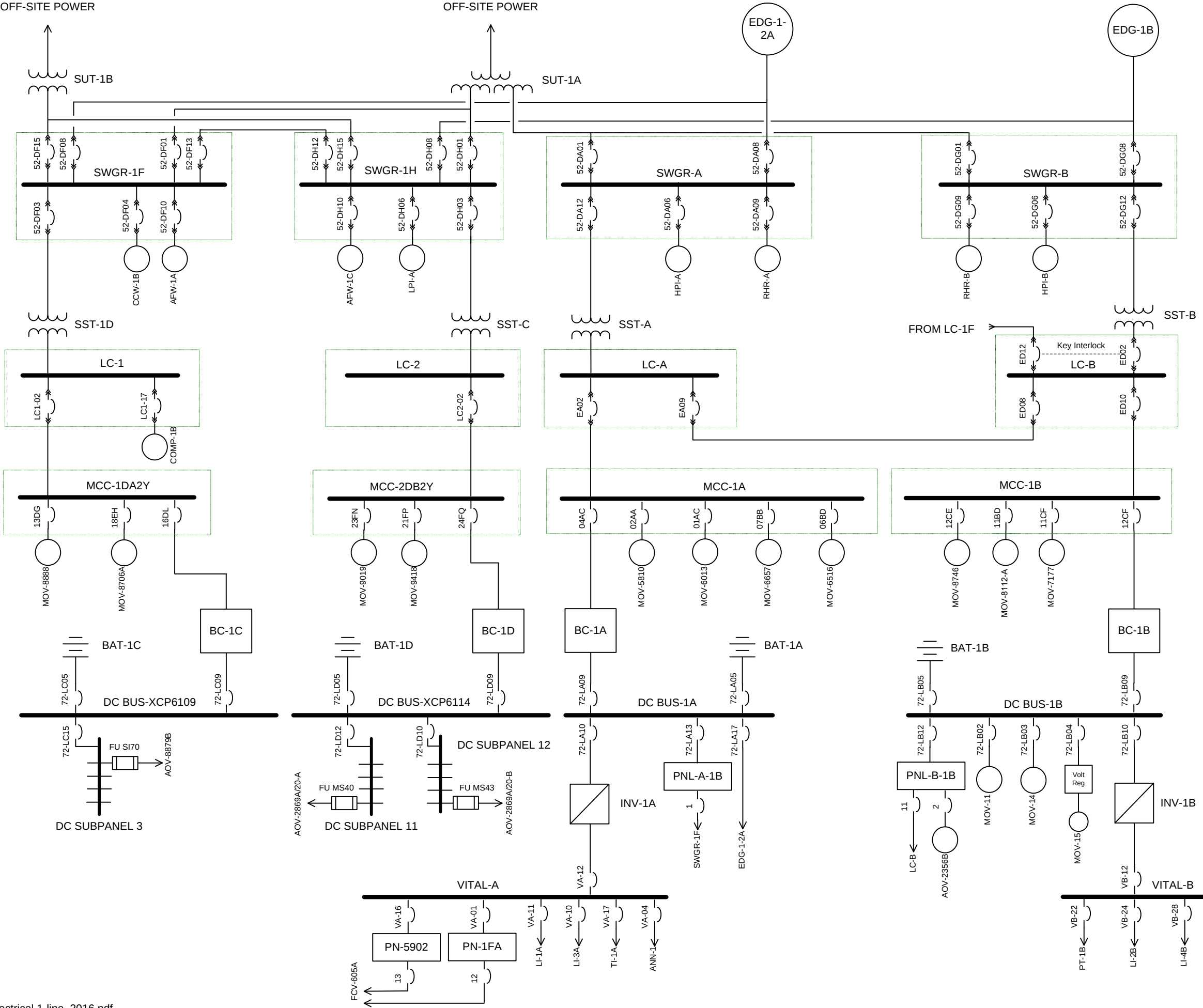




EPRI-RES FIRE PRA TRAINING
MODEL 2 - ELECTRICAL

ELECTRIC POWER DISTRIBUTION
SYSTEM – ONE-LINE DIAGRAM

SCHEMATIC DIAGRAM AND CIRCUIT DEVICE LEGEND

MOV LIMIT SWITCH DEVELOPMENT

R O T O R	LIMIT SWITCH DEVELOPMENT - LIMITORQUE OPER.			
	POSITION SWITCH	C O N T	VALVE POSITION	
			FULL CLOSE	FULL OPEN
1	33A0	1		
	33A0	2		
	33B0	3		
	33B0	4		
2	33BC	5		
	33BC	6		
	33AC	7		
	33AC	8		
3	33A0	9		
	33A0	10		
	33B0	11		
	33B0	12		
4	33BC	13		
	33BC	14		
	33AC	15		
	33AC	16		
		17	CLOSING TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING CLOSING CYCLE OR FULLY CLOSED VALVE	
		18	OPENING TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING OPENING CYCLE OR FULLY OPENED VALVE	

NOTES: LIMIT SWITCH DEVELOPMENT- LIMITORQUE OPER.

1. INTERMEDIATE POSITIONS ARE EXPRESSED IN PERCENTAGE OF FULL OPEN.
EX. 33A05 CONTACT ACTUATES WHEN THE VALVE IS 5% OPEN.
2. THE TOLERANCE FOR ROTOR 2 CONTACTS SET AT 25% OPEN IS ± 2.5%.
3. LIMITORQUE VALVES STROKED OPEN TO A POSITION OF 290% ARE CONSIDERED 'FULLY OPEN' WITH THE EXCEPTION OF XVG2802A & B-MS, WHICH MUST BE STROKED OPEN TO 95%. THE BASIS FOR THIS STATEMENT IS NUCLEAR ENGINEERING LETTER CGSS-20371, DATED 11/9/87.

MOV LIMIT SWITCH DEVELOPMENT

33 LIMIT SWITCH CONTACT DEVELOPMENT				
CONT	VALVE POSITION		FUNCTION	
	FULL OPEN	FULL CLOSED		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

— CONTACT CLOSED

CLOSING TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING CLOSING CYCLE

OPENING TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING OPENING CYCLE

AOV LIMIT SWITCH DEVELOPMENT

LIMIT SWITCH DEVELOPMENT FOR AIR OPERATED VALVES AND DAMPERS				
	LIMIT SWITCH	DEVICE POSITION		
		FULL CLOSE		FULL OPEN
SWITCH ACTUATED DEVICE CLOSED	33bc			
	33bc			
	33ac			
SWITCH ACTUATED DEVICE OPEN	33ao			
	33ao			
	33bo			

NOTE: 33 CONTACTS SHOWN FOR DEVICE FULL CLOSED

MOV LIMIT SWITCH DEVELOPMENT

LIMIT SWITCH DEVELOPMENT - ROTORK OPERATOR				
SWITCH	CONTACT	OPEN	INTERMEDIATE	CLOSED
OT/LS	24-25			
CT/LS	26-27			
OAS1	15-16			
CAS1	6-7			
OAS2	17-18			
CAS2	8-9			

ADD-ON-PAK 1 SWITCH OPERATION				
SWITCH	CONTACT	OPEN	INTERMEDIATE	CLOSED
IAS1	10-11			
IAS2	12-13			
IAS3	19-20			
IAS4	21-22			
IAS5	28-29			
IAS6	30-31			

ADD-ON-PAK SWITCHES CAN BE SET AT VALVE FULL OPEN, FULL CLOSED, OR ANY POSITION IN BETWEEN

SCHEMATIC DIAGRAM AND CIRCUIT DEVICE LEGEND

SCHEMATIC DIAGRAM WIRE NUMBER LEGEND DIAGRAMS

WIRE NUMBERING SYSTEM

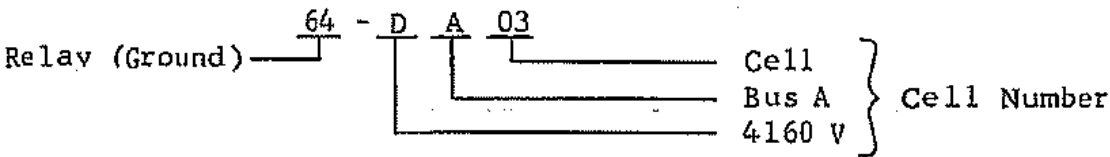
1. The following standard interconnecting wire numbers shall be used wherever applicable (for computer - schedule programming).

Wire Number	Purpose	Wire Number	Purpose
1	A - Phase Power	4	A - Phase Potential
2	B - Phase Power		(See Notes 3 & 5)
3	C - Phase Power	5	A - Phase Current
(Note 1)	Annunciator		(See Notes 3 & 5)
N	D. C. Negative (See Note 2)	6	B - Phase Potential
p	D. C. Positive (See Note 2)		(See Notes 3 & 5)
U	115 volt A. C.-Ground Return (see Note 2)	7	B Phase Current
X	115 volt A. C. (See Note 2)		(see Notes 3 & 5)
C	Closing (See Note 2)	8	C - Phase Potential
T	Tripping (See Note. 2).		(See Notes 3 & 5)
O	Opening, MOV Only (See Note 2)	9	C - Phase Current
F	Instrumentation (e.g. indicator, recorder, etc; See Note 2)		(See Notes 3 & 5)
H	Computer (See Note 2)		
M	General Control (Neither tripping nor closing; See Note 2)	0	Potential (or Current) Neutral (See Notes 4 & 5)
A	Amber Lamp (See Note 2)		
B	Blue Lamp (See Note 2)		
L	Green Lamp (See Note 2)		
R	Red Lamp (See Note 2)		
W	White Lamp (See Note 2)		

RELAY NUMBERING SYSTEM

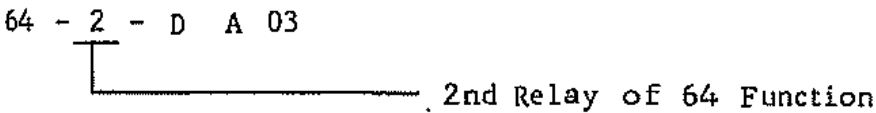
A relay number consists of a device number and a cell number. The device number describes the function of the relay and the cell number gives the relay location.

