FULL STANDBY POWER IS SUPPLIED TO THE NORMAL BUS VIA THE SELECTED FEEDER TIE. MODES 4* AND 4A/B PROVIDE EMERGENCY ONLY AND FULL STANDBY, RESPECTIVELY.
6. FOR EXERCISING THE GENERATORS, A SPLIT SYSTEM MODE OF OPERATION IS PROVIDED WHEREIN 1 UTILITY SUPPLIES ITS RESPECTIVE NORMAL BUS WHILE ONE OR BOTH GENERATORS SUPPLY THE EMERGENCY BUS AND THE OTHER NORMAL BUS. THE SIX MODE 5 VARIANTS (5A1, 5A2, 5A3, 5B1, 5B2, 5B3) SHOW THESE CONFIGURATIONS. (GENERATORS CAN SUPPLY FULL CAMPUS EMERGENCY AND NORMAL LOAD FOR TESTING PURPOSES BY THE OPERATOR SELECTING MODE 4A OR 4B.)

PROTECTIVE INTERLOCKS REQUIREMENT:

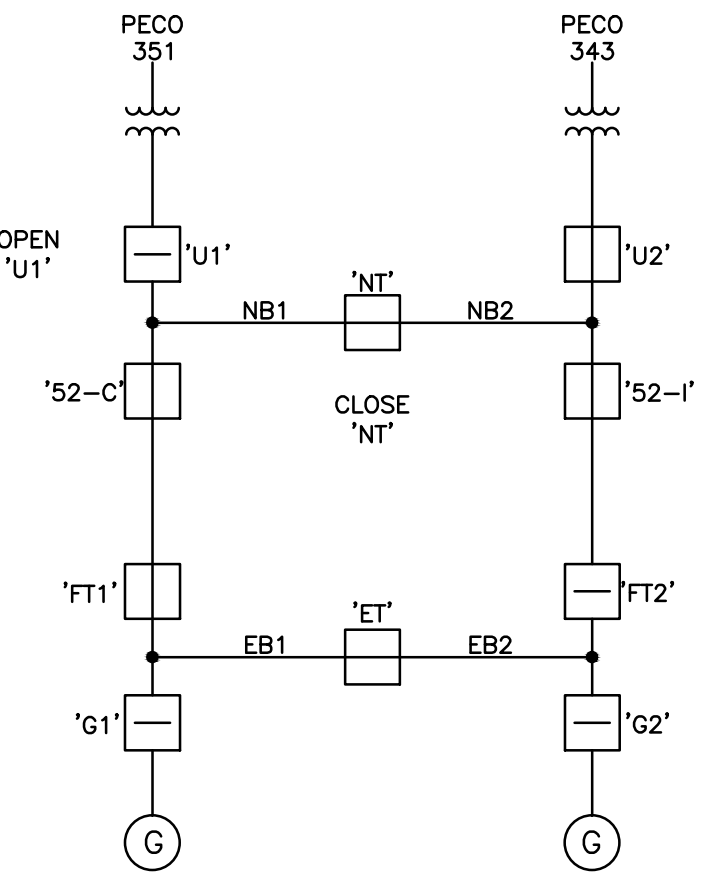
1. TO PROTECT AGAINST INADVERTENT PARALLELING OF UTILITY AND GENERATORS, AND TO PREVENT CLOSING A GENERATOR BREAKER INTO AN OVERLOAD SITUATION, THE FOLLOWING PROTECTIVE INTERLOCKS SHALL BE IN PLACE AT ALL TIMES, WHETHER IN AUTOMATIC OR MANUAL MODE OF OPERATION. THESE INTERLOCKS CANNOT BE DEFEATED.
2. AT MOST 2 OF THE FOLLOWING MAY BE CLOSED AT THE SAME TIME: 'U1', 'U2', 'NT'.
3. AT MOST 2 OF THE FOLLOWING MAY BE CLOSED AT THE SAME TIME: 'FT1', 'FT2', 'ET'.
4. TO CLOSE BREAKERS 'NT', 'U1', OR 'U2', BOTH FEEDER TIES 'FT1' AND 'FT2' MUST BE OPEN OR BOTH GENERATOR BREAKERS 'G1' AND 'G2' MUST BE OPEN.
5. TO CLOSE EITHER OF GENERATOR BREAKERS 'G1' OR 'G2', 'ET' MUST BE CLOSED AND 'FT1' AND 'FT2' MUST BE OPEN UNLESS THE BUS IS ALREADY SUPPLIED BY THE OTHER GENERATOR AND THE GENERATOR PARALLELING CONTROLLER IS EMPLOYED TO BRING 2ND GENERATOR ONTO THE BUS.
6. BREAKER CLOSE PERMISSIVE LOGIC SHALL BE EMPLOYED TO PREVENT CLOSING A BREAKER IN VIOLATION OF THE ABOVE INTERLOCKS.



