HITACHI

GE Hitachi Nuclear Energy

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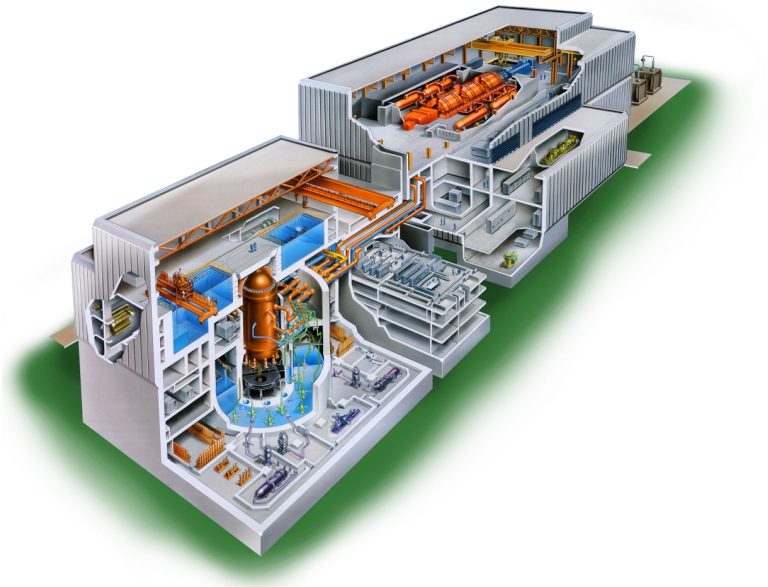
ABWR
Design Control Document
Tier 2



Chapter 21

Volume 5

Chapter 21 Volume 5
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NO.	TITLE
1	NOTES, CONTENTS
2	HECW PUMP (A&D) (1)
3	HECW PUMP (A&D) (2)
4	HECW PUMP (A&D) (3)
5	HECW REFRIGERATOR (A) COMPRESSOR
6	HECW PUMP (B&E) (1)
7	HECW PUMP (B&E) (2)
8	HECW PUMP (B&E) (3)
9	HECW REFRIGERATOR (A) REACTOR BUILDING COOLING WATER INLET VALVE (P21)
10	HECW CHILLED WATER IN-OUT PRESSURE DIFFERENCE CONTROL VALVE
11	ANNUNCIATOR

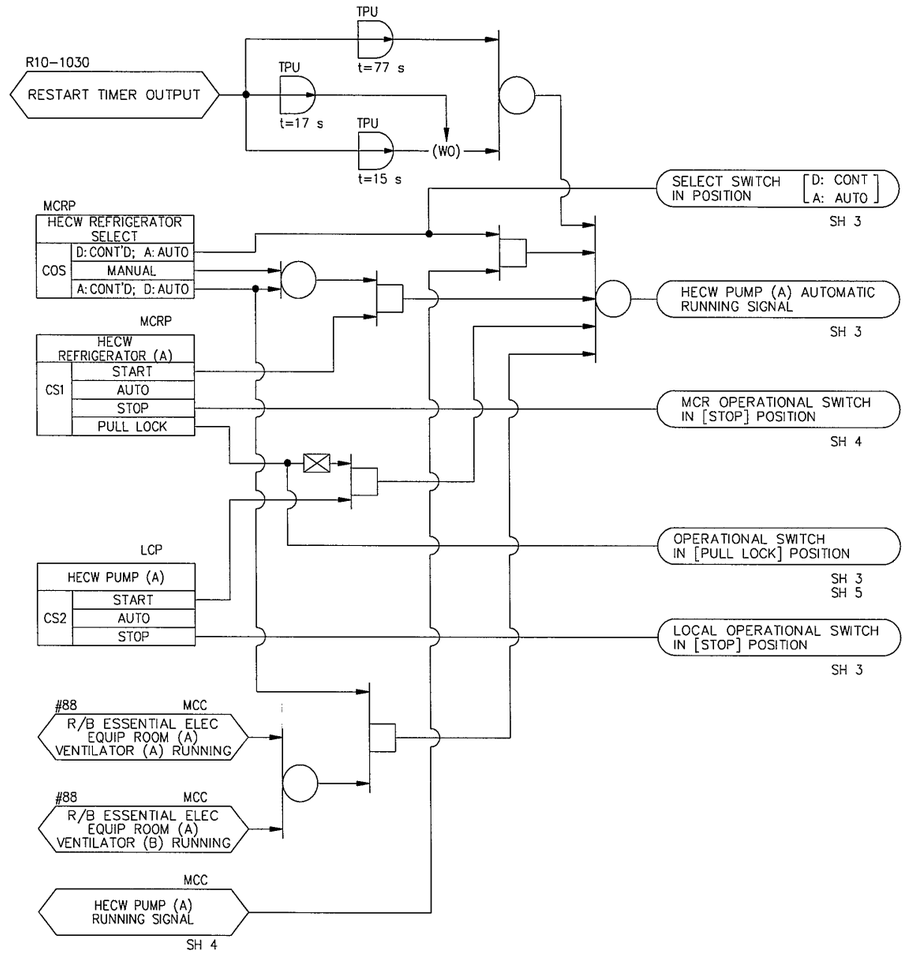
NOTES:

1. UNLESS OTHERWISE NOTED, THE EQUIPMENT NUMBERS SHOWN ON THIS DIAGRAM ARE PREFIXED WITH P25.
2. UNLESS OTHERWISE NOTED, THE POWER SUPPLY FOR SUPPORTING EQUIPMENT IS FROM THE ESSENTIAL POWER.
3. "#" FIXED NUMBERS IN THIS DIAGRAM INDICATE THE SWGR FUNTIONAL NUMBERS.
4. THE LOGIC OF REFRIGERATOR IS OMITTED BECAUSE IT DEPENDS ON HARDWARE STRUCTURE.

REFERENCE DOCUMENT	MPL NO.
1. HVAC EMERGENCY COOLING WATER SYS P&ID	P25-1010
2. REACTOR BUILDING COOLING WATER SYS P&ID	P21-1010
3. REACTOR BUILDING COOLING WATER SYS/ REACTOR SERVICE WATER SYS IBD	P21/P41-1030

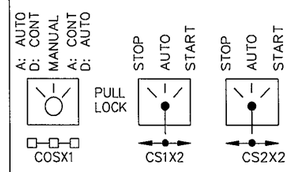
P25-1030

Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 1 of 11)



HECW PUMP (A AND D)

CONTROL SWITCH



OBSERVATIONAL MEASURES

USE	SPECIFICATION	LOCATION

ANNUNCIATOR

NO.	INDICATOR	LOCATION

OTHERS

INSTANT INTERRUPTION COUNTER MEAS		NEED	
		NOT NEED	
VALVE	INCHING OPERATION	NEED	
		NOT NEED	
	SEATING FORM	OPEN SIDE	
		CLOSED SIDE	
	THERMAL BYPASS	EXIST	
		NOT EXIST	
SWGR PWR SUPPLY OBSERVATION		EXIST NOT EXIST	
ELECTRICAL SOL VLV PWR SUPPLY		AC V	
		DC V	

P25-1030

Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 2 of 11)

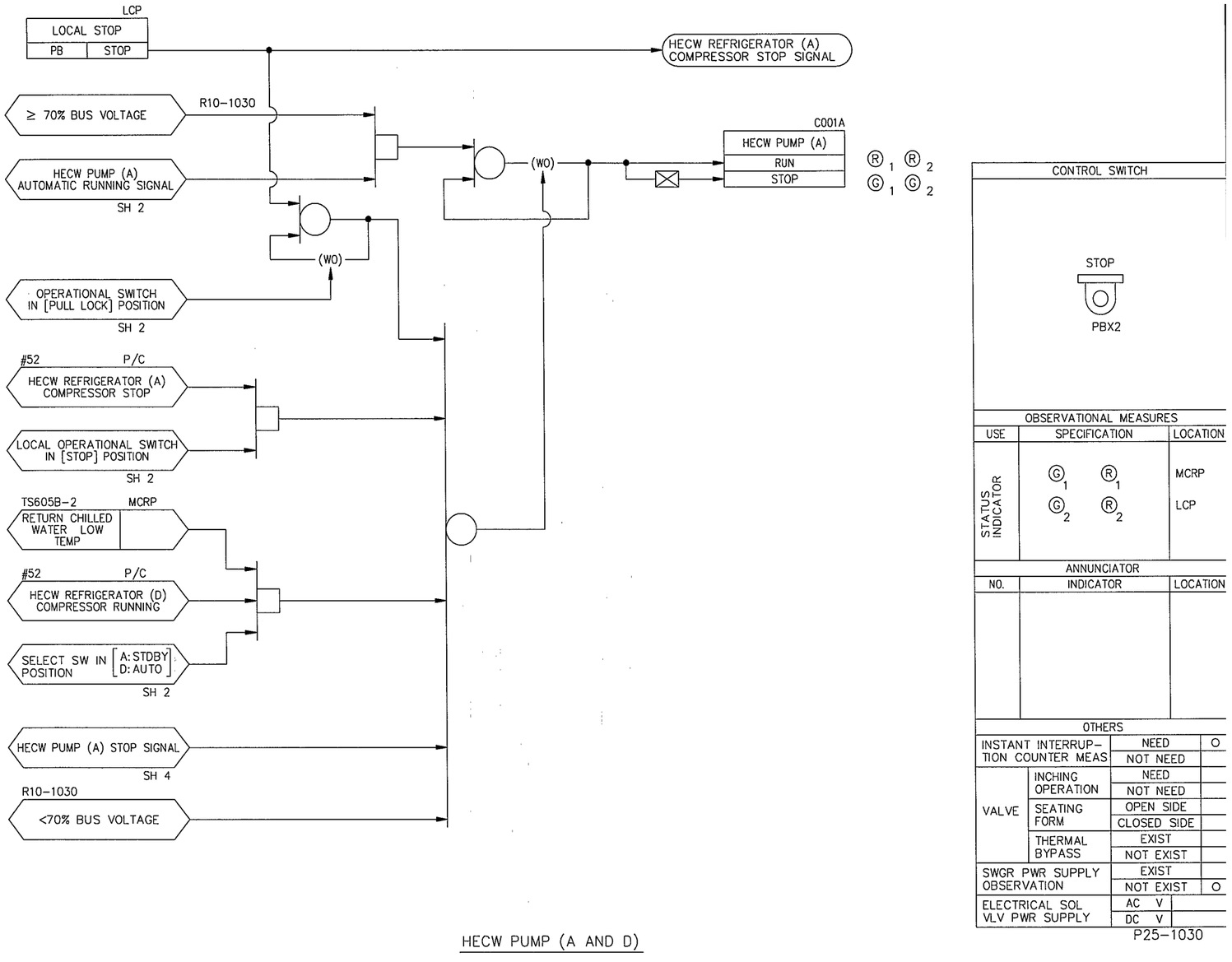
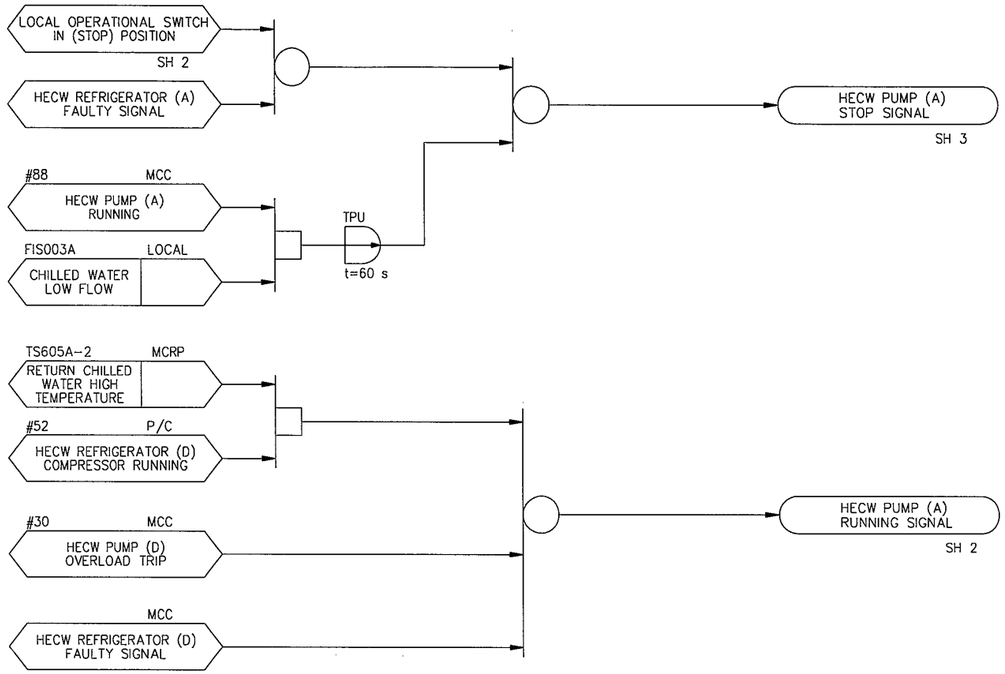


Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 3 of 11)



HECW PUMP (A AND D)