Example:



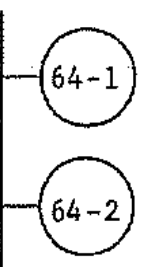
If more than one relay of the same type is associated with the same cell number then a sequence number is added.

Example:



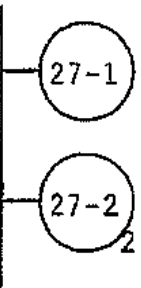
The following methods are used on drawings to identify relays:

1)



Two (2) 64 devices 64-1 and 64-2 in same cell.

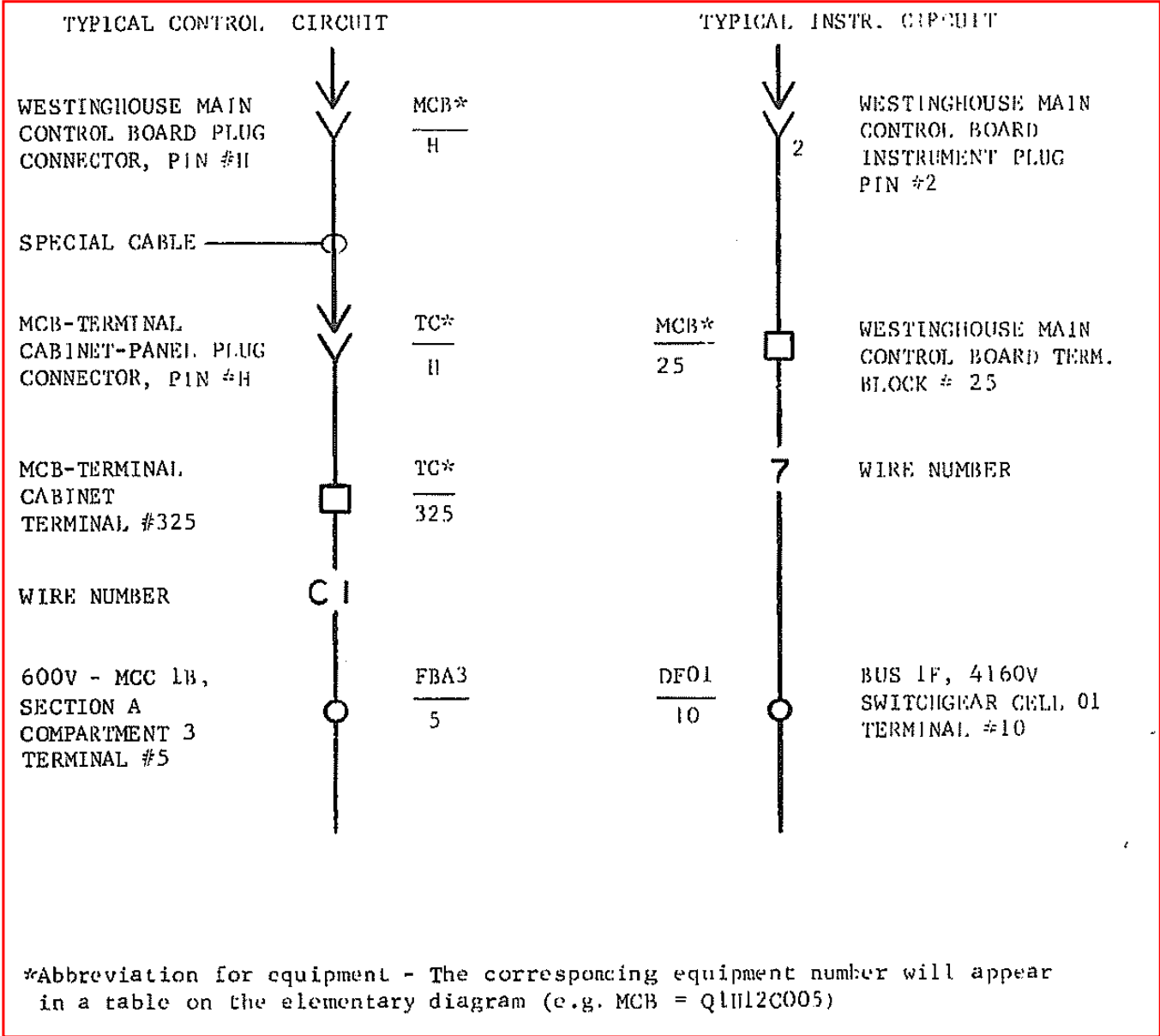
2)



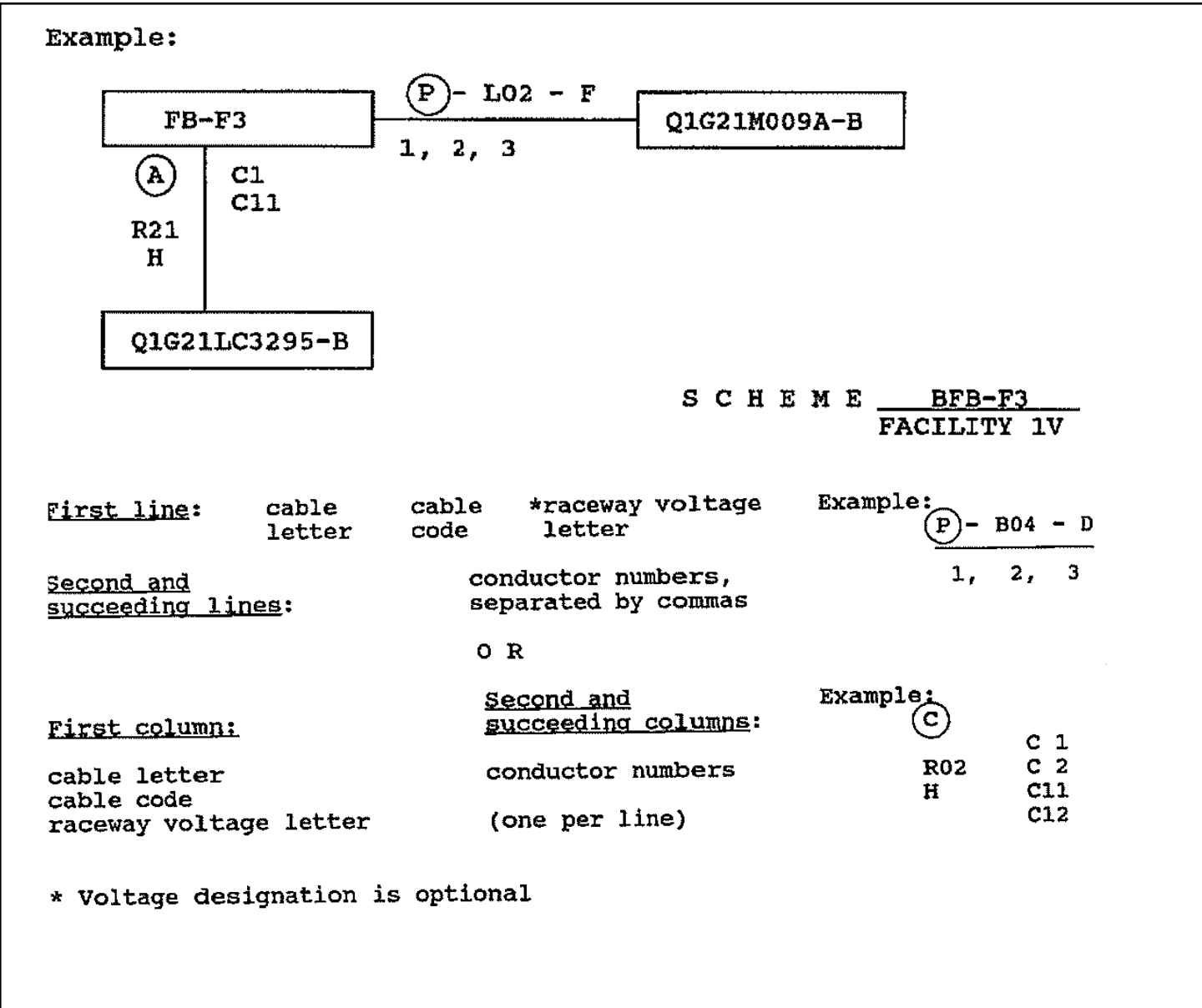
Three (3) 27 devices 27-1, 27-2 and 27-3. The two (2) below the 27-2 device indicates there are two (2) 27 devices and their sequence numbers are in numerical order starting with -2.