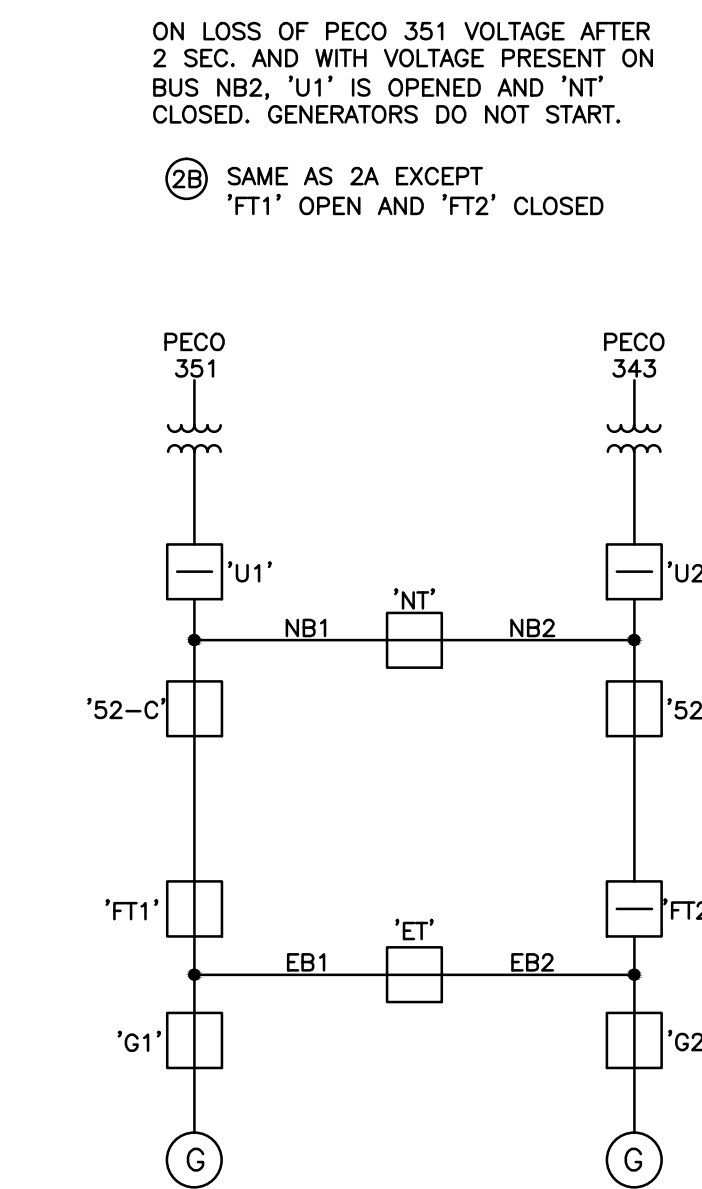
1A NORMAL, BOTH UTILITIES



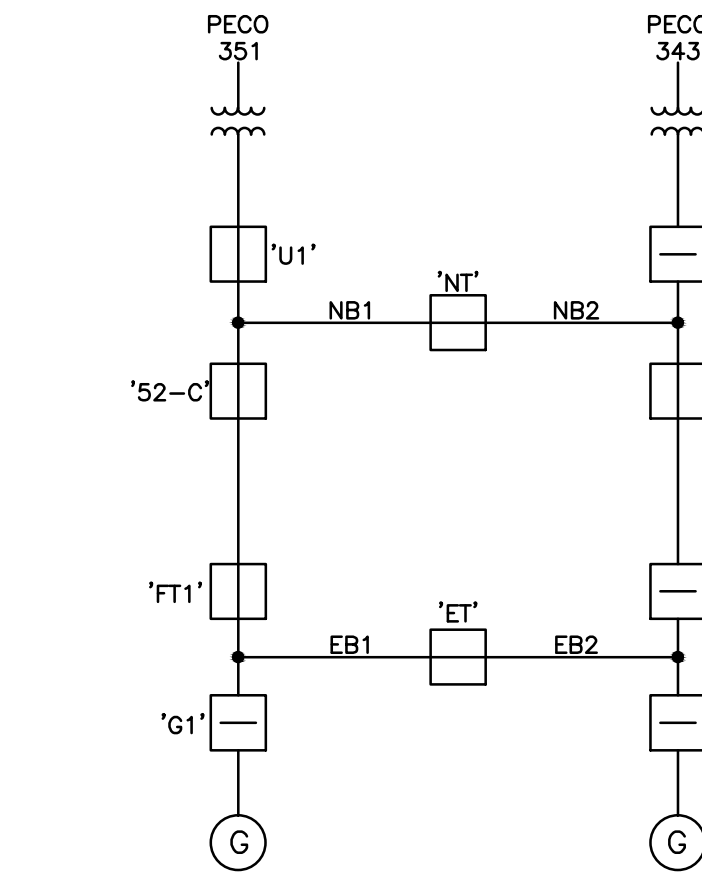
1B SAME AS 1A EXCEPT 'FT1' OPEN AND 'FT2' CLOSED