CONTROL SWITCH			

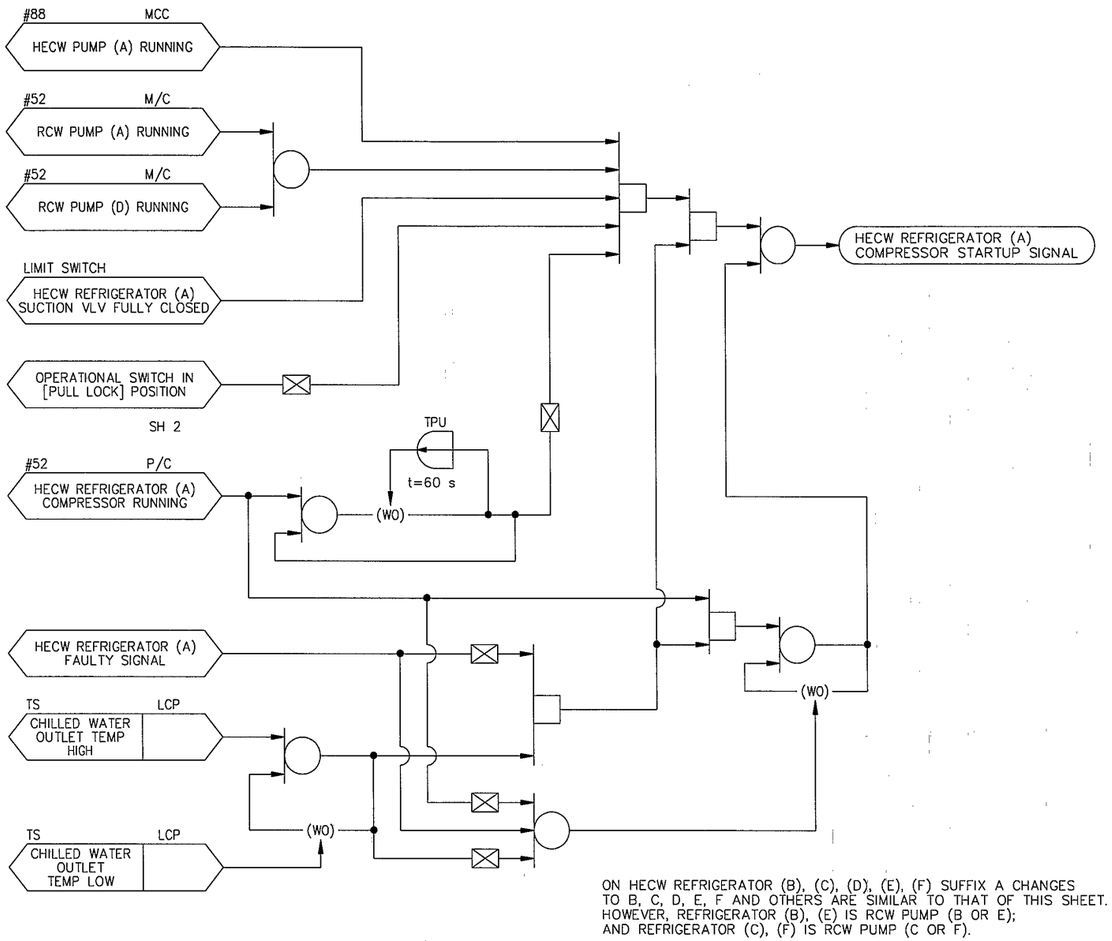
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS			
INSTANT INTERRUPTION COUNTER MEAS		NEED	
		NOT NEED	
VALVE	INCHING OPERATION	NEED	
		NOT NEED	
	SEATING FORM	OPEN SIDE	
		CLOSED SIDE	
	THERMAL BYPASS	EXIST	
		NOT EXIST	
SWGR PWR SUPPLY OBSERVATION		EXIST	
		NOT EXIST	
ELECTRICAL SOL VLV PWR SUPPLY		AC V	
		DC V	

P25-1030

Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 4 of 11)



HECW REFRIGERATOR (A) COMPRESSOR

CONTROL SWITCH

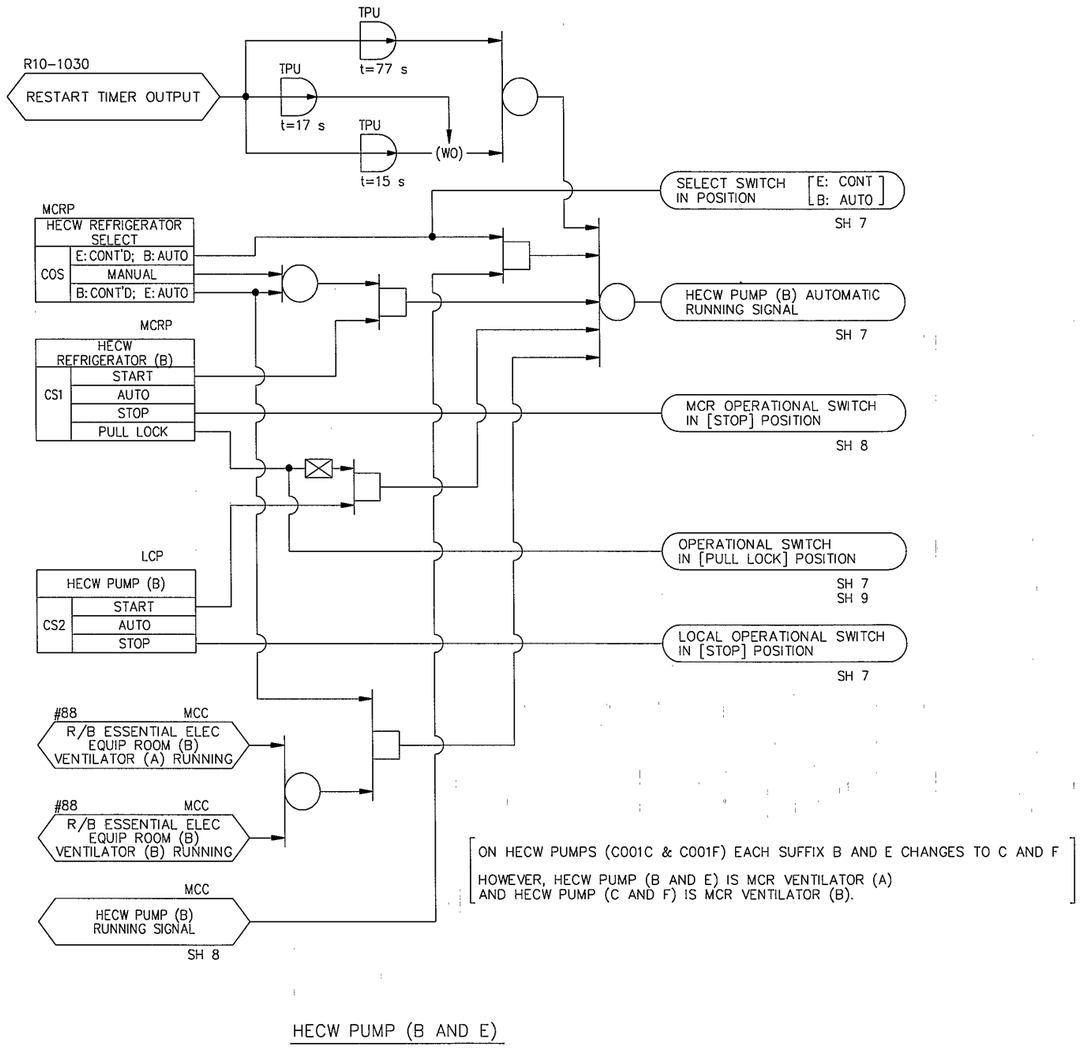
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS			
INSTANT INTERRUPTION COUNTER MEAS		NEED	
		NOT NEED	
VALVE	INCHING OPERATION	NEED	
		NOT NEED	
	SEATING FORM	OPEN SIDE	
		CLOSED SIDE	
	THERMAL BYPASS	EXIST	
		NOT EXIST	
SWGR PWR SUPPLY OBSERVATION		EXIST	
		NOT EXIST	
ELECTRICAL SOL VLV PWR SUPPLY		AC V	
		DC V	

P25-1030

Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 5 of 11)



CONTROL SWITCH									
B: AUTO E: CONT	MANUAL	B: CONT E: AUTO	PULL LOCK	STOP	AUTO	START	STOP	AUTO	START
COSX2				CS1X4			CS2X4		

OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS			
INSTANT INTERRUP–TION COUNTER MEAS		NEED	
		NOT NEED	
VALVE	INCHING OPERATION	NEED	
		NOT NEED	
	SEATING FORM	OPEN SIDE	
		CLOSED SIDE	
	THERMAL BYPASS	EXIST	
		NOT EXIST	
SWGR PWR SUPPLY OBSERVATION		EXIST	
		NOT EXIST	
ELECTRICAL SOL VLV PWR SUPPLY		AC V	
		DC V	

P25–1030

Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 6 of 11)

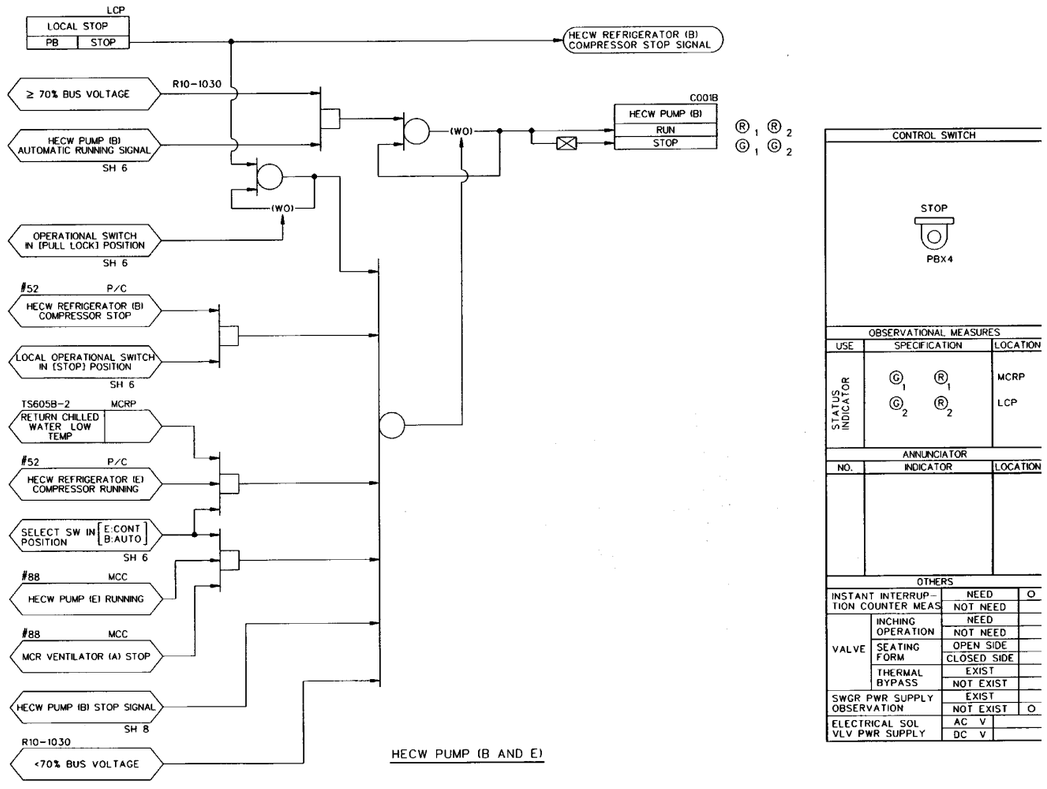
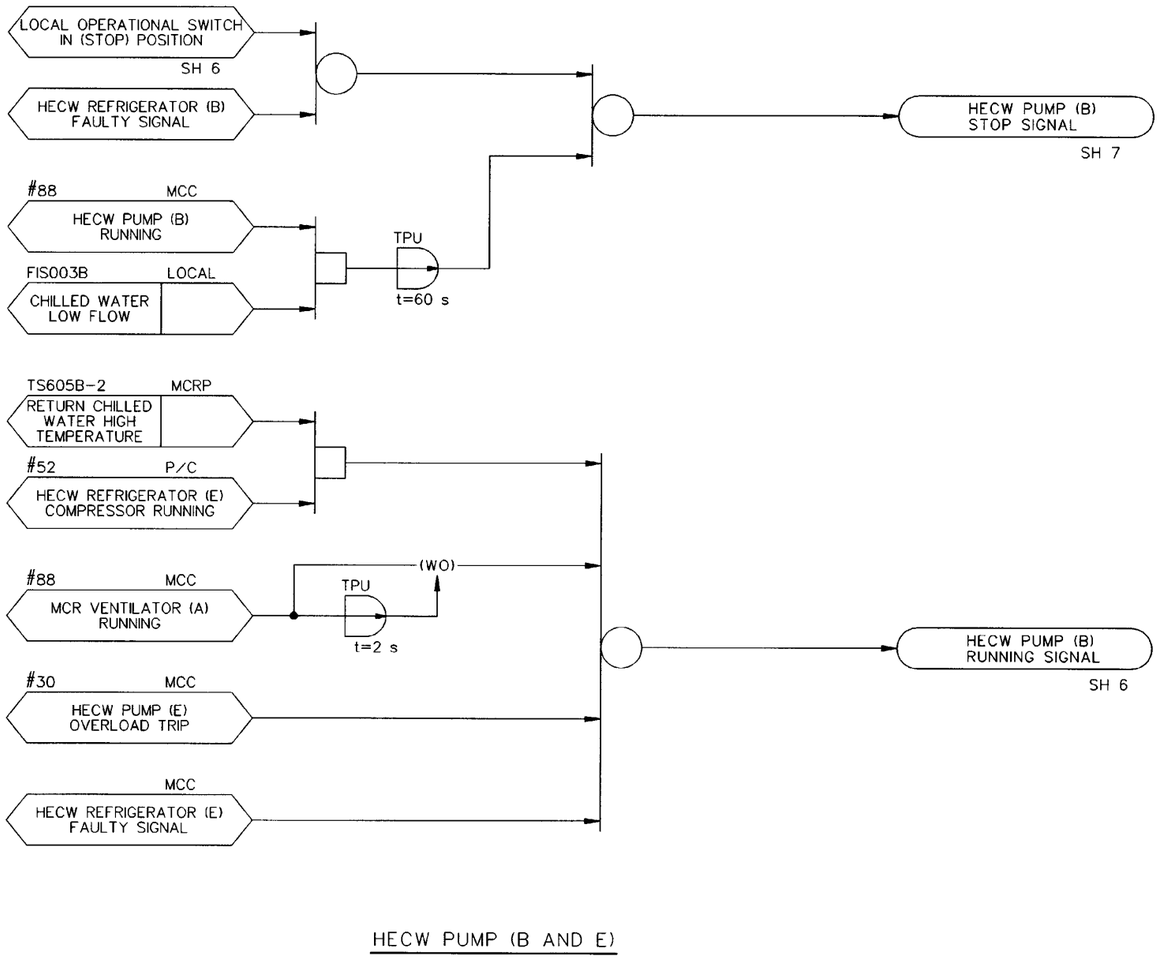