SCHEMATIC DIAGRAM AND CIRCUIT DEVICE LEGEND

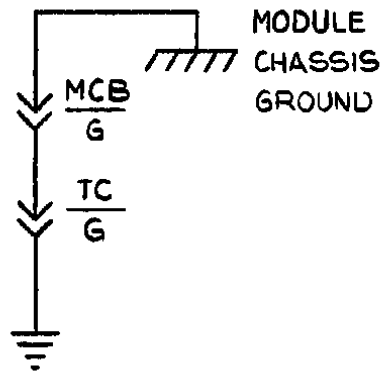
SCHEMATIC DIAGRAM



BLOCK DIAGRAMS



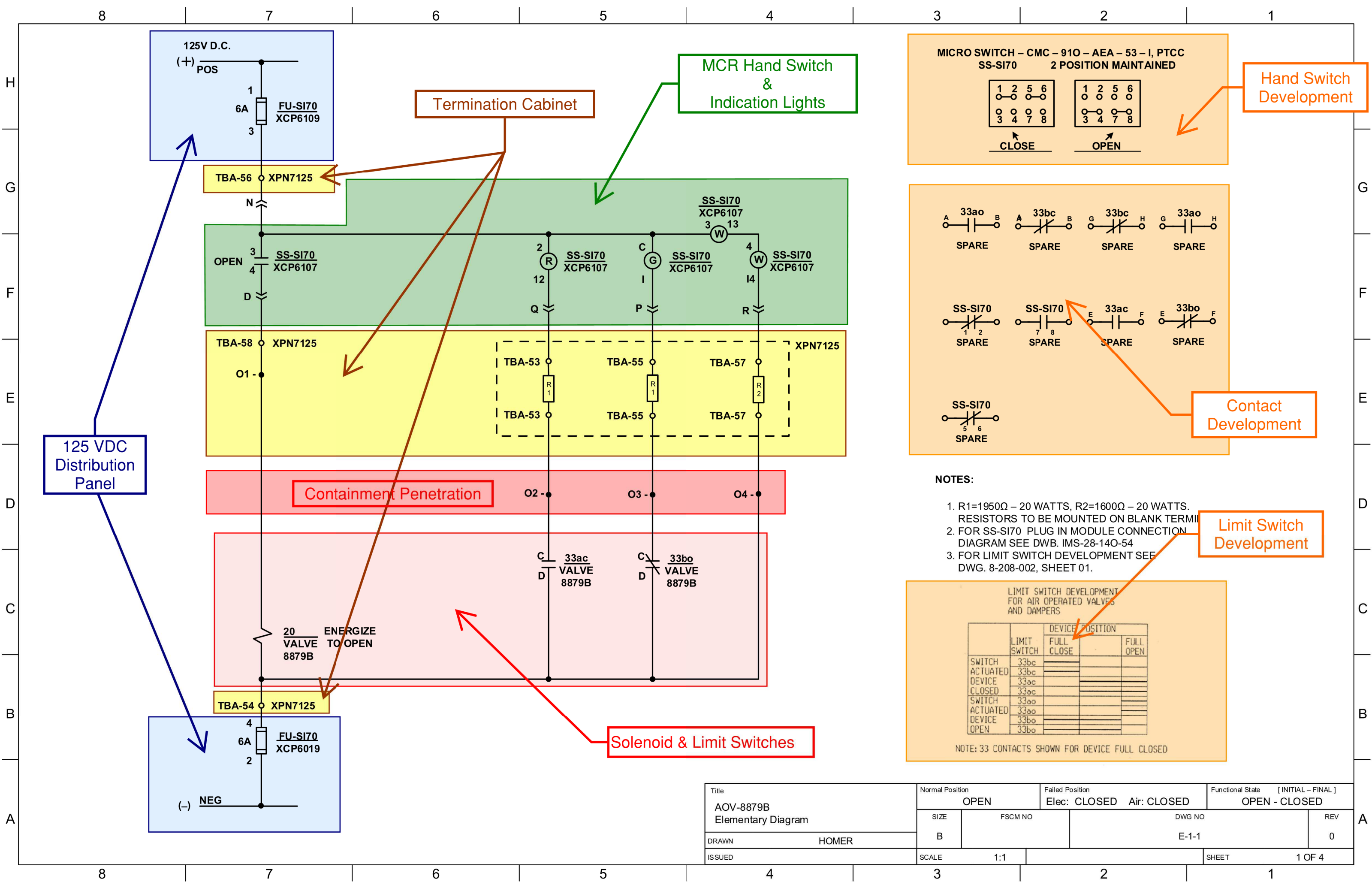
GROUNDING



CONTROL SWITCH DEVELOPMENT - TYPICAL

RHS	BLK	CONT	CLOSE	AUTO	OPEN
AUTO			R	↑	↗
CLOSE ↑ OPEN	1	A			X
	(FRONT)	B	X		
	2	A		X	
	(REAR)				

REMOTE HANDSWITCH
GEMCO CAT NO 404532221-Y-AA3,A4
SPRING RETURN TO AUTO



NOTES:

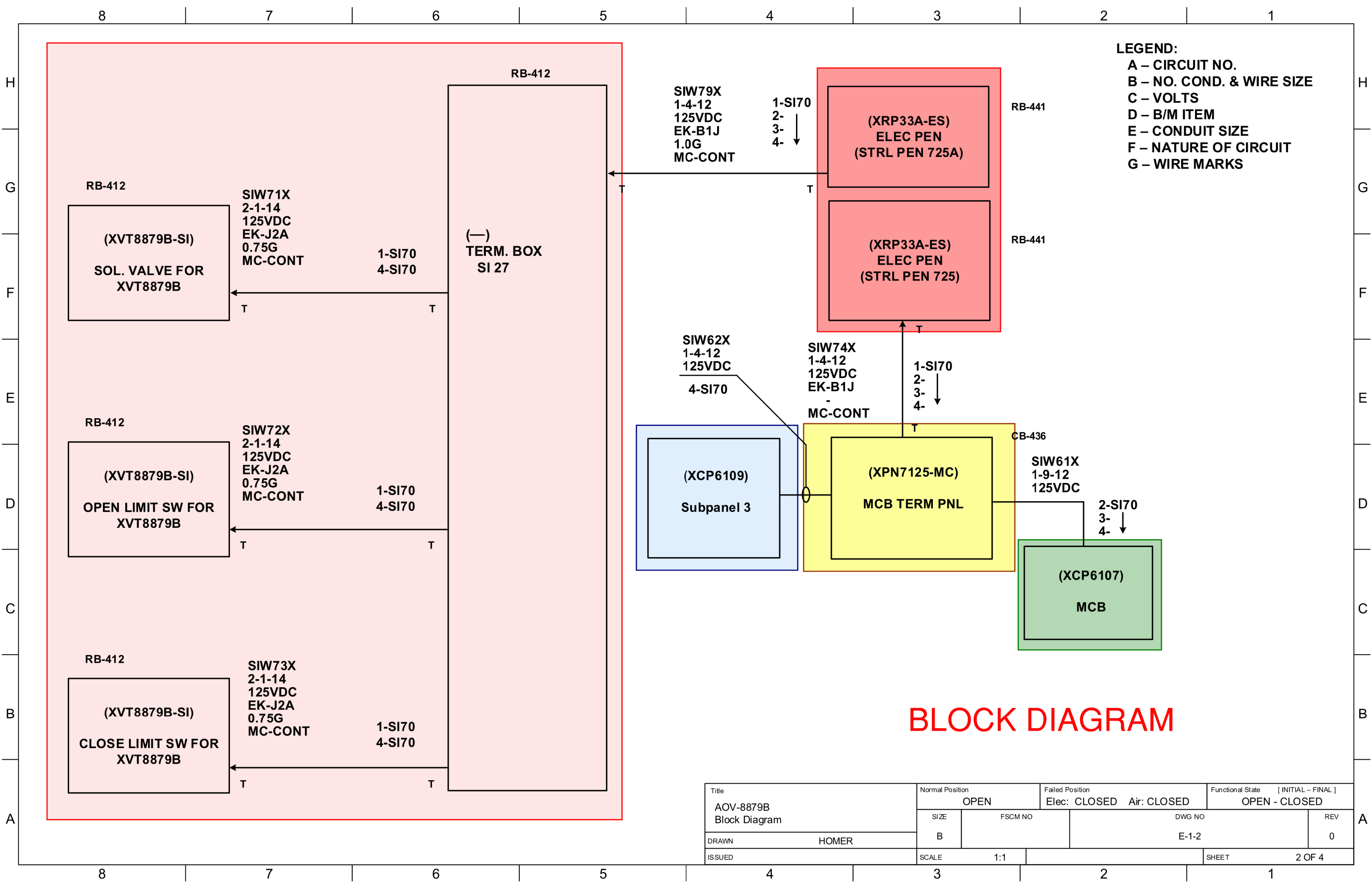
1. R1=1950Ω – 20 WATTS, R2=1600Ω – 20 WATTS. RESISTORS TO BE MOUNTED ON BLANK TERMINAL
2. FOR SS-SI70 PLUG IN MODULE CONNECTION DIAGRAM SEE DWB. IMS-28-140-54
3. FOR LIMIT SWITCH DEVELOPMENT SEE DWG. 8-208-002, SHEET 01.