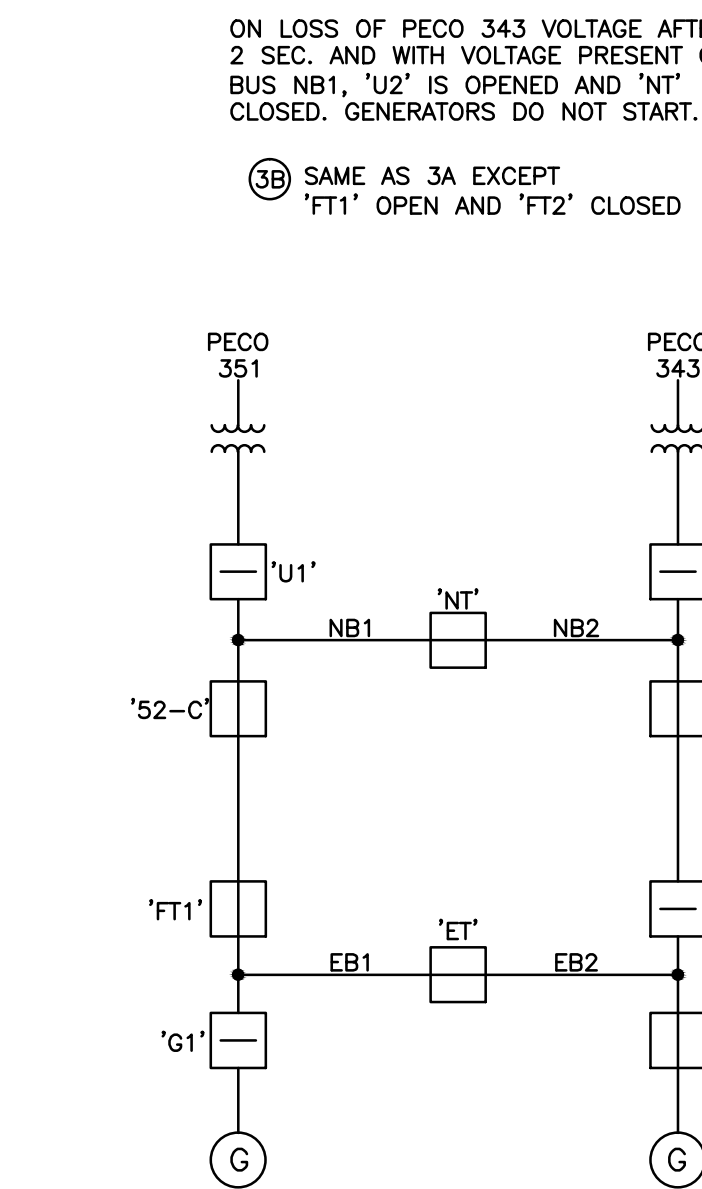
2A PECO 343 ONLY, 'U1' OPEN



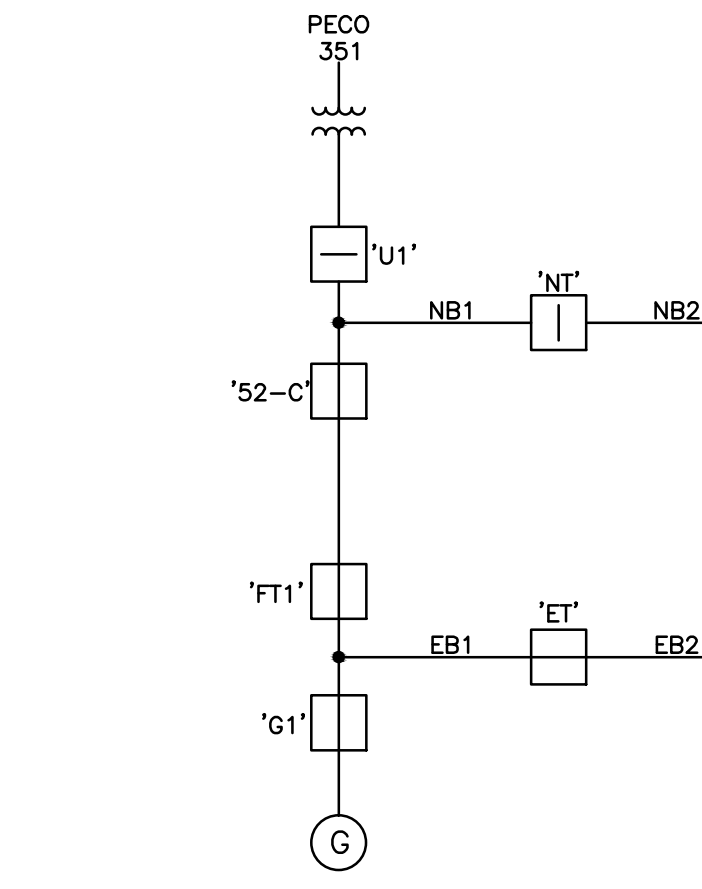
2B SAME AS 2A EXCEPT 'FT1' OPEN AND 'FT2' CLOSED