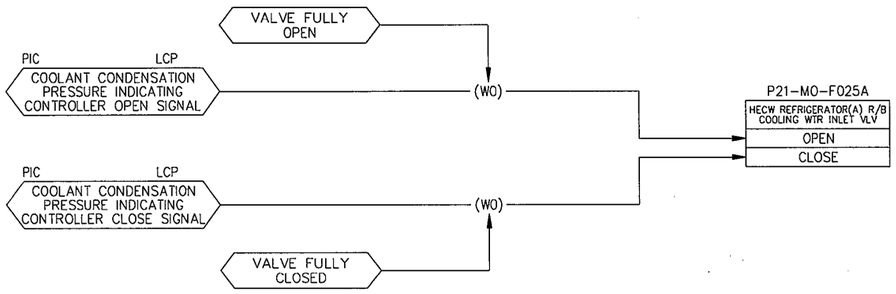
Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 7 of 11)



HECW PUMP (B AND E)

CONTROL SWITCH			
OBSERVATIONAL MEASURES			
USE	SPECIFICATION		LOCATION
ANNUNCIATOR			
NO.	INDICATOR		LOCATION
OTHERS			
INSTANT INTERRUPTION COUNTER MEAS		NEED	
		NOT NEED	
VALVE	INCHING OPERATION	NEED	
		NOT NEED	
	SEATING FORM	OPEN SIDE	
		CLOSED SIDE	
	THERMAL BYPASS	EXIST	
		NOT EXIST	
SWGR PWR SUPPLY OBSERVATION		EXIST	
		NOT EXIST	
ELECTRICAL SOL VLV PWR SUPPLY		AC V	
		DC V	

Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 8 of 11)



ON HECW REFRIGERATOR (B), (C), (D). (E), (F) COOLING WATER INLET VALVE, SUFFIX A CHANGES TO B, C, D, E, F ARE SIMILAR TO THAT OF THIS SHEET.

REFRIGERATOR (A) COOLING WATER INLET VALVE

CONTROL SWITCH		

OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS			
INSTANT INTERRUP-TION COUNTER MEAS		NEED	O
		NOT NEED	O
VALVE	INCHING OPERATION	NEED	
		NOT NEED	
	SEATING FORM	OPEN SIDE	LT
		CLOSED SIDE	LT
	THERMAL BYPASS	EXIST	
		NOT EXIST	
SWGR PWR SUPPLY OBSERVATION		EXIST	
		NOT EXIST	O
ELECTRICAL SOL VLV PWR SUPPLY		AC V	
		DC V	

P25-1030

Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 9 of 11)

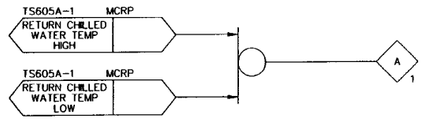
ON HECW CHILLED WATER IN-OUT PRESSURE DIFFERENCE CONTROL VALVES (F012B, F012C) AND OTHERS ARE SIMILAR TO THAT OF THIS SHEET.

HECW CHILLED WATER IN-OUT PRESSURE DIFFERENCE CONTROL VALVE

CONTROL SWITCH		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS		
INSTANT INTERRUPTION COUNTER MEAS	NEED	
	NOT NEED	
VALVE	INCHING OPERATION	NEED
		NOT NEED
	SEATING FORM	OPEN SIDE
		CLOSED SIDE
	THERMAL BYPASS	EXIST
		NOT EXIST
SWGR PWR SUPPLY OBSERVATION		EXIST
		NOT EXIST
ELECTRICAL SOL VLV PWR SUPPLY		AC V
		DC V

Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 10 of 11)



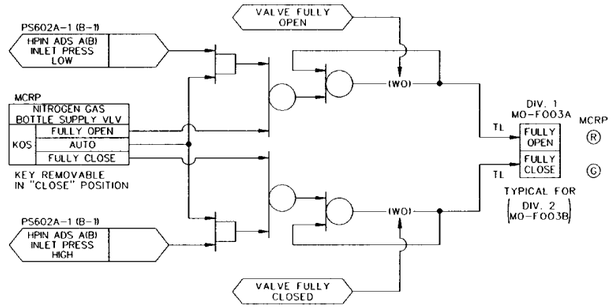
ON HECW PUMP (B AND E), (C AND F) SUFFIX A CHANGES TO B, C, AND ARE SIMILAR TO THAT OF THIS SHEET.

ANNUNCIATOR

CONTROL SWITCH		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
1	HECW PUMP A RETURN CHILLED WATER TEMPERATURE HIGH/LOW *	MCRP

OTHERS			
INSTANT INTERRUPTION COUNTER MEAS		NEED	
		NOT NEED	
VALVE	INCHING OPERATION	NEED	
		NOT NEED	
	SEATING FORM	OPEN SIDE	
		CLOSED SIDE	
	THERMAL BYPASS	EXIST	
		NOT EXIST	
SWGR PWR SUPPLY OBSERVATION		EXIST	
		NOT EXIST	
ELECTRICAL SOL VLV PWR SUPPLY		AC V	
		DC V	

Figure 7.3-9 HVAC Emergency Cooling Water System IBD (Sheet 11 of 11)



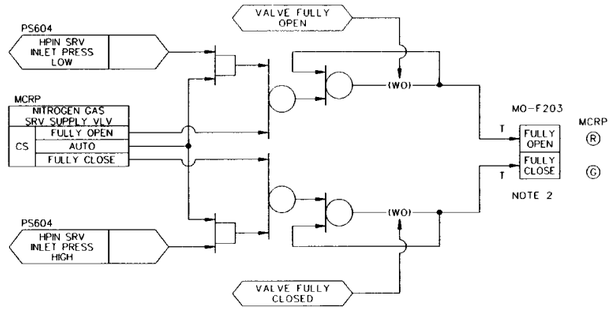
NITROGEN GAS BOTTLE SUPPLY MO-F003A

NOTES:

1. HPIN SYSTEM DIVISION – A IS POWERED FROM CLASS 1E DIVISION 1 AND HPIN SYSTEM DIVISION – B IS POWERED FROM CLASS 1E DIVISION 2.
2. THE NON-SAFETY RELATED PORTION OF HPIN IS POWERED FROM NON-CLASS 1E SOURCE.

REFERENCE DOCUMENT:

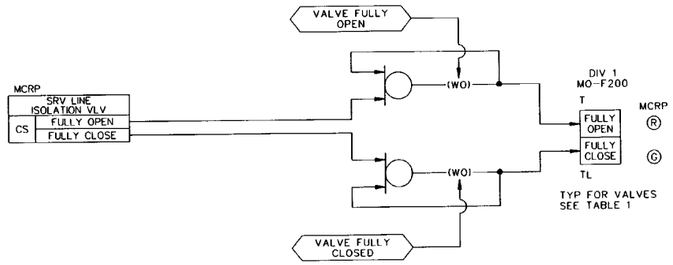
	MPL NO.
1. HIGH PRESS NITROGEN GAS SUPPLY SYS P&ID	P54-1010



NITROGEN GAS SRV SUPPLY VALVE MO-F203

MPL NO. P54-1030

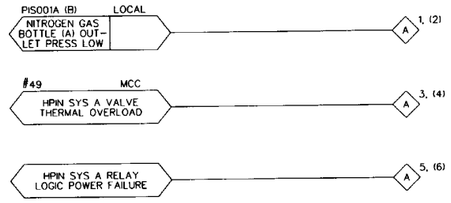
Figure 7.3-10 High Pressure Nitrogen Gas System IBD (Sheet 1 of 3)



SRV LINE ISOLATION VALVE MO-F200

TABLE 1

VALVE DESCRIPTION	VALVE NUMBER	SWITCH LOCATION	SEATING FORM		DIVISION
			OPEN	CLOSE	
ADS LINE – A ISOLATION VALVE	MO-F007A	MCRP	TL	TL	1
ADS LINE – B ISOLATION VALVE	MO-F007B	MCRP	TL	TL	2



MISCELLANEOUS ALARMS

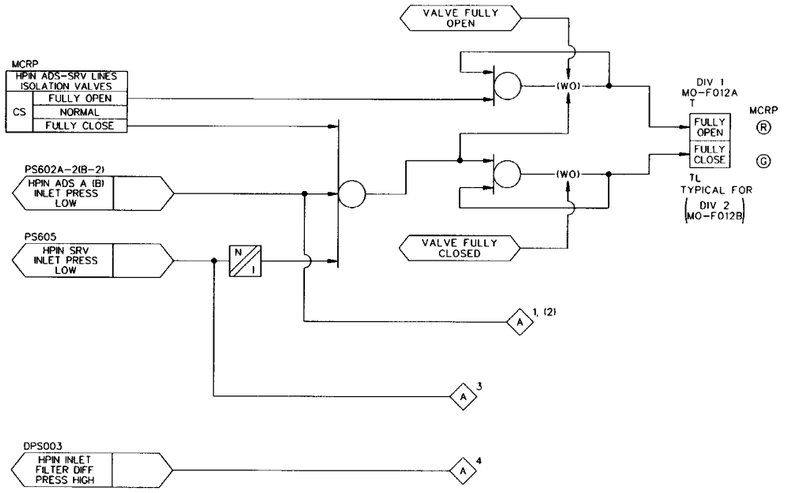
CONTROL SWITCH

OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR			
NO.	GRADE	INDICATOR	LOCATION
1	IV	N2 GAS BOTTLE (A) OUTLET PRESS LOW	MCRP
2	IV	N2 GAS BOTTLE (B) OUTLET PRESS LOW	MCRP
3	IV	HPIN SYS A VALVE THERMAL OVERLOAD	MCRP
4	IV	HPIN SYS B VALVE THERMAL OVERLOAD	MCRP
5	IV	HPIN SYS A RELAY LOGIC POWER FAILURE	MCRP
6	IV	HPIN SYS B RELAY LOGIC POWER FAILURE	MCRP

OTHERS

Figure 7.3-10 High Pressure Nitrogen Gas System IBD (Sheet 2 of 3)



HPIN ADS – SRV LINES ISOLATION
VALVE MO-F012A AND
MISCELLANEOUS ALARMS

CONTROL SWITCH		

OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR			
NO.	GRADE	INDICATOR	LOCATION
1	IV	HPIN (A) D/W INLET PRESS LOW	MCRP
2	IV	HPIN (A) D/W INLET PRESS LOW	MCRP
3	IV	HPIN SRV D/W INLET PRESS LOW	MCRP
4	IV	HPIN INLET FILTER DIF. PRESS LOW	MCRP

OTHERS

Figure 7.3-10 High Pressure Nitrogen Gas System IBD (Sheet 3 of 3)

SH NO.	TITLE
1	NOTES, CONTENTS
2	SLC PUMP (A), (B)
3	SLC LUBRICANT PUMP (A), (B)
4	SLC INJECTION VALVE (A), (B)
5	SLC PUMP (A), (B) SUCTION VALVE
6	SLC STORAGE TANK LOW POWER HEATER, HIGH POWER HEATER & SLC MANUAL VALVE