LIMIT SWITCH DEVELOPMENT
FOR AIR OPERATED VALVES
AND DAMPERS

	LIMIT SWITCH	DEVICE POSITION	
		FULL CLOSE	FULL OPEN
SWITCH	33bc		
ACTUATED	33bc		
DEVICE	33ac		
CLOSED	33ac		
SWITCH	33ao		
ACTUATED	33ao		
DEVICE	33bo		
OPEN	33bo		

NOTE: 33 CONTACTS SHOWN FOR DEVICE FULL CLOSED

Title		Normal Position		Failed Position		Functional State [INITIAL – FINAL]	
AOV-8879B		OPEN		Elec: CLOSED Air: CLOSED		OPEN - CLOSED	
Elementary Diagram		SIZE	FSCM NO	DWG NO		REV	
DRAWN HOMER		B		E-1-1		0	
ISSUED		SCALE	1:1	SHEET		1 OF 4	



Title AOV-8879B Block Diagram	Normal Position OPEN		Failed Position Elec: CLOSED Air: CLOSED		Functional State [INITIAL – FINAL] OPEN - CLOSED
	SIZE B	FSCM NO		DWG NO E-1-2	
DRAWN HOMER		SCALE 1:1		SHEET 2 OF 4	
ISSUED					

3-Phase Power Circuit

Control Power Transformer

120 V Control Circuit

MOV Limit Switch Development