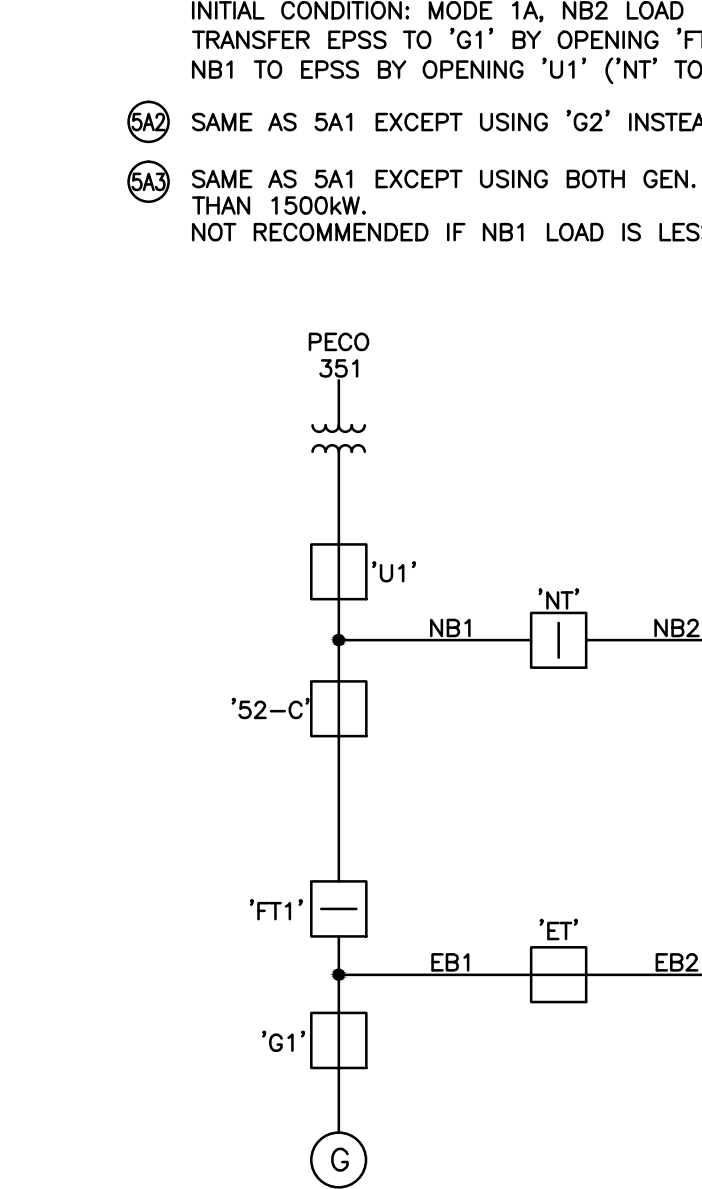
3A PECO 351 ONLY, 'U2' OPEN



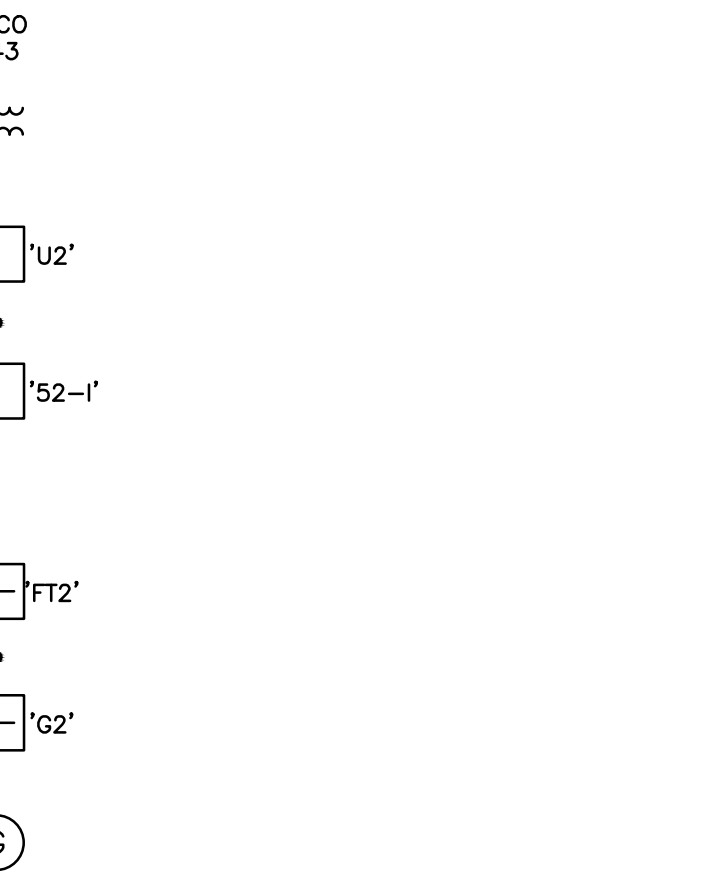
3B SAME AS 3A EXCEPT 'FT1' OPEN AND 'FT2' CLOSED



4A GENERATOR EXERCISE MODE, 'G1' SUPPLYING NB1 & EPSS, PECO SUPPLYING NB2



4B SAME AS 4A EXCEPT USING 'G2' INSTEAD OF GEN 'G1'

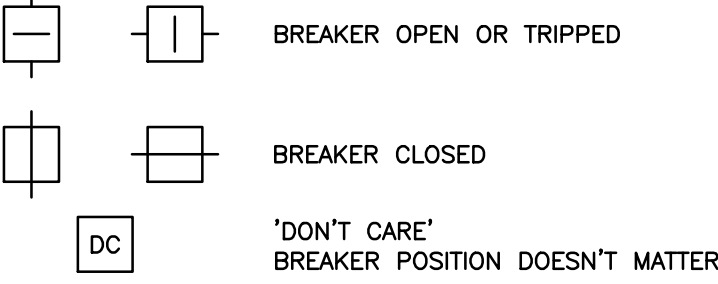


4C SAME AS 4A EXCEPT USING BOTH GEN. REQUIRED IF NB1 LOAD IS GREATER THAN 1500KW. NOT RECOMMENDED IF NB1 LOAD IS LESS THAN 1100 KW.