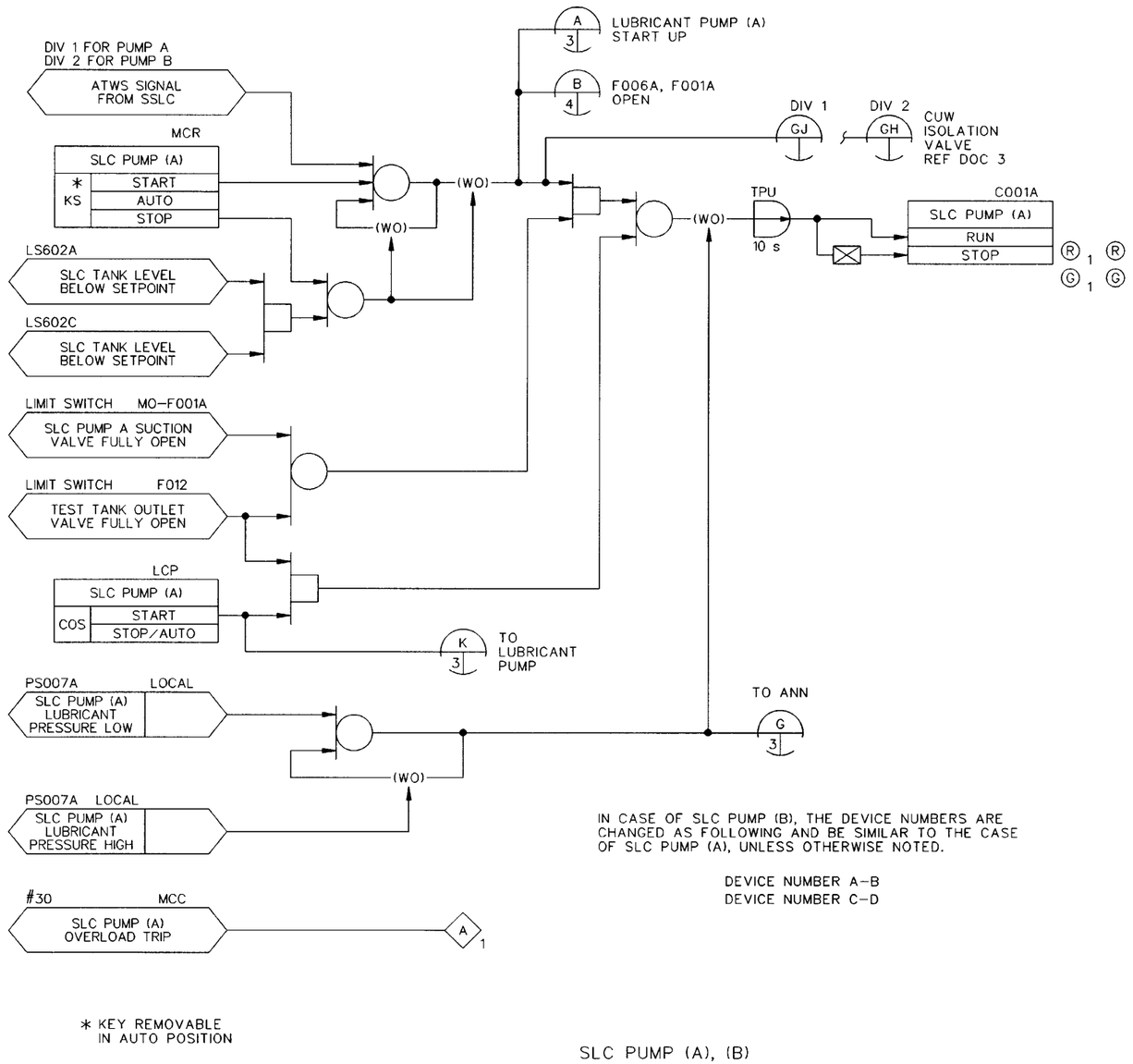
NOTES:

1. UNLESS OTHERWISE NOTED, THE DEVICE NUMBERS SHOWN ON THIS DIAGRAM ARE PREFIXED WITH C41.
2. UNLESS OTHERWISE NOTED, POWER SUPPLY OF THIS SYSTEM IS EMERGENCY ONE.
3. "#" FIXED NUMBERS IN THIS DIAGRAM INDICATE THE SWGR FUNCTION NUMBERS.
4. THIS IBD EXPRESS FOR SYSTEM (A) AND TYPICAL FOR (B).

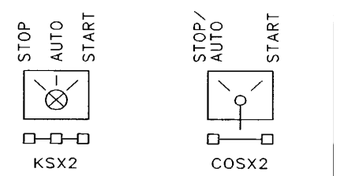
REFERENCE DOCUMENT		MPL NO.
1.	STANDBY LIQUID CONTROL SYS P&ID	C41-1010
2.	STANDBY LIQUID CONTROL SYS PFD	C41-1020
3.	LEAK DETECTION AND ISOLATION SYS IBD	E31-1030

MPL NO. C41-1030

Figure 7.4-1 Standby Liquid Control System IBD (Sheet 1 of 6)



CONTROL SWITCH



OBSERVATIONAL MEASURES

USE	SPECIFICATION	LOCATION
STATUS INDICATOR	G 1 R 1 G 2 R 2	MCRP LCP

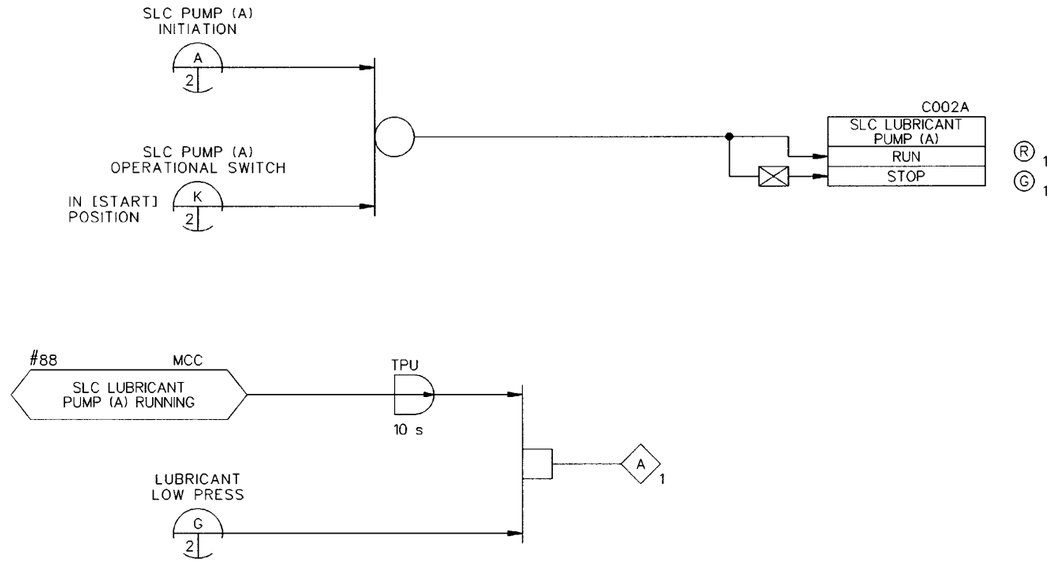
ANNUNCIATOR

NO.	INDICATOR	LOCATION
1	SLC PUMP (A) OVERLOAD TRIP	MCRP

OTHERS

INSTANT INTERRUPTION COUNTER MEASURE		NEED	
		NOT NEED	
VALVE	INCHING OPERATION	NEED	
		NOT NEED	
	SEATING FORM	OPEN SIDE	
		CLOSED SIDE	
	THERMAL BYPASS	EXIST	
		NOT EXIST	
SWGR POWER SUPPLY OBSERVATION		EXIST	
		NOT EXIST	O
ELECTRICAL SOLENOID VALVE POWER SUPPLY		AC V	
		DC V	

Figure 7.4-1 Standby Liquid Control System IBD (Sheet 2 of 6)



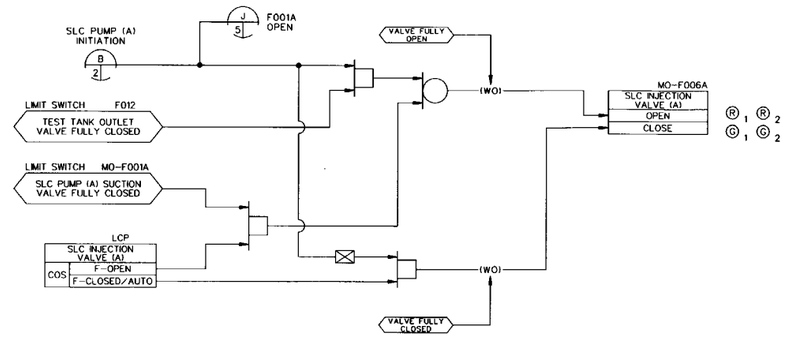
IN CASE OF LUBRICANT PUMP (B), THE DEVICE NUMBERS ARE CHANGED AS FOLLOWING AND BE SIMILAR TO THE CASE OF LUBRICANT PUMP (A), UNLESS OTHERWISE NOTED.

DEVICE NUMBER A-B

SLC LUBRICANT PUMP (A), (B)

CONTROL SWITCH			
OBSERVATIONAL MEASURES			
USE	SPECIFICATION		LOCATION
STATUS INDICATOR	G 1 R 1		MCRP
ANNUNCIATOR			
NO.	INDICATOR		LOCATION
1	SLC PUMP (A) LUBRICANT PRESS LOW		MCRP
OTHERS			
INSTANT INTERRUPTION COUNTER MEASURE		NEED	
		NOT NEED	
VALVE	INCHING OPERATION	NEED	
		NOT NEED	
	SEATING FORM	OPEN SIDE	
		CLOSED SIDE	
	THERMAL BYPASS	EXIST	
		NOT EXIST	
SWGR POWER SUPPLY OBSERVATION		EXIST	
		NOT EXIST	O
ELECTRICAL SOLENOID VALVE POWER SUPPLY		AC V	
		DC V	

Figure 7.4-1 Standby Liquid Control System IBD (Sheet 3 of 6)

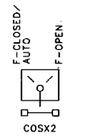


IN CASE OF SLC INJECTION VALVE (B), THE DEVICE NUMBERS ARE CHANGED AS FOLLOWING AND BE SIMILAR TO THE CASE OF SLC INJECTION VALVE (A), UNLESS OTHERWISE NOTED.

DEVICE NUMBER A-B

SLC INJECTION VALVE (A), (B)

CONTROL SWITCH



OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
STATUS INDICATOR	G1 R1	MCRP
	G2 R2	LCP

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS			
INSTANT INTERRUPTION COUNTER MEASURE		NEED	
		NOT NEED	
VALVE	INCHING OPERATION	NEED	
		NOT NEED	O
	SEATING FORM	OPEN SIDE	T
		CLOSED SIDE	T
	THERMAL BYPASS	EXIST	
		NOT EXIST	O
SWGR POWER SUPPLY OBSERVATION		EXIST	
		NOT EXIST	O
ELECTRICAL SOLENOID VALVE POWER SUPPLY		AC V	
		DC V	

Figure 7.4-1 Standby Liquid Control System IBD (Sheet 4 of 6)

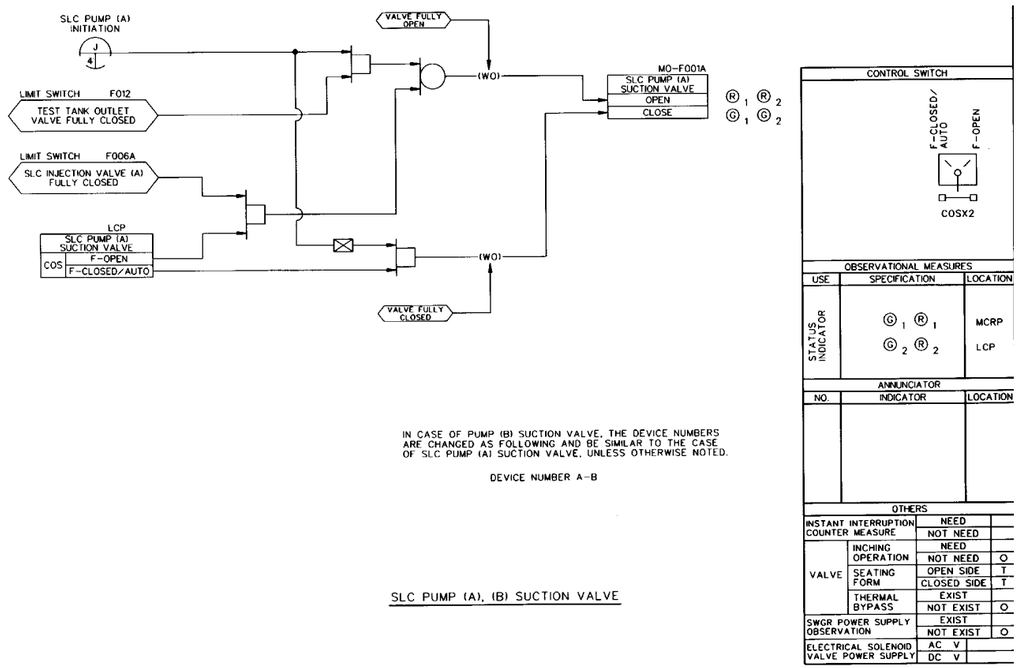


Figure 7.4-1 Standby Liquid Control System IBD (Sheet 5 of 6)