Hand Switch Development

Block Diagram

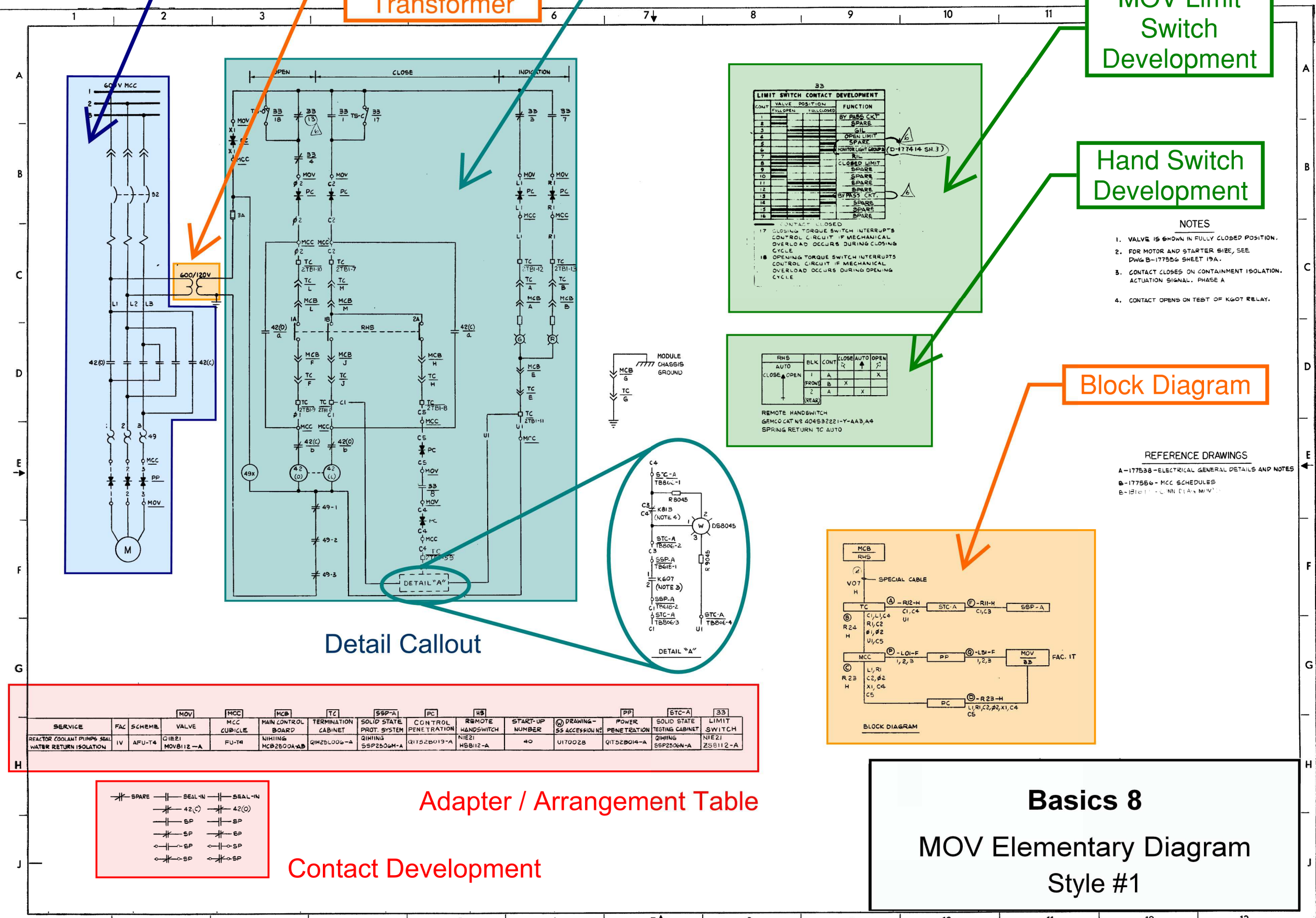
Detail Callout

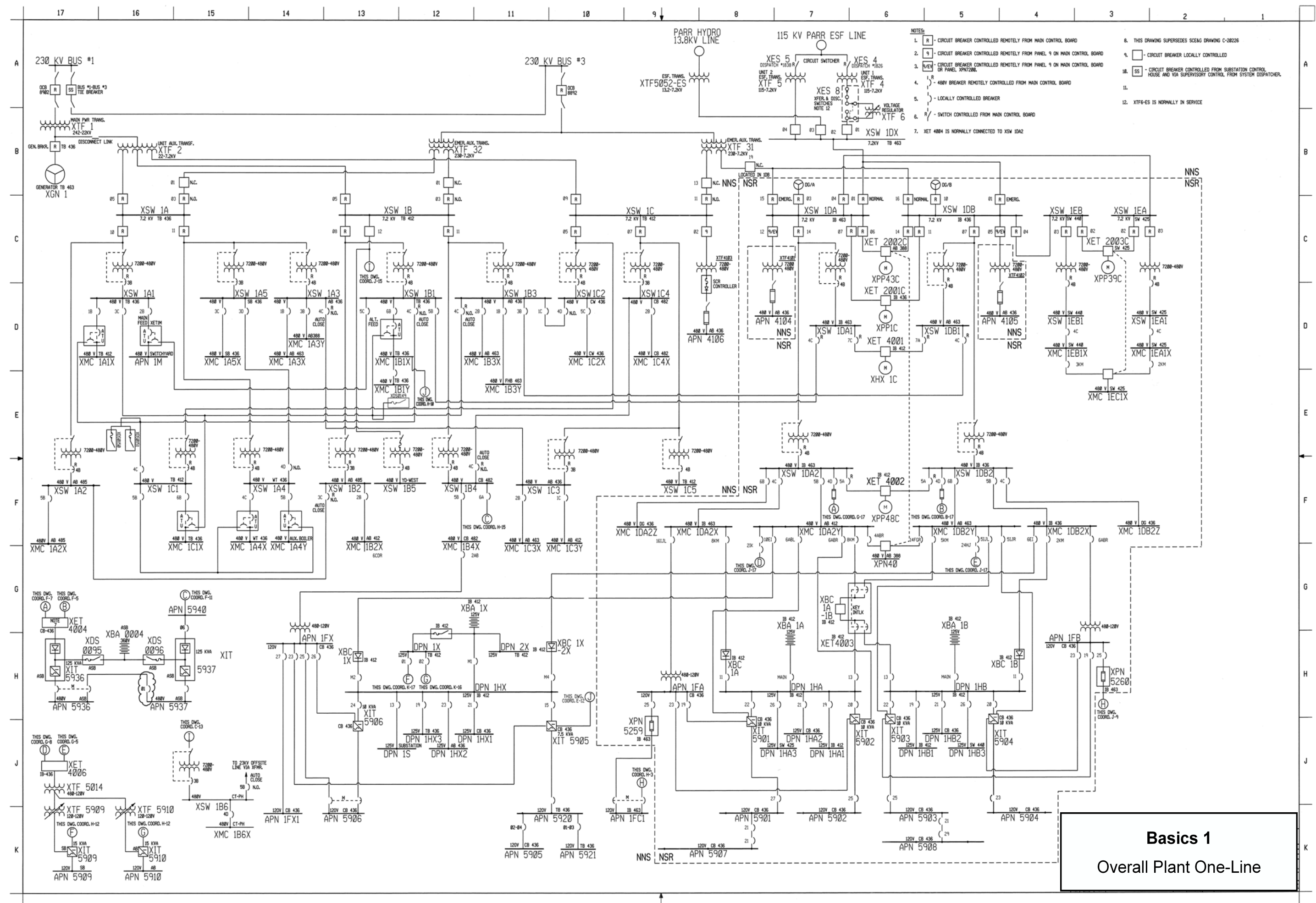
Adapter / Arrangement Table

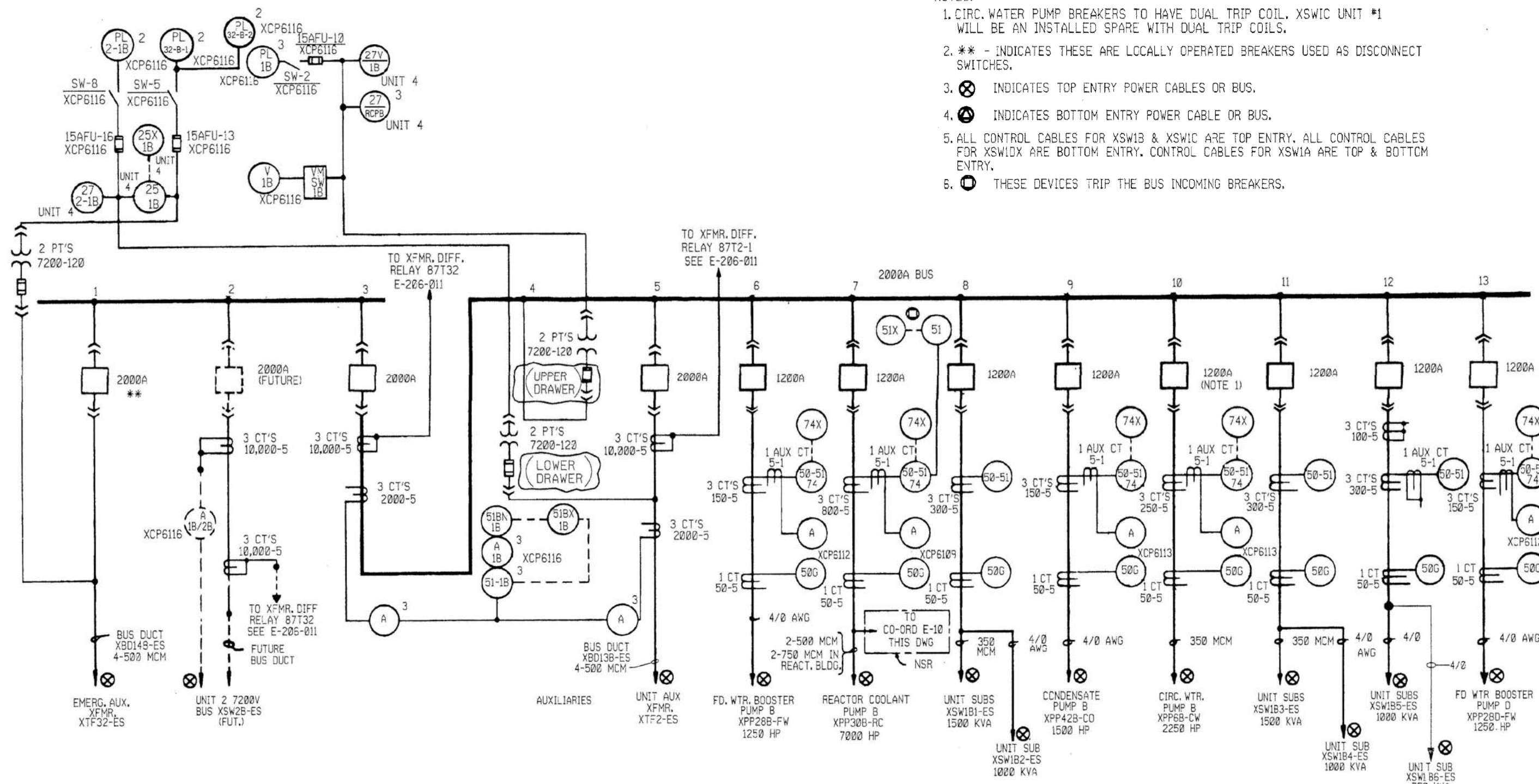
Contact Development

Basics 8

MOV Elementary Diagram Style #1







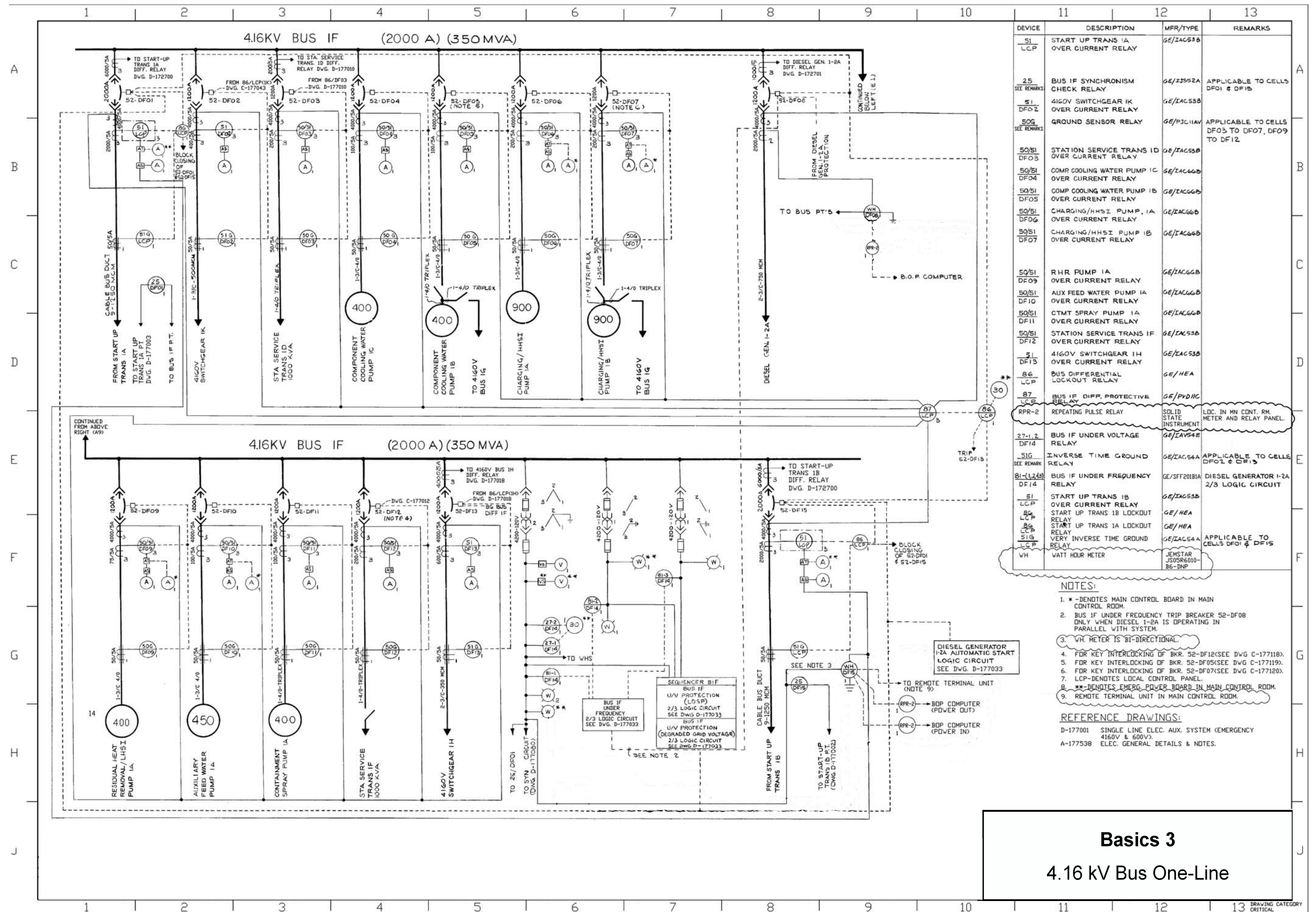
NOTES:

1. CIRC. WATER PUMP BREAKERS TO HAVE DUAL TRIP COIL. XSWIC UNIT #1 WILL BE AN INSTALLED SPARE WITH DUAL TRIP COILS.
2. ** - INDICATES THESE ARE LOCALLY OPERATED BREAKERS USED AS DISCONNECT SWITCHES.
3. ⊗ INDICATES TOP ENTRY POWER CABLES OR BUS.
4. ⊙ INDICATES BOTTOM ENTRY POWER CABLE OR BUS.
5. ALL CONTROL CABLES FOR XSW1B & XSWIC ARE TOP ENTRY. ALL CONTROL CABLES FOR XSW1A ARE BOTTOM ENTRY. CONTROL CABLES FOR XSW1A ARE TOP & BOTTOM ENTRY.
6. ⊕ THESE DEVICES TRIP THE BUS INCOMING BREAKERS.