4* (TRANSITIONAL MODE) LOSS OF BOTH UTILITIES; NB1 AND NB2 DEAD.

BOTH GENERATORS STARTED, 'FT1' AND 'FT2' BOTH OPEN TO ISOLATE EPSS FROM NORMAL SUPPLY. FIRST AVAILABLE GENERATOR RESTORES EB1 AND EB2. SECOND GENERATOR IS PARALLELED TO BUS WHEN READY.

BREAKER LEGEND



2

E-603

13.8 kV POWER SYSTEM MODES OF OPERATION

SCALE: NTS

LOAD SERVED	KVA / Phase		OCT BRKR	OCT NO	NEUTRAL		OCT BRKR	OCT NO	KVA / Phase		LOAD SERVED		
	A	B			A	B			A	B			
GENERATOR #2 BLOCK HEATERS	4.77	---	2P-60	3		2	1P-20	0.75	---	1.26	SWITCHGR RM & EXTERIOR LTS		
	---	4.77		1		4	1P-20	---	1.26		SWITCHGR RM RECEPITS		
GEN #2 BATTERY CHARGER	0.29	---	1P-20	5		6	1P-20	0.30	---	---	STATION BATTERY CHARGER		
GEN #2 ALTERNATOR HEATER	---	0.30	1P-20	7		8	1P-20	---	0.40	---	STATION MONITORING & CONTROL		
FUEL TRANSFER SYSTEM GEN #2	0.75	---	2P-20	9		10	1P-20	0.10	---	---	FIRE ALARM LOCAL PANEL		
	---	0.75		11		12	1P-20	---	0.00	---	SPARE		
SPACE	0.00	---	---	13		14	1P-20	0.00	---	---	SPARE		
SPACE	---	0.00	---	15		16	1P-20	---	0.00	---	SPARE		
SPACE	0.00	---	---	17		18	---	---	0.00	---	SPACE		
SPACE	---	0.00	---	19		20	---	---	0.00	---	SPACE		
ELECTRIC UNIT HEATER EUH-2	2.50	---	2P-30	21		22	---	0.00	---	---	SPACE		
	---	2.50		23		24	---	---	0.00	---	SPACE		
SWITCHGEAR ROOM HVAC	---	2.50	2P-30	25		26	---	0.00	---	---	SPACE		
	---	---		27		28	---	---	0.00	---	SPACE		
SPACE	0.00	---	---	29		30	---	0.00	---	---	SPACE		
SUB TOTAL	10.81	10.82						1.15	1.66	SUB TOTAL			
										11.96	12.48	TOTAL	
C/B TEMP. 75 C.													
MOUNTING SURFACE	RATING	120	240 V 1 PH 3 W	LOAD TYPE				CONNECTED KVA		NEC DEM			
ISOLATED GROUND BUS	NO			GENERAL LIGHTING				A	B	FACTOR	DEMAND KVA		
MAIN CIRCUIT BREAKER	YES			GENERAL USE				0.75	0.00	125%	0.94 0.00		
SERVICE ENTER RATED	YES			RECEPT				0.00	1.26	>10 KVA @100%	0.00 1.26		
MINIMUM AIC (K AMPS) 10				MOTORS AND EQUIPMENT				4.77	1.47	125%	5.96 5.96		
MOB RATING 125A				BUS RATING 125A				1.44	1.45	100%	1.44 1.45		
NEUTRAL RATING 100%				FIX ELEC. SPACE HEAT				5.00	5.00	125%	6.25 6.25		
								TOTAL KVA PER PHASE		11.96	12.48	14.60	14.92
								TOTAL DEMAND AMPERES PER PHASE				122	124
								PANEL / FEEDER (TOTAL KVA)				29.52	
								(TOTAL KVA) X 1000 = TOTAL AMPS					
								VOLTS				120	
PANEL 'GB'													