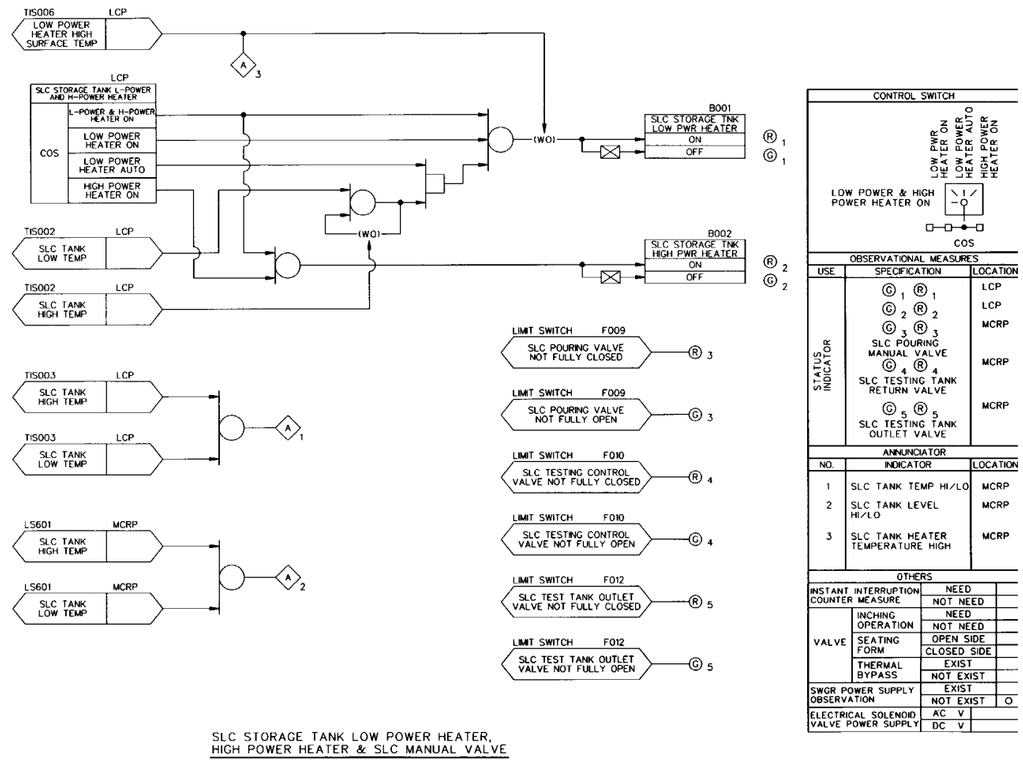
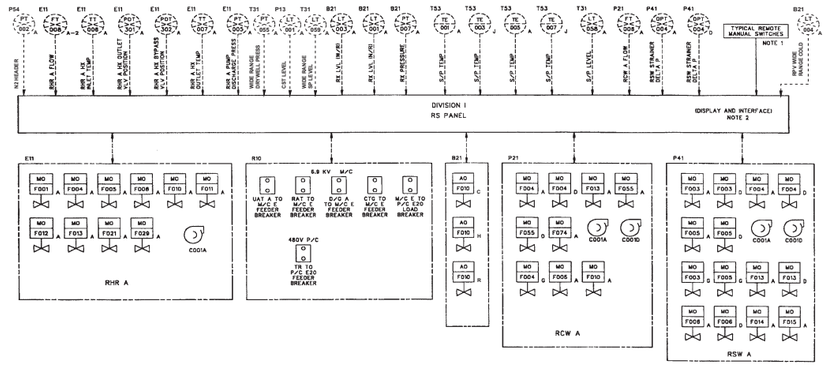
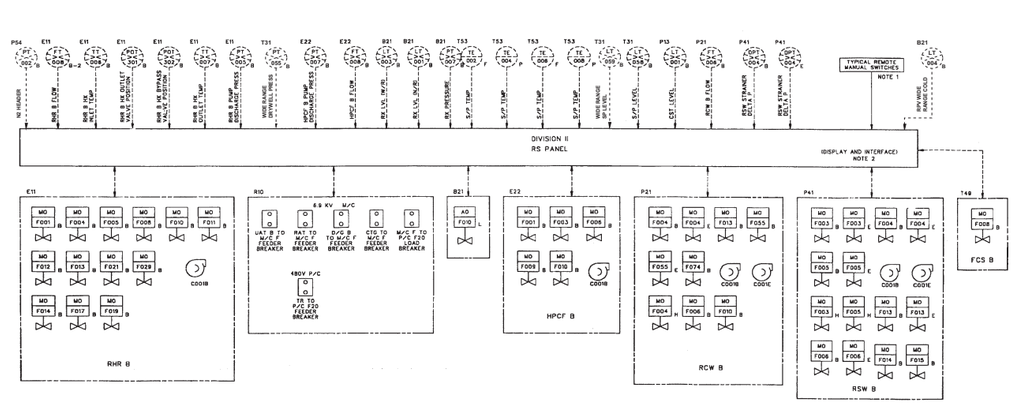


Figure 7.4-1 Standby Liquid Control System IBD (Sheet 6 of 6)





NOTES:

1. INCLUDES THE FOLLOWING FUNCTIONS:
   A. MCR–RSS TRANSFER SWITCHES
   B. RSS CONTROL SWITCHES
2. THE DIVISION I AND II REMOTE SHUTDOWN PANELS INCLUDE PROCESS INDICATIONS (RPV LEVEL, RPV PRESSURE, FLOW RATE, TEMPERATURE) AND VARIOUS STATUS INDICATIONS (PUMP RUN/STOP, VALVE OPEN/CLOSE, AND EMERGENCY DIESEL GENERATOR RUN/STOP). A 6.9 KV VOLTMETER ON EACH PANEL PROVIDES SUPPLY VOLTAGE INDICATION.

REFERENCE DOCUMENTS:	MPL NO.
1. REMOTE SHUTDOWN SYS IBD	C61–1030
2. RHR SYS P&ID	E11–1010
3. HPCF SYS P&ID	E22–1010
4. NUCLEAR BOILER SYS P&ID	B21–1010
5. REAC BLDG COOLING WATER SYS P&ID	P21–1010
6. REAC SERVICE WATER SYS P&ID	P41–1010
7. ATMOSPHERIC CONTROL SYS P&ID	T31–1010
8. MAKEUP WATER SYS (CONDENSATE) P&ID	P13–1010
9. SUPPRESSION POOL TEMP MONITORING SYS ICD	T53–1010
10. FLAMMABILITY CONTROL SYS P&ID	T49–1010

MPL NO. C61–1010

Figure 7.4-2 Remote Shutdown System IED

NOTES:

1. MOTOR OPERATED VALVE CONTROL LOGIC ON SHEETS 6 AND 8 APPLIES TO MANY VALVES AS TABULATED ON SHEETS 2 AND 3. INTERFACE INFORMATION IS AVAILABLE FROM APPLICABLE REFERENCE DOCUMENTS LISTED ON SHEET 1.

REFERENCE DOCUMENT	MPL NO.
1. REMOTE SHUTDOWN SYS IED	C61-1010
2. RESIDUAL HEAT REMOVAL SYS IBD	E11-1030
3. HIGH PRESS CORE FLOODER SYS IBD	E22-1030
4. REAC BLDG COOLING WATER SYS/ REACTOR SERVICE WATER SYS IBD	P21/P41-1030
5. NUCLEAR BOILER SYS IBD	B21-1030
6. FLAMMABILITY CONTROL SYSTEM P&ID	T49-1010
7. ELECTRICAL POWER DISTRIBUTION ONE LINE DIAG	R10-1010
8. MAKEUP WATER SYSTEM (CONDENSATE) P&ID	P13-1010
9. ATMOSPHERIC CONTROL SYSTEM P&ID	T31-1010
10. RESIDUAL HEAT REMOVAL SYSTEM P&ID	E11-1010
11. HIGH PESSURE CORE FLOODER SYSTEM P&ID	E22-1010
12. NUCLEAR BOILER SYSTEM P&ID	B21-1010
13. INTERLOCK BLOCK DIAGRAM (IBD) STANDARDS	A10-3070

LEGEND:

MCR = MAIN CONTROL ROOM
RSP = REMOTE SHUTDOWN CONTROL PANEL
RSTS = REMOTE SHUTDOWN TRANSFER SWITCH
RSCS = REMOTE SHUTDOWN CONTROL SWITCH

MPL NO. C61-1030

Figure 7.4-3 Remote Shutdown System IBD (Sheet 1 of 27)

SYS	NAME	SH NO.	PART NO.
RHR	RHR PUMP (A)	SH 14	E11-C001A
	RHR S/P SUCTION VALVE (A)	SH 7	E11-F001A
	RHR HX BYPASS VALVE (A)	SH 6	E11-F013A
	RHR INJECTION VALVE (A)	SH 15	E11-F005A
	RHR HX OUTLET VALVE (A)	SH 6	E11-F004A
	RHR S/P RETURN VALVE (A)	SH 16	E11-F008A
	RHR SHC (INBOARD) SUCTION ISOL VALVE (A)	SH 21	E11-F010A
	RHR SHC (OUTBOARD) SUCTION ISOL VALVE (A)	SH 22	E11-F011A
	RHR SHC SUCTION VALVE (A)	SH 17	E11-F012A
	RHR MINIMUM FLOW VALVE (A)	SH 12	E11-F021A
	RHR LIQUID WASTE FLUSH ISOLATION VALVE (A)	SH 8	E11-F029A
	RHR PUMP (B)	SH 14	E11-C001B
	RHR S/P SUCTION VALVE (B)	SH 7	E11-F001B
	RHR HX BYPASS VALVE (B)	SH 6	E11-F013B
	RHR INJECTION VALVE (B)	SH 15	E11-F005B
	RHR HX OUTLET VALVE (B)	SH 6	E11-F004B
	RHR D/W SPRAY VALVE (B)	SH 8	E11-F017B
	RHR WW SPRAY VALVE (B)	SH 25	E11-F019B
	RHR S/P RETURN VALVE (B)	SH 16	E11-F008B
	RHR SHC (INBOARD) SUCTION ISOL VALVE (B)	SH 23	E11-F010B
	RHR SHC (OUTBOARD) SUCTION ISOL VALVE (B)	SH 24	E11-F011B
	RHR SHC SUCTION VALVE (B)	SH 18	E11-F012B
	RHR MINIMUM FLOW VALVE (B)	SH 12	E11-F021B
	RHR LIQUID WASTE FLUSH ISOLATION VALVE (B)	SH 8	E11-F029B
	RHR-FPC ISOLATION VALVE (B)	SH 8	E11-F014B

SYS	NAME	SH NO.	PART NO.
HPCF	HPCF PUMP (B)	SH 19	E22-C001B
	HPCF CST SUCTION VALVE (B)	SH 6	E22-F001B
	HPCF INJECTION VALVE (B)	SH 6	E22-F003B
	HPCF S/P SUCTION VALVE (B)	SH 20	E22-F006B
	HPCF TEST LINE BYPASS VALVE (B)	SH 8	E22-F009B
	HPCF MINIMUM FLOW VALVE (B)	SH 13	E22-F010B
NBS	SAFETY RELIEF VALVE (NON ADS)	SH 9	B21-F010R
	SAFETY RELIEF VALVE (NON ADS)	SH 9	B21-F010C
	SAFETY RELIEF VALVE (NON ADS)	SH 9	B21-F010H
	SAFETY RELIEF VALVE (NON ADS)	SH 9	B21-F010L
RCW	RCW PUMP (A)	SH 5	P21-C001A
	RCW PUMP (D)	SH 5	P21-C001D
	RCW HX COOLING WATER OUTLET VALVE (A)	SH 6	P21-F004A
	RCW HX COOLING WATER OUTLET VALVE (D)	SH 6	P21-F004D
	RCW HX COOLING WATER OUTLET VALVE (G)	SH 6	P21-F004G
	RCW RHR HX OUTLET VALVE (A)	SH 6	P21-F013A
	RCW D/G OUTLET VALVE (A)	SH 6	P21-F055A
	RCW D/G OUTLET VALVE (D)	SH 6	P21-F055D
	RCW SEPARATE VALVE (A)	SH 6	P21-F074A
	RCW PUMP (B)	SH 5	P21-C001B
	RCW PUMP (E)	SH 5	P21-C001E
	RCW HX COOLING WATER OUTLET VALVE (B)	SH 6	P21-F004B
	RCW HX COOLING WATER OUTLET VALVE (E)	SH 6	P21-F004E
	RCW HX COOLING WATER OUTLET VALVE (H)	SH 6	P21-F004H
	RCW RHR HX OUTLET VALVE (B)	SH 6	P21-F013B
	RCW D/G OUTLET VALVE (B)	SH 6	P21-F055B
	RCW D/G OUTLET VALVE (E)	SH 6	P21-F055E
	RCW SEPARATE VALVE (B)	SH 6	P21-F074B
	RCW COOLING WATER TEMPERATURE CONTROL VALVES	SH 27	P21-F006A(B) P21-F010A(B)

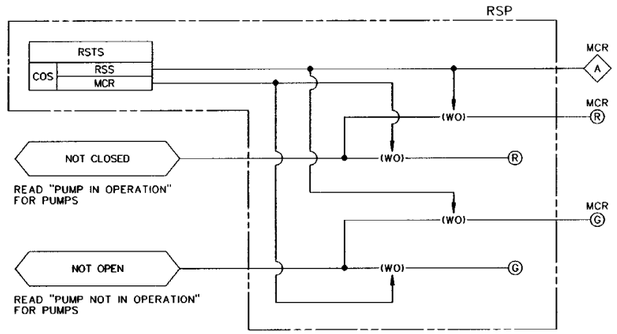
Figure 7.4-3 Remote Shutdown System IBD (Sheet 2 of 27)

SYS	NAME	SH NO.	PART NO.
RSW	RSW PUMP (A)	SH 5	P41-C001A
	RSW PUMP (D)	SH 5	P41-C001D
	RCW HX SERVICE WATER INLET VALVE (A)	SH 6	P41-F003A
	RCW HX SERVICE WATER INLET VALVE (D)	SH 6	P41-F003D
	RSW STRAINER INLET VALVE (A)	SH 26	P41-F004A
	RSW STRAINER INLET VALVE (D)	SH 26	P41-F004D
	RCW HX SERVICE WATER OUTLET VALVE (A)	SH 6	P41-F005A
	RCW HX SERVICE WATER OUTLET VALVE (D)	SH 6	P41-F005D
	RCW HX SERVICE WATER INLET VALVE (G)	SH 6	P41-F003G
	RCW HX SERVICE WATER OUTLET VALVE (G)	SH 6	P41-F005G
	RSW STRAINER OUTLET VALVE (A)	SH 6	P41-F013A
	RSW STRAINER OUTLET VALVE (D)	SH 6	P41-F013D
	RSW STRAINER BACKWASH VALVE (A)	SH 6	P41-F006A
	RSW STRAINER BACKWASH VALVE (D)	SH 6	P41-F006D
	RSW (A) SUPPLY VALVE	SH 6	P41-F014A
	RSW (A) RETURN VALVE	SH 6	P41-F015A
	RSW PUMP (B)	SH 5	P41-C001B
	RSW PUMP (E)	SH 5	P41-C001E
	RCW HX SERVICE WATER INLET VALVE (B)	SH 6	P41-F003B
	RCW HX SERVICE WATER INLET VALVE (E)	SH 6	P41-F003E
	RSW STRAINER INLET VALVE (B)	SH 26	P41-F004B
	RSW STRAINER INLET VALVE (E)	SH 26	P41-F004E
	RCW HX SERVICE WATER OUTLET VALVE (B)	SH 6	P41-F005B
	RCW HX SERVICE WATER OUTLET VALVE (E)	SH 6	P41-F005E
	RCW HX SERVICE WATER INLET VALVE (H)	SH 6	P41-F003H
	RCW HX SERVICE WATER OUTLET VALVE (H)	SH 6	P41-F005H
	RSW STRAINER OUTLET VALVE (B)	SH 6	P41-F013B
	RSW STRAINER OUTLET VALVE (E)	SH 6	P41-F013E
	RSW STRAINER BACKWASH VALVE (B)	SH 6	P41-F006B
	RSW STRAINER BACKWASH VALVE (E)	SH 6	P41-F006E
	RSW (B) SUPPLY VALVE	SH 6	P41-F014B
	RSW (B) RETURN VALVE	SH 6	P41-F015B