7.2 KV SWGR. BUS 1B XSW1B-ES

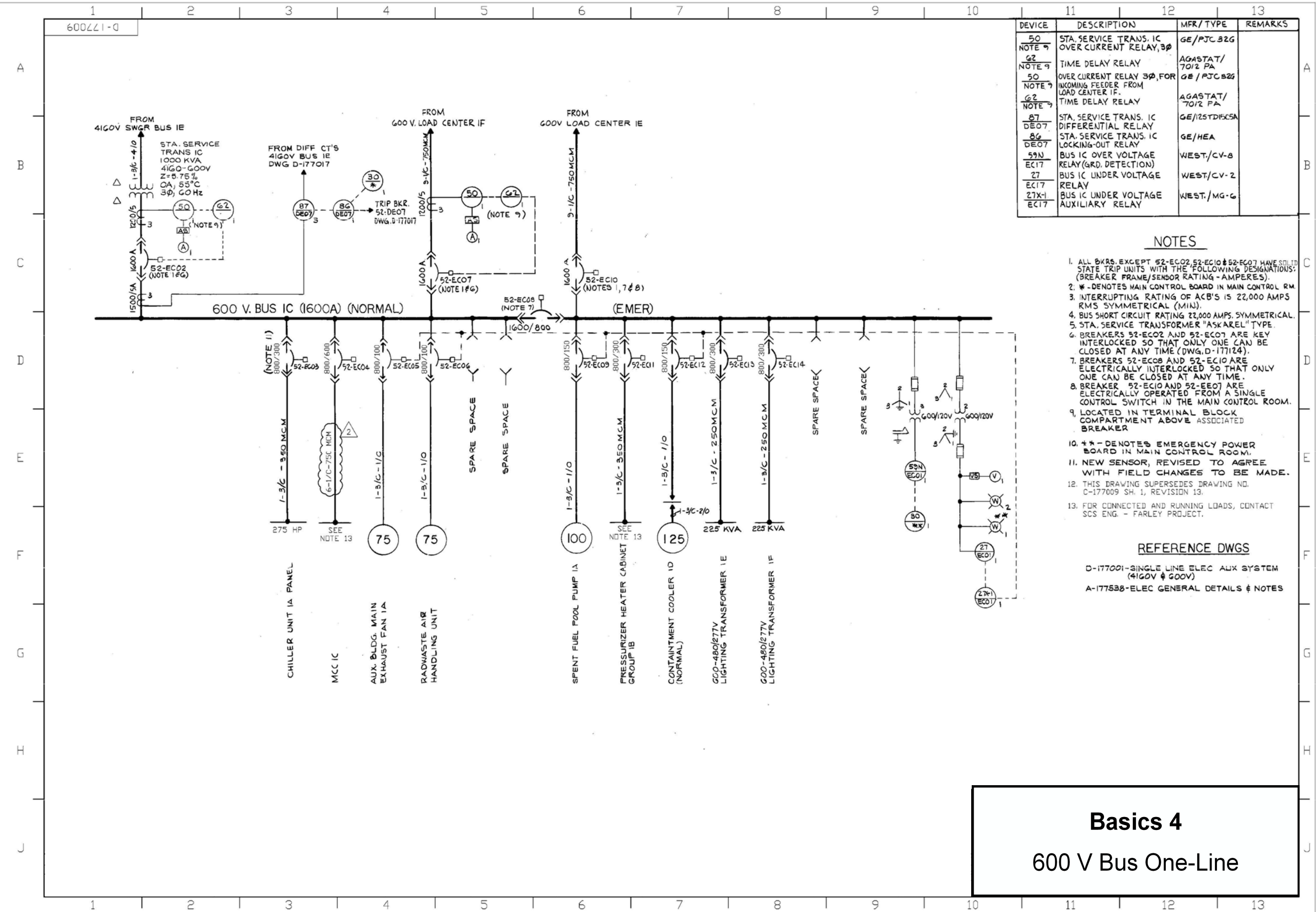
Basics 2

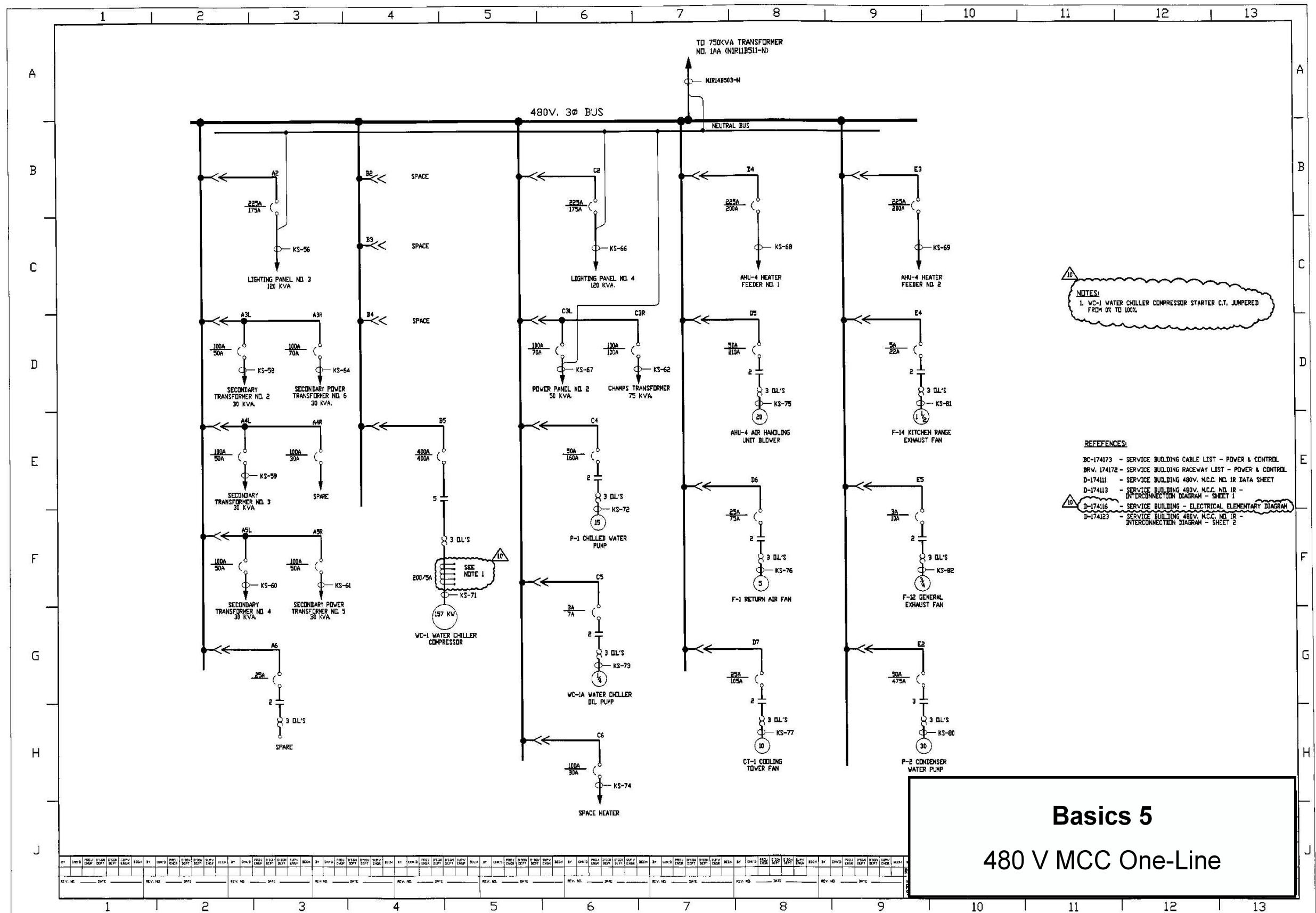
7.2 kV Bus One-Line

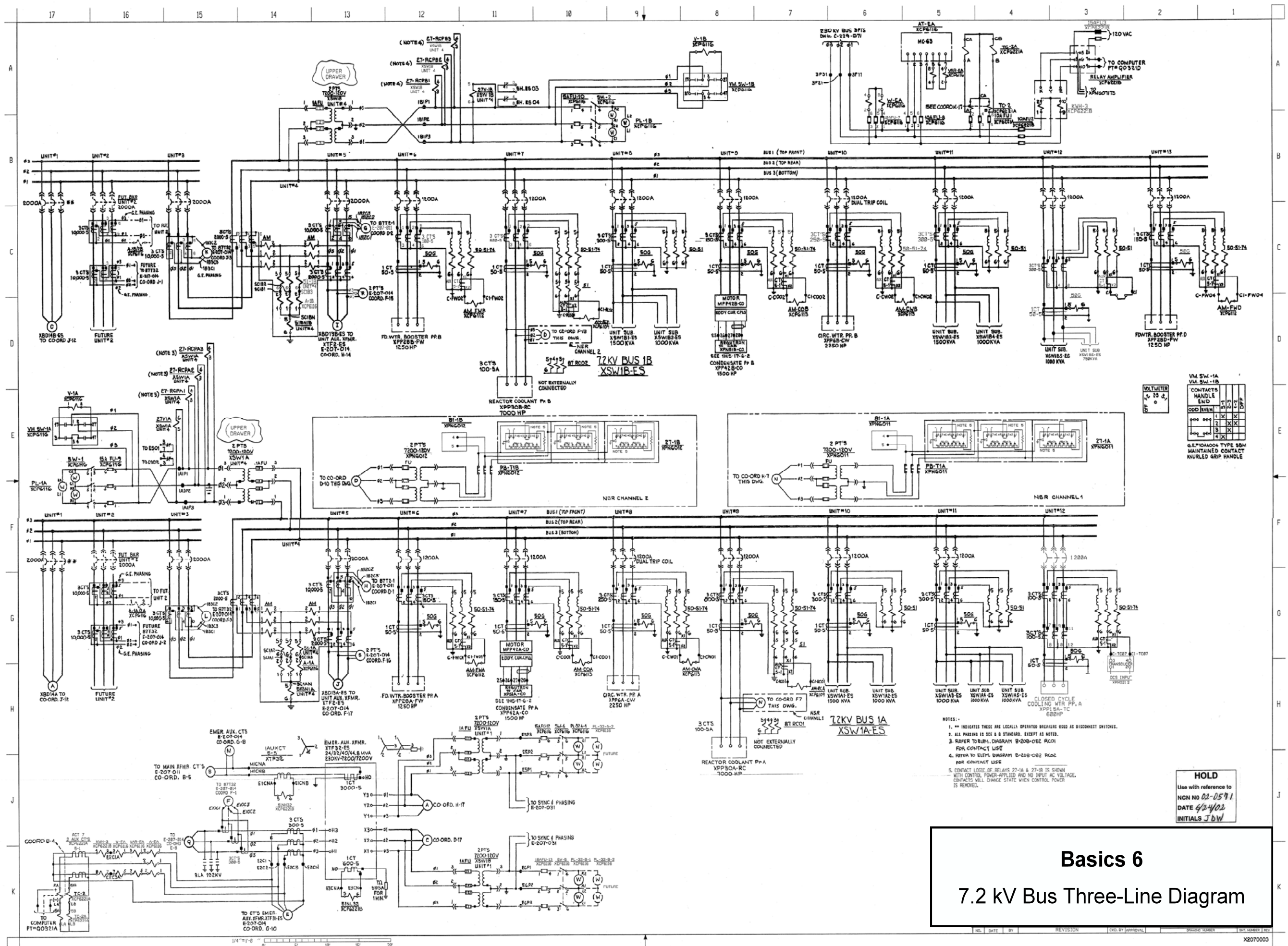


Basics 3

4.16 kV Bus One-Line



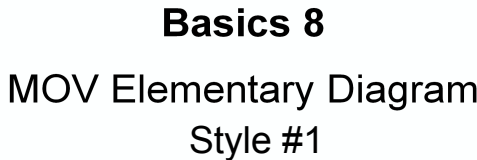


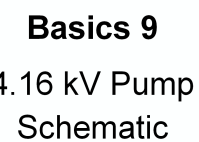


Basics 6

7.2 kV Bus Three-Line Diagram

HOLD
Use with reference to
NGN No 02-0571
DATE 4/24/02
INITIALS J.B.W.





LEGEND:
 A - CIRCUIT NO.
 B - NO. COND. & WIRE SIZE
 C - VOLTS
 D - B/M ITEM
 E - CONDUIT SIZE
 F - NATURE OF CIRCUIT

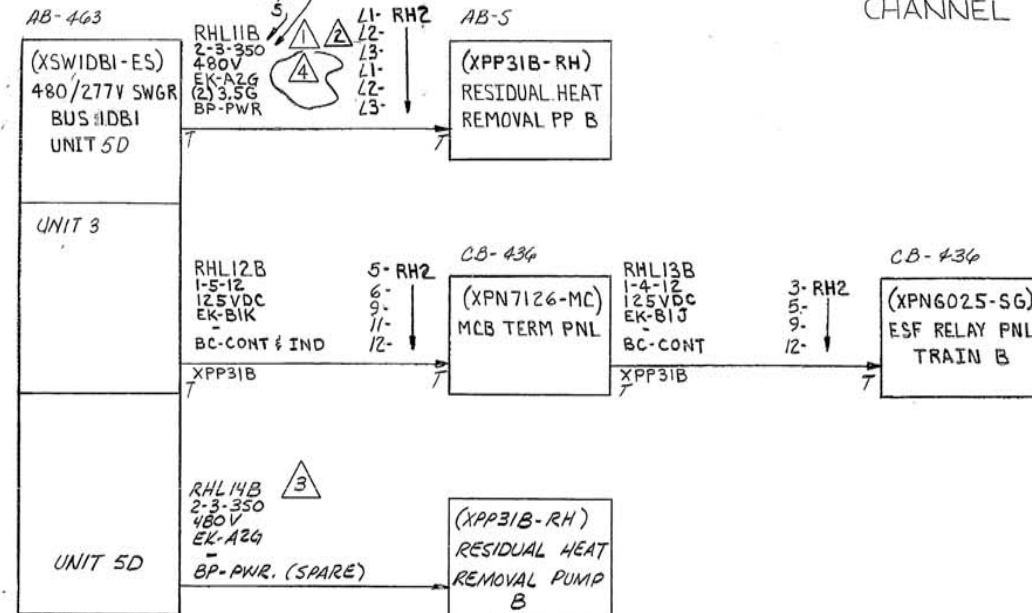
NUCLEAR
 SAFETY
 RELATED

Basics 10

480 V Pump Block Diagram

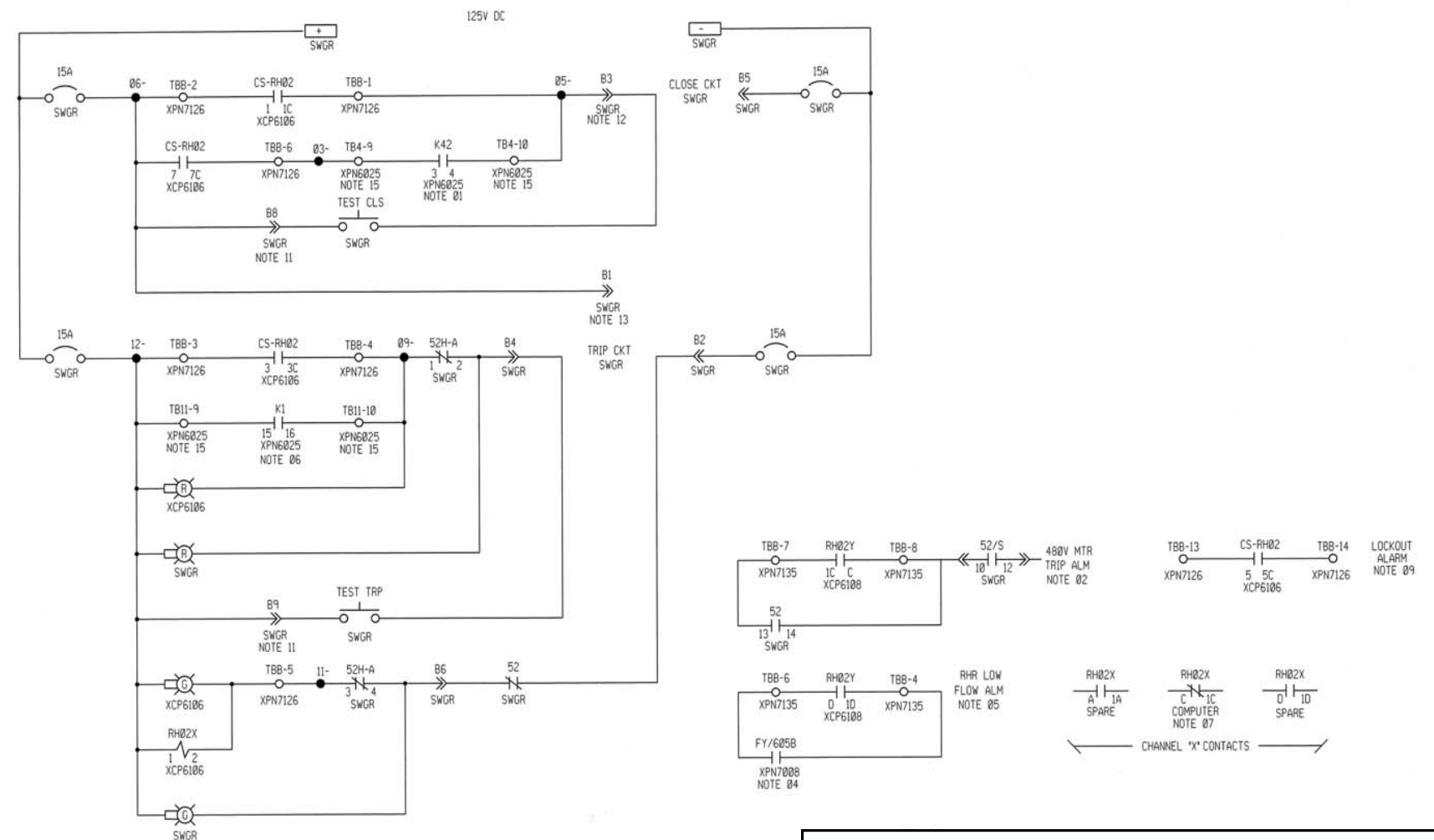
CHANNEL B REFERENCE: - GA1 B-208-084 SH. RH-2 REV 0

SHEET L2



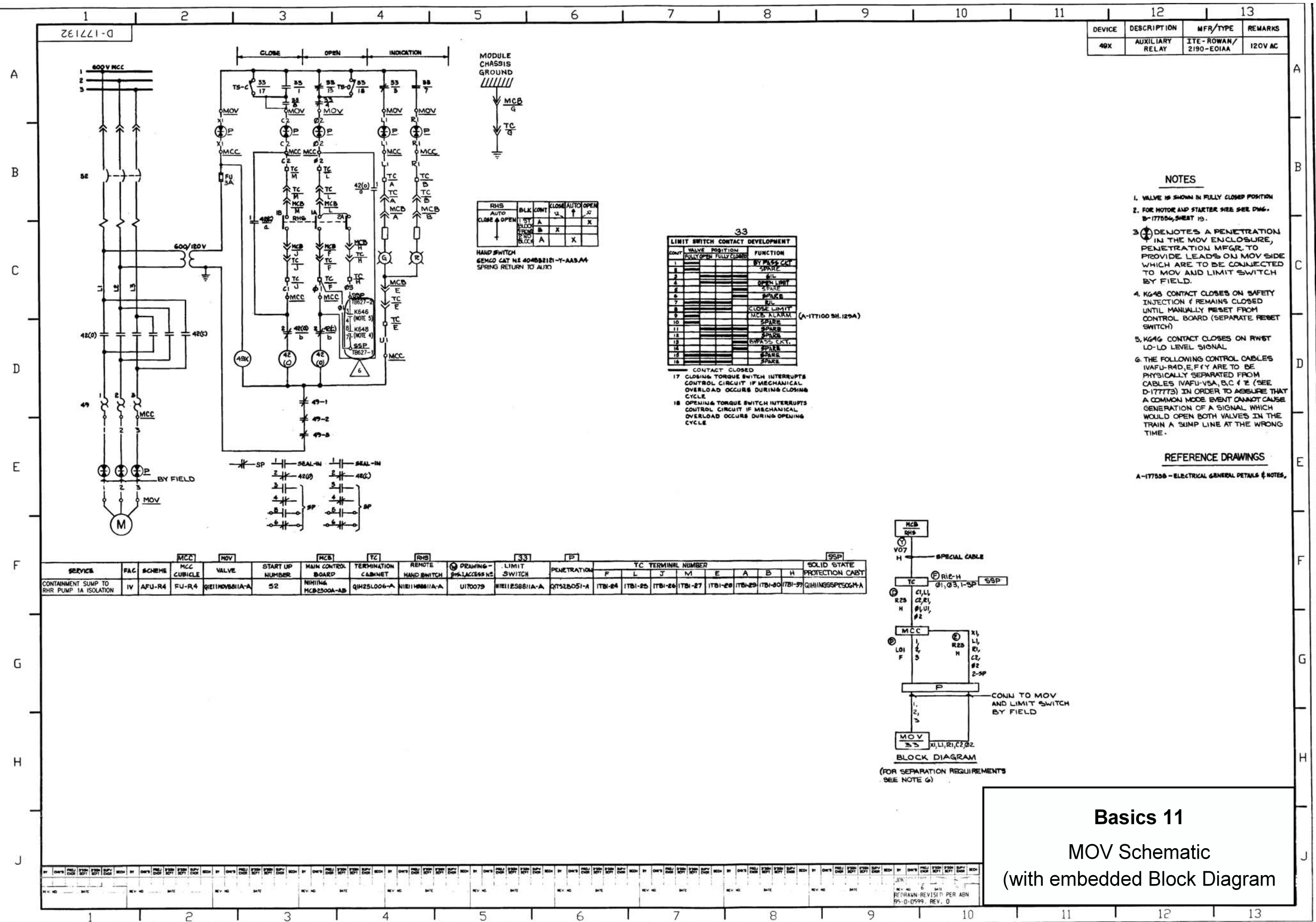
- ⚠ VIA PB-RHI
- ⚠ TYPING NOTE 2 (SS-200-105) 2#4 GND WIRE PER CONDUIT
- ⚠ SPARE CABLE - TO BE COILED & STORED IN WAREHOUSE FOR USE IN CASE OF DESTRUCTION TO RHL11B DUE TO FIRE.
- ⚠ USE SPARE CABLE RHL14B SHOULD RHL11B BE DESTROYED BY FIRE.