SYS	NAME	SH NO.	PART NO.
D/G	DIESEL GENERATOR A START-UP CIRCUIT	SH 11	–
	DIESEL GENERATOR B START-UP CIRCUIT	SH 11	–
FCS	FCS COOLING WATER INLET VALVE B	SH 8	T49-F008B

EPDS	6.9KV FEEDER BREAKER – UAT A TO M/C E	SH 10	–
	6.9KV FEEDER BREAKER – RAT TO M/C E	SH 10	–
	6.9KV FEEDER BREAKER – D/G A TO M/C E	SH 10	–
	6.9KV FEEDER BREAKER – CTG TO M/C E	SH 10	–
	6.9KV LOAD BREAKER – M/C E TO PC E20	SH 10	–
	480V FEEDER BREAKER – TR TO P/C E20	SH 10	–
	6.9KV FEEDER BREAKER – UAT B TO M/C F	SH 10	–
	6.9KV FEEDER BREAKER – RAT TO M/C F	SH 10	–
	6.9KV FEEDER BREAKER – D/G B TO M/C F	SH 10	–
	6.9KV FEEDER BREAKER – CTG TO M/C F	SH 10	–
	6.9KV LOAD BREAKER – M/C F TO PC F20	SH 10	–
	480V FEEDER BREAKER – TR TO P/C E 20	SH 10	–

Figure 7.4-3 Remote Shutdown System IBD (Sheet 3 of 27)



STATUS INDICATION

APPLY TO ALL VALVES AND PUMPS

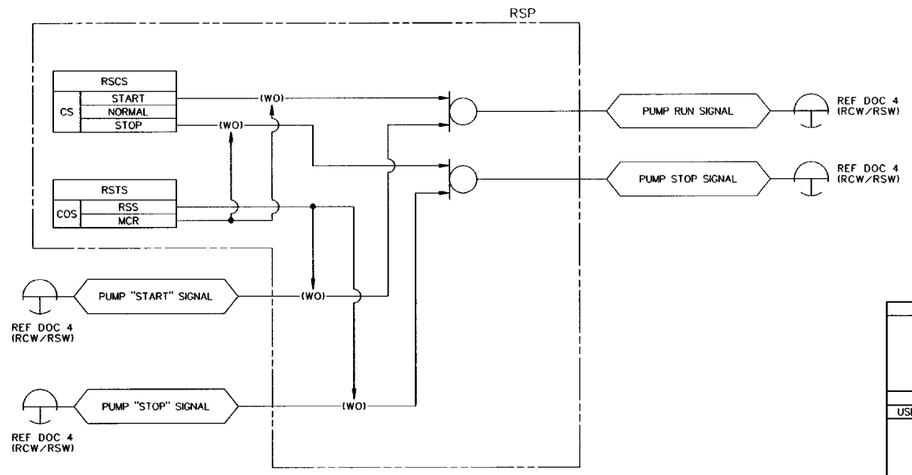
CONTROL SWITCH

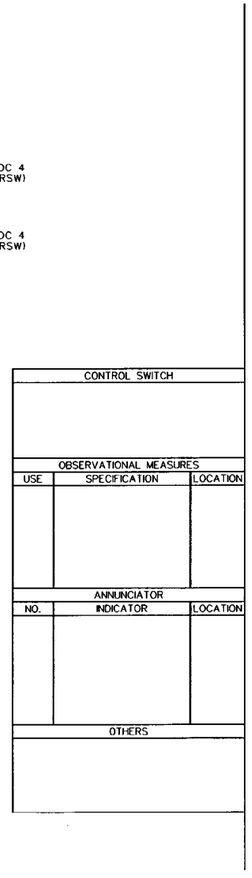
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS

Figure 7.4-3 Remote Shutdown System IBD (Sheet 4 of 27)

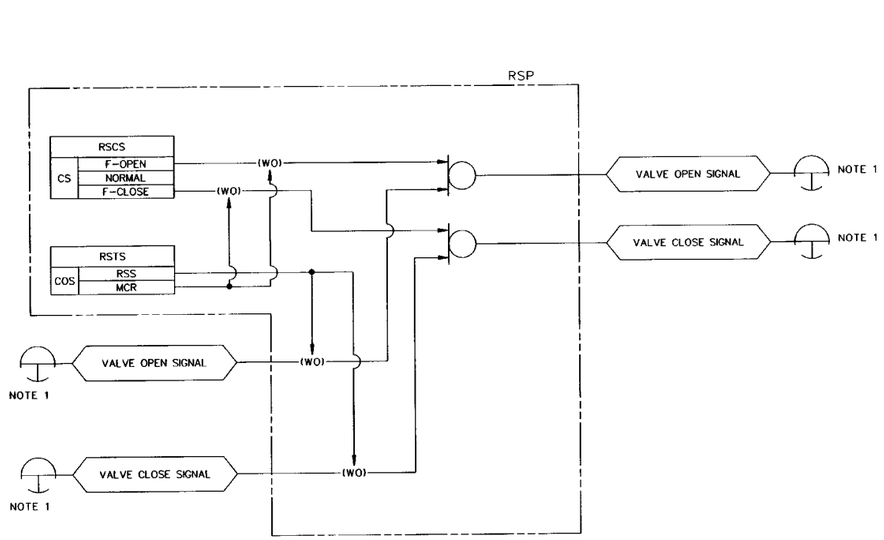




RCW PUMP CONTROL LOGIC (P21-C001A)

TYPICAL FOR PUMPS RCW P21-C001D
RCW P21-C001B
RCW P21-C001E
RSW P41-C001A
RSW P41-C001D
RSW P41-C001B
RSW P41-C001E

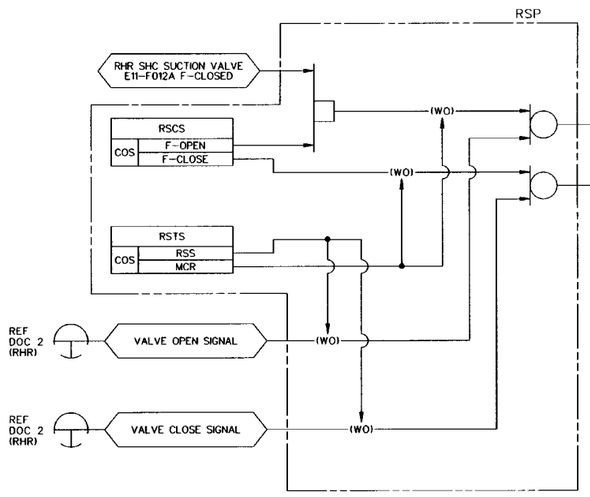
Figure 7.4-3 Remote Shutdown System IBD (Sheet 5 of 27)



MOTOR OPERATED VALVE

(APPLICABLE TO VALVES TABULATED ON SHEETS 2 & 3 THAT REFERENCE THIS SHEET)

Figure 7.4-3 Remote Shutdown System IBD (Sheet 6 of 27)



RHR S/P SUCTION VALVE E11-F001A

TYPICAL FOR VALVE E11-F001B

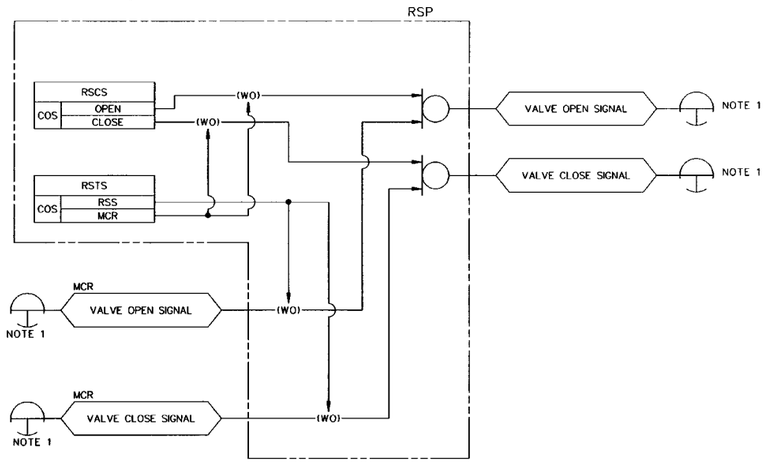
CONTROL SWITCH

OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS

Figure 7.4-3 Remote Shutdown System IBD (Sheet 7 of 27)



MOTOR OPERATED VALVE

(APPLICABLE TO VALVES TABULATED ON SHEETS 2 AND 3 THAT REFERENCE THIS SHEET)

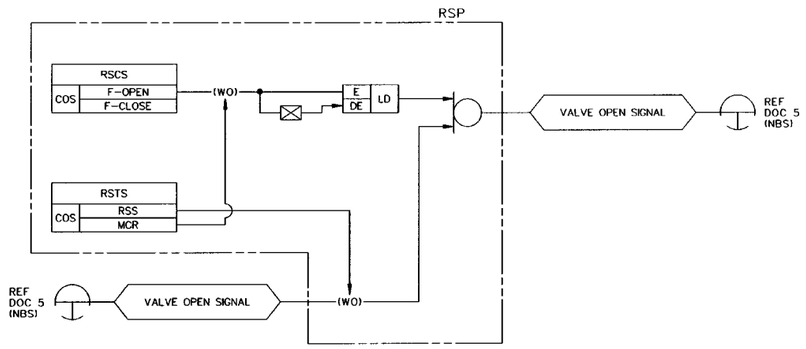
CONTROL SWITCH

OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS

Figure 7.4-3 Remote Shutdown System IBD (Sheet 8 of 27)

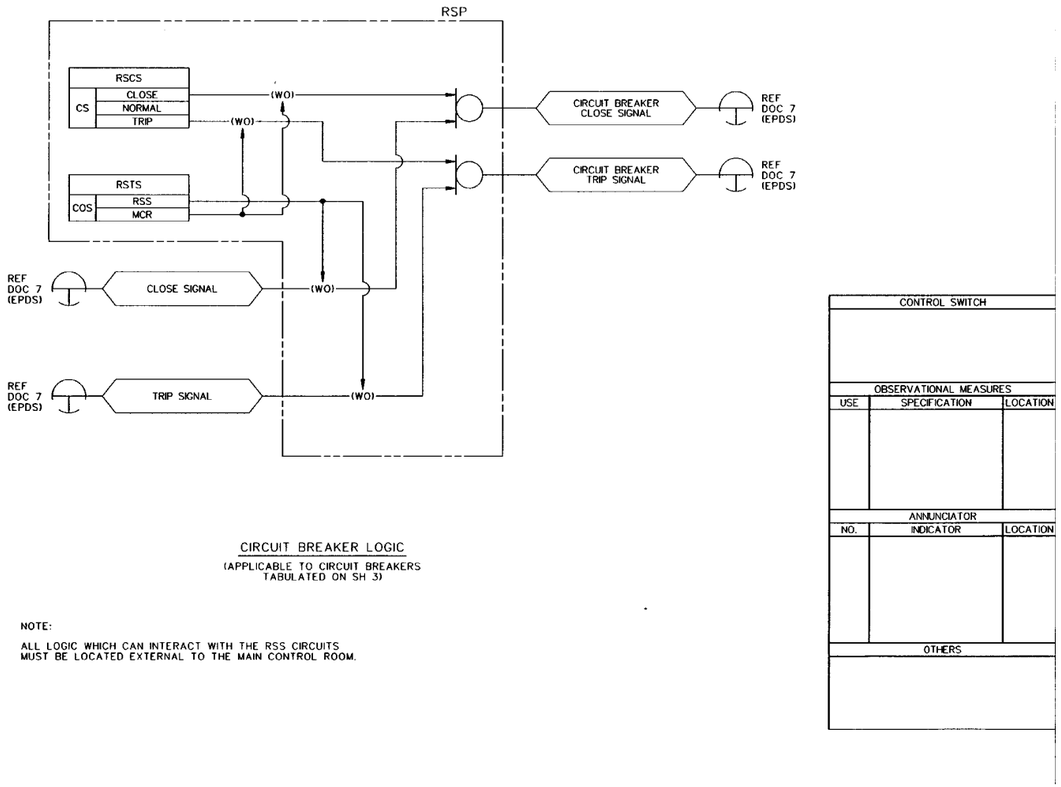


AIR OPERATED SAFETY RELIEF VALVE B21–F010C (DIV I)

TYPICAL FOR VALVES B21 – F010H (DIV I)
B21 – F010R (DIV I)
B21 – F010L (DIV II)

CONTROL SWITCH		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
OTHERS		

Figure 7.4-3 Remote Shutdown System IBD (Sheet 9 of 27)



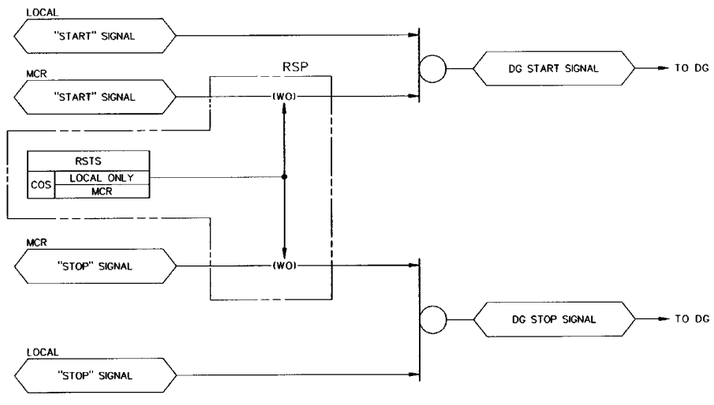
CIRCUIT BREAKER LOGIC

(APPLICABLE TO CIRCUIT BREAKERS TABULATED ON SH 3)

NOTE:

ALL LOGIC WHICH CAN INTERACT WITH THE RSS CIRCUITS MUST BE LOCATED EXTERNAL TO THE MAIN CONTROL ROOM.