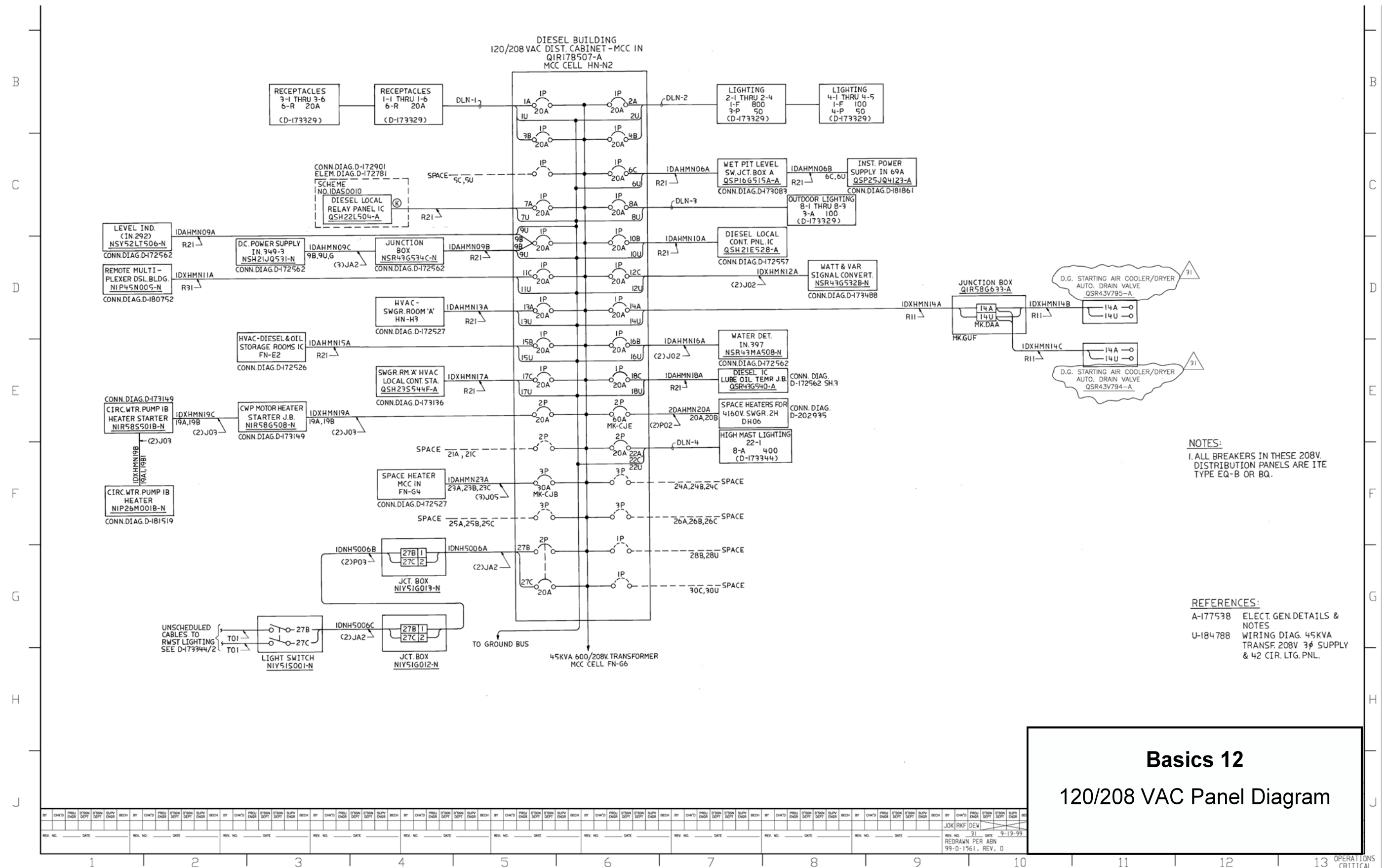
K817 62173



Basics 10

480 V Pump Schematic





NOTES:

1. BREAKERS SHOWN IN THE "OPEN" POSITION
2. COILS SHOWN IN THE "DE-ENERGIZED" STATE.
3. PRESSURE SWITCHES, FLOW SWITCHES, ETC. SHOWN IN THE "OFF-SHELF" POSITION.
4. THE COMPLETE WIRE MARK IS THE WIRE MARK SHOWN PLUS THE SYSTEM SHEET NUMBER (e.g. 1-ES09, 2-ES09, ETC.)
5. VALVES SHOWN IN THE "CLOSED" POSITION (EXCEPT AS NOTED).
6. GAI-ERAC NO.'S WILL BE USED TO IDENTIFY EQUIPMENT LOCATION WHERE APPLICABLE. SEE EQUIPMENT LIST FOR GAI-ERAC DESIGNATION
7. ALL AUX. RELAYS WILL BE "CUTLER-HAMMER" TYPE M-600V AS SHOWN ON B-208-002 SHT. 19. EXCEPT AS NOTED ON ELEM. DIAGRAM'S
8. DROPPING RESISTORS FOR "CMC" LIGHT MODULES ON MCB SHALL BE AS FOLLOWS:
a) 125VDC CIRCUITS - 1950 OHMS FOR SINGLE LAMP; 1600 OHMS FOR TWO LAMPS IN SERIES
b) 120VAC CIRCUITS - 1750 OHMS FOR SINGLE LAMP; 1400 OHMS FOR TWO LAMPS IN SERIES
9. INSTRUMENTATION SETPOINTS SHOWN ON THIS SERIES DRAWINGS ARE FOR INFORMATION ONLY. THE SETPOINT DATABASE/LIST SHALL BE CHECKED TO VERIFY INSTRUMENT SETPOINTS LISTED ON THESE DRAWINGS.

ABBREVIATIONS

ABBREVIATIONS	DEFINITIONS
AL	ALARM
BLU	BLUE
B.O.	BLACK OUT
COMPT	COMPUTER
CONT	CONTROL
DFTD	DEFEATED
GRN	GREEN
INTERLK	INTERLOCK
MON AL 2	MONITOR LIGHT ALARM GROUP 2
MON LT 2	MONITOR LIGHT GROUP 2
REM	REMOTE
T.C.	TORQUE SWITCH TO STOP VALVE CLOSING
T.O.	TORQUE SWITCH TO STOP VALVE OPENING
WH	WESTINGHOUSE
WHT	WHITE
YEL	YELLOW

ROTOR	POSITION SWITCH	LIMIT SWITCH DEVELOPMENT - LIMITORQUE OPER.			
		CLOSING	VALVE POSITION		OPENING
		FULL CLOSE			FULL OPEN
1	33A0	1			
	33A0	2			
	33B0	3			
	33B0	4			
2	33BC	5			
	33BC	6			
	33AC	7			
	33AC	8			
3	33A0	9			
	33A0	10			
	33B0	11			
	33B0	12			
4	33BC	13			
	33BC	14			
	33AC	15			
	33AC	16			
		17	CLOSING TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING CLOSING CYCLE OR FULLY CLOSED VALVE		
		18	OPENING TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING OPENING CYCLE OR FULLY OPENED VALVE		

LIMIT SWITCH DEVELOPMENT - ROTORK OPERATOR

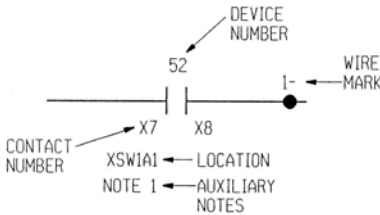
SWITCH	CONTACT	OPEN	INTERMEDIATE	CLOSED
OT/LS	24-25			
CT/LS	26-27			
OAS1	15-16			
CAS1	6-7			
OAS2	17-18			
CAS2	8-9			

ADD-ON-PAK 1 SWITCH OPERATION

SWITCH	CONTACT	OPEN	INTERMEDIATE	CLOSED
IAS1	10-11			
IAS2	12-13			
IAS3	19-20			
IAS4	21-22			
IAS5	28-29			
IAS6	30-31			

ADD-ON-PAK SWITCHES CAN BE SET AT VALVE FULL OPEN, FULL CLOSED, OR ANY POSITION IN BETWEEN

DEVICE IDENTIFICATION (COMPUTER DRAWINGS)



LIMIT SWITCH DEVELOPMENT FOR AIR OPERATED VALVES AND DAMPERS

SWITCH	LIMIT SWITCH	DEVICE POSITION		
		FULL CLOSE		FULL OPEN
ACTUATED	33bc			
	33bc			
	33ac			
CLOSED	33ac			
	33ac			
	33ao			
ACTUATED	33ao			
	33ao			
	33bo			
DEVICE OPEN	33bo			
	33bo			

NOTE: 33 CONTACTS SHOWN FOR DEVICE FULL CLOSED

NOTES: LIMIT SWITCH DEVELOPMENT- LIMITORQUE OPER.

1. INTERMEDIATE POSITIONS ARE EXPRESSED IN PERCENTAGE OF FULL OPEN.
EX. 33A05 CONTACT ACTUATES WHEN THE VALVE IS 5% OPEN.
2. THE TOLERANCE FOR ROTOR 2 CONTACTS SET AT 25% OPEN IS $\pm 2.5\%$.
3. LIMITORQUE VALVES STROKED OPEN TO A POSITION OF $\geq 90\%$ ARE CONSIDERED "FULLY OPEN" WITH THE EXCEPTION OF XVG2802A & B-MS, WHICH MUST BE STROKED OPEN TO 95%. THE BASIS FOR THIS STATEMENT IS NUCLEAR ENGINEERING LETTER CGSS-20371, DATED 11/9/87.

LEGEND (FOR COMPUTER GENERATED DRAWINGS)