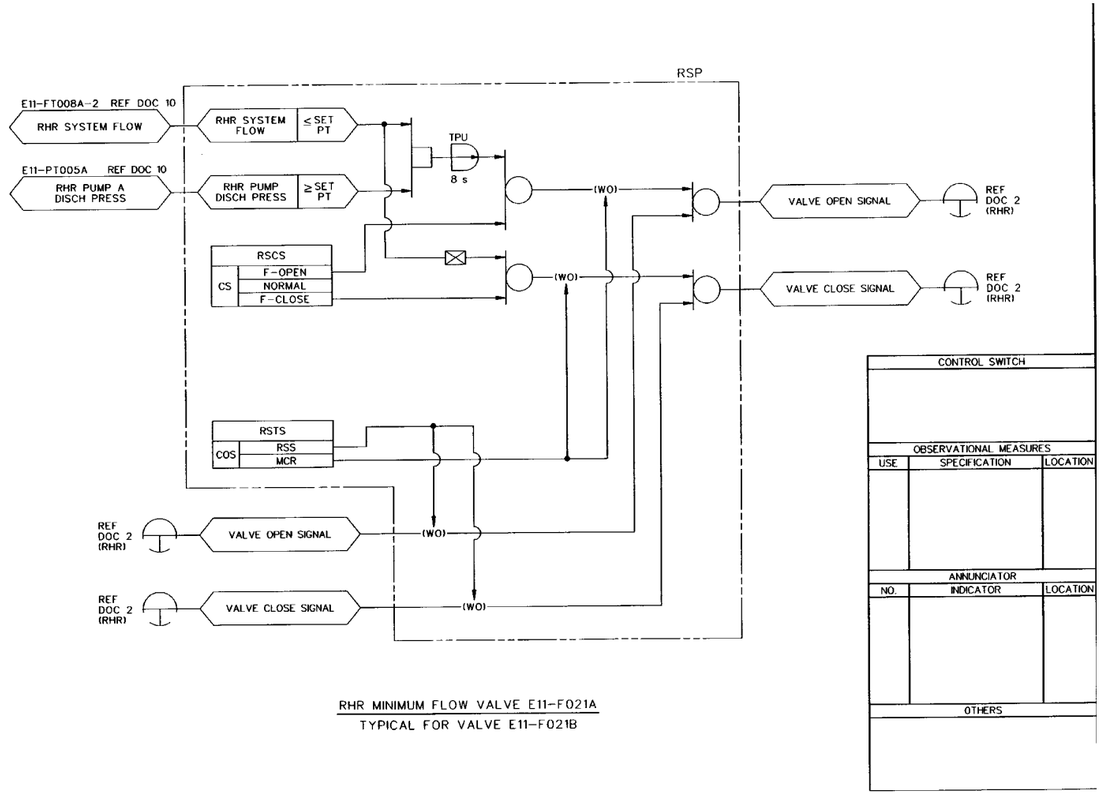
Figure 7.4-3 Remote Shutdown System IBD (Sheet 10 of 27)



DIESEL GENERATOR (D/G) LOGIC
TYPICAL FOR D/G A AND B

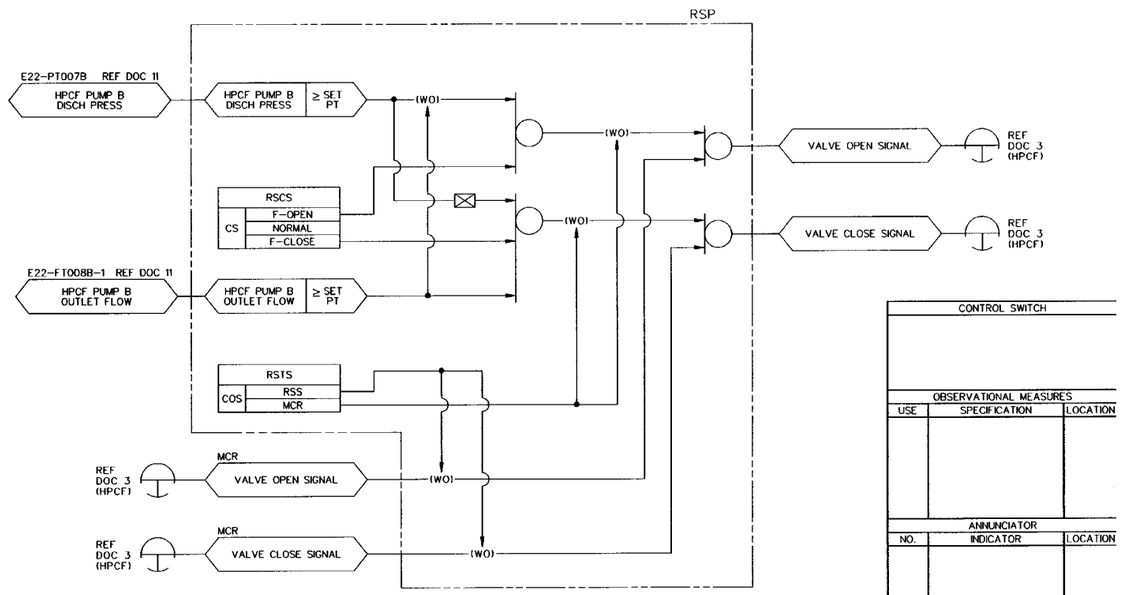
CONTROL SWITCH		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
OTHERS		

Figure 7.4-3 Remote Shutdown System IBD (Sheet 11 of 27)



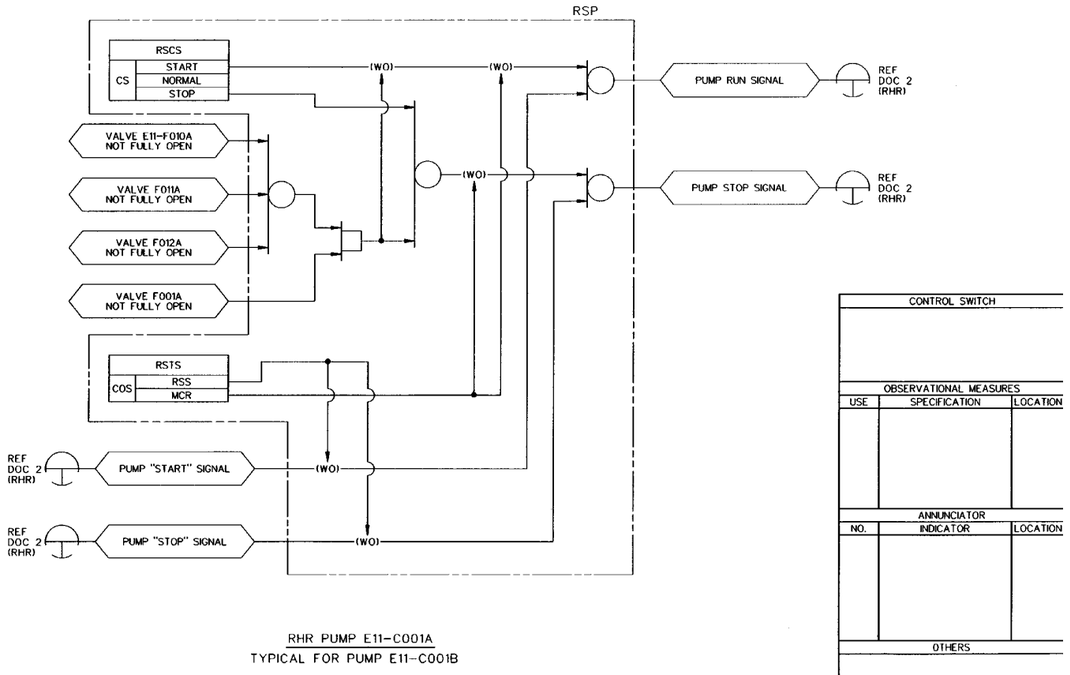
RHR MINIMUM FLOW VALVE E11-F021A
TYPICAL FOR VALVE E11-F021B

Figure 7.4-3 Remote Shutdown System IBD (Sheet 12 of 27)



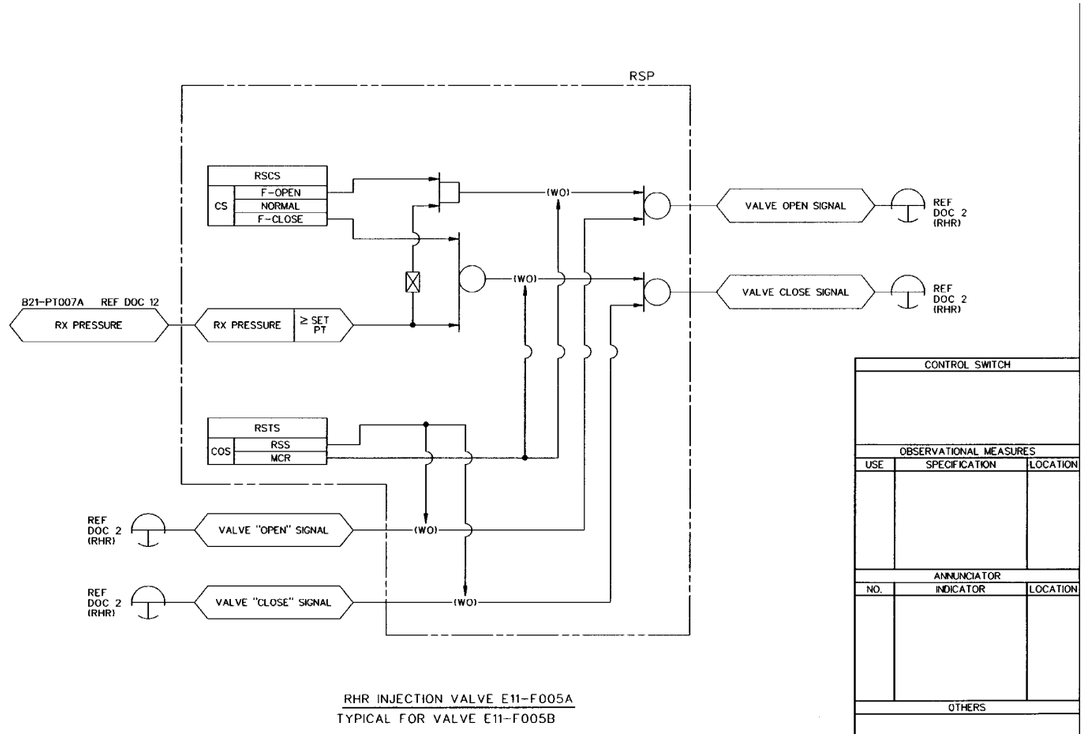
HPCF MINIMUM FLOW VALVE E22-F010B

Figure 7.4-3 Remote Shutdown System IBD (Sheet 13 of 27)



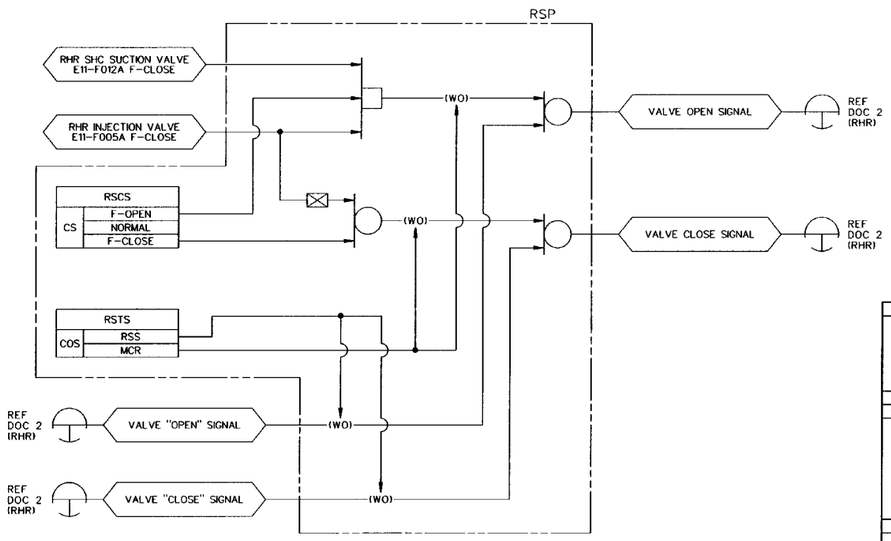
RHR PUMP E11-C001A
TYPICAL FOR PUMP E11-C001B

Figure 7.4-3 Remote Shutdown System IBD (Sheet 14 of 27)



RHR INJECTION VALVE E11-F005A
TYPICAL FOR VALVE E11-F005B

Figure 7.4-3 Remote Shutdown System IBD (Sheet 15 of 27)



RHR S/P RETURN VALVE E11-F008A

TYPICAL FOR VALVE E11-F008B

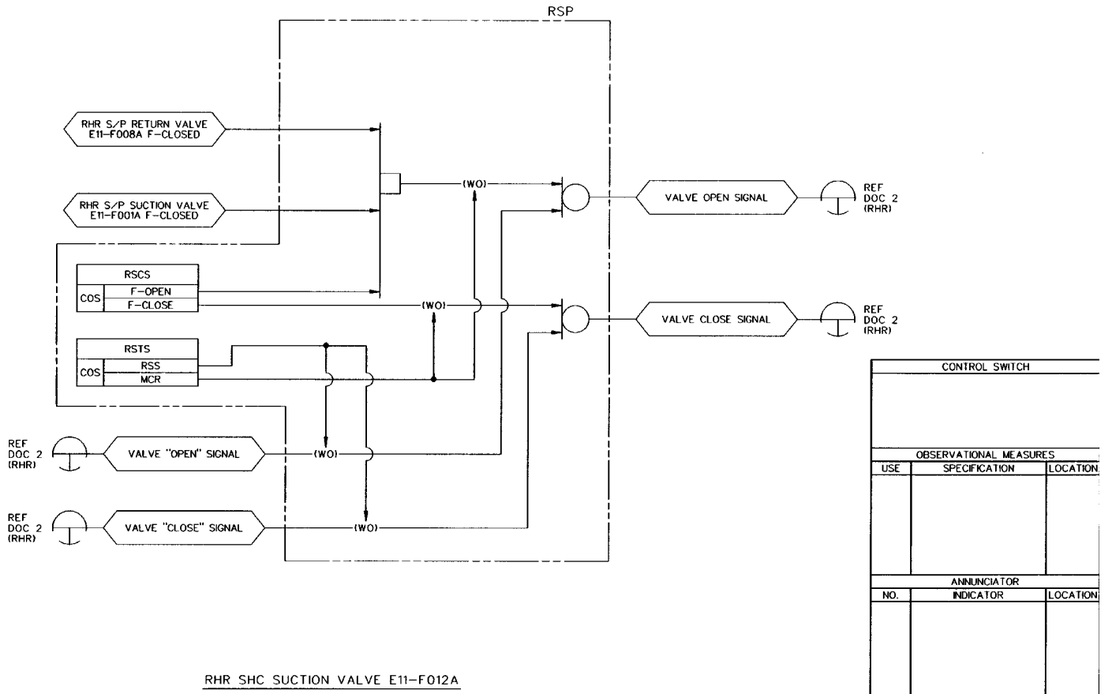
CONTROL SWITCH

OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

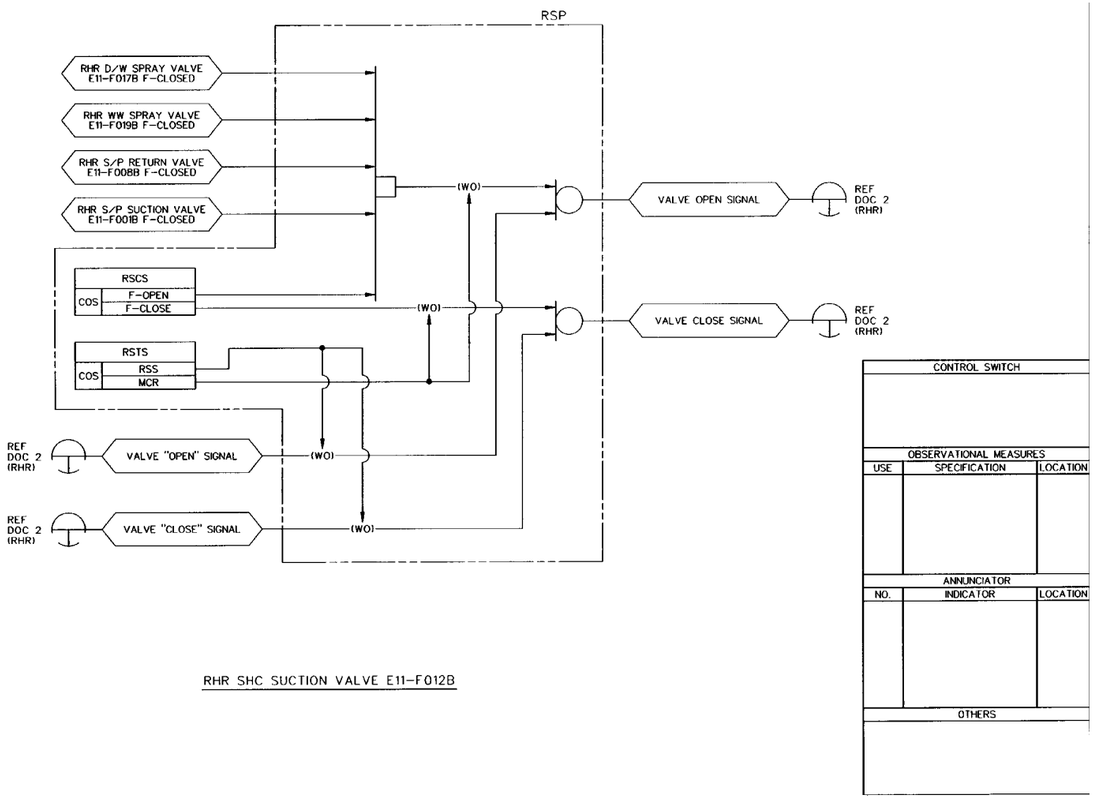
OTHERS

Figure 7.4-3 Remote Shutdown System IBD (Sheet 16 of 27)



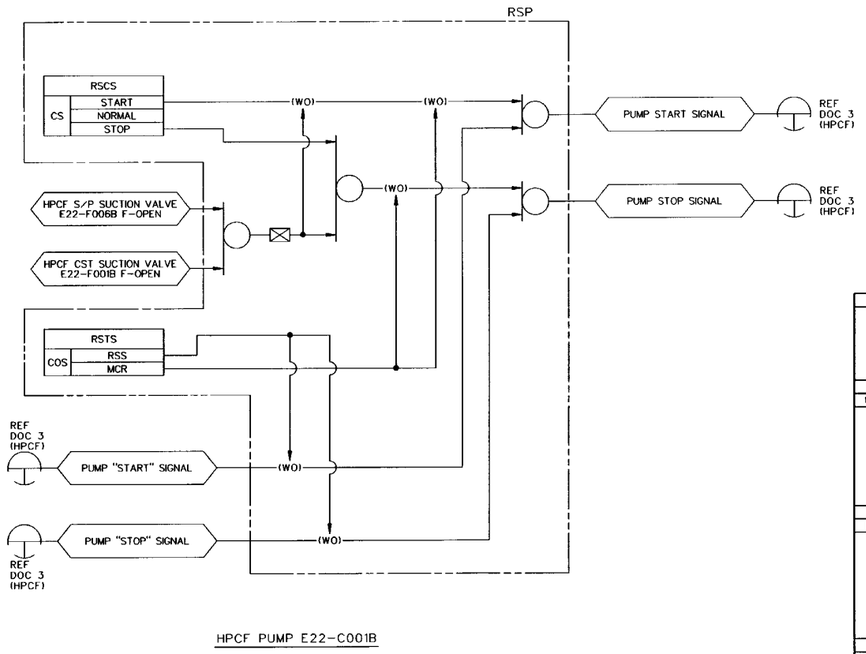
RHR SHC SUCTION VALVE E11-F012A

Figure 7.4-3 Remote Shutdown System IBD (Sheet 17 of 27)



RHR SHC SUCTION VALVE E11-F012B

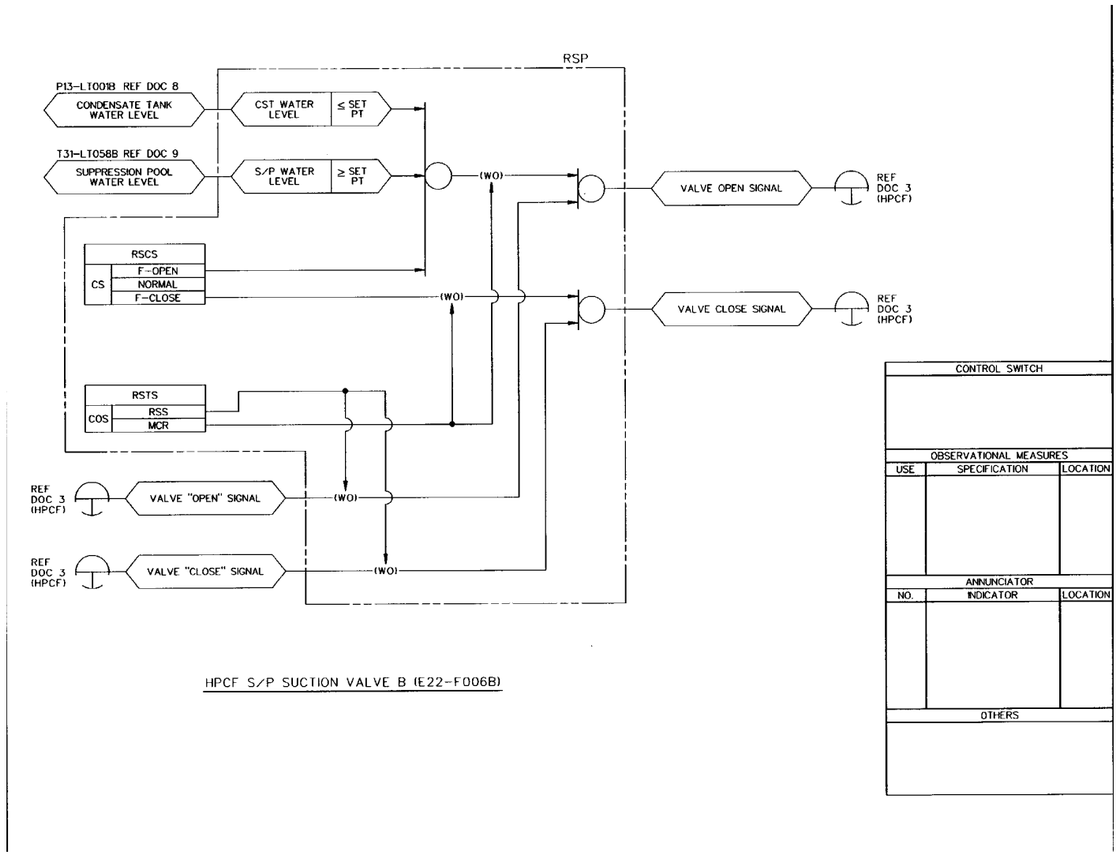
Figure 7.4-3 Remote Shutdown System IBD (Sheet 18 of 27)



HPCF PUMP E22-C001B

CONTROL SWITCH		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
OTHERS		

Figure 7.4-3 Remote Shutdown System IBD (Sheet 19 of 27)



HPCF S/P SUCTION VALVE B (E22-F006B)

Figure 7.4-3 Remote Shutdown System IBD (Sheet 20 of 27)

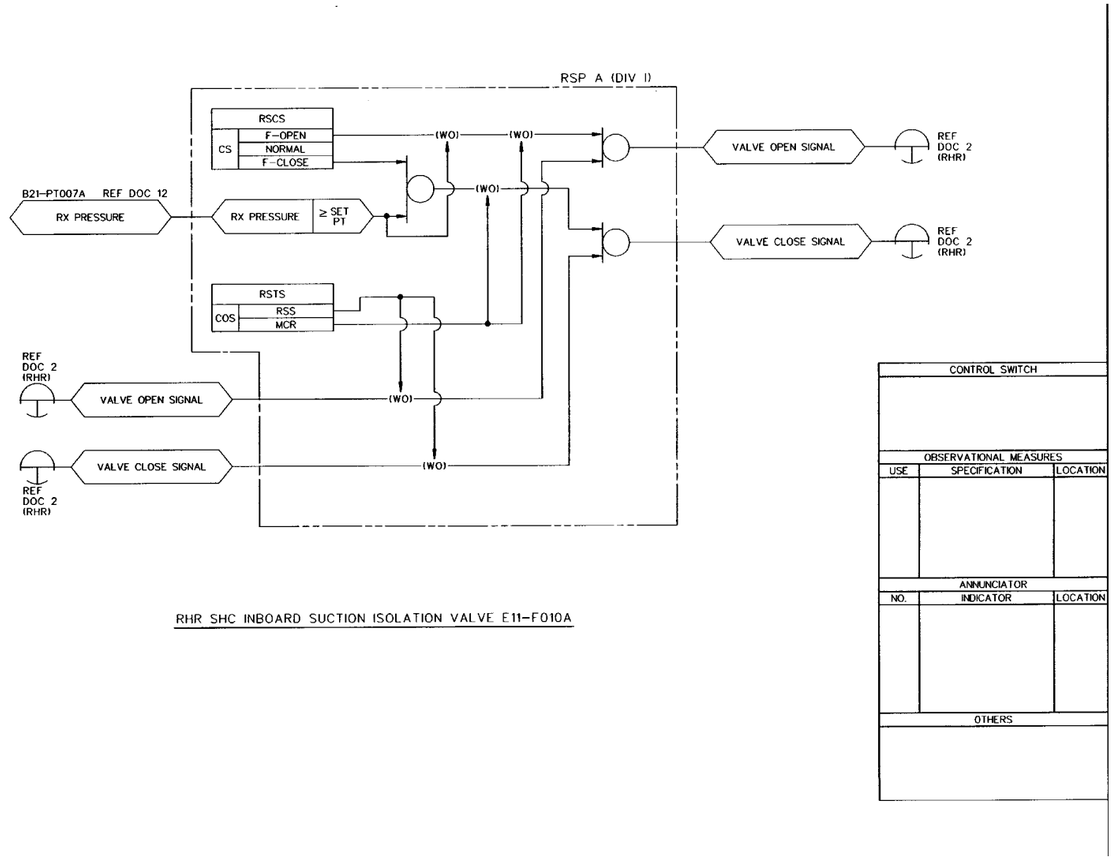


Figure 7.4-3 Remote Shutdown System IBD (Sheet 21 of 27)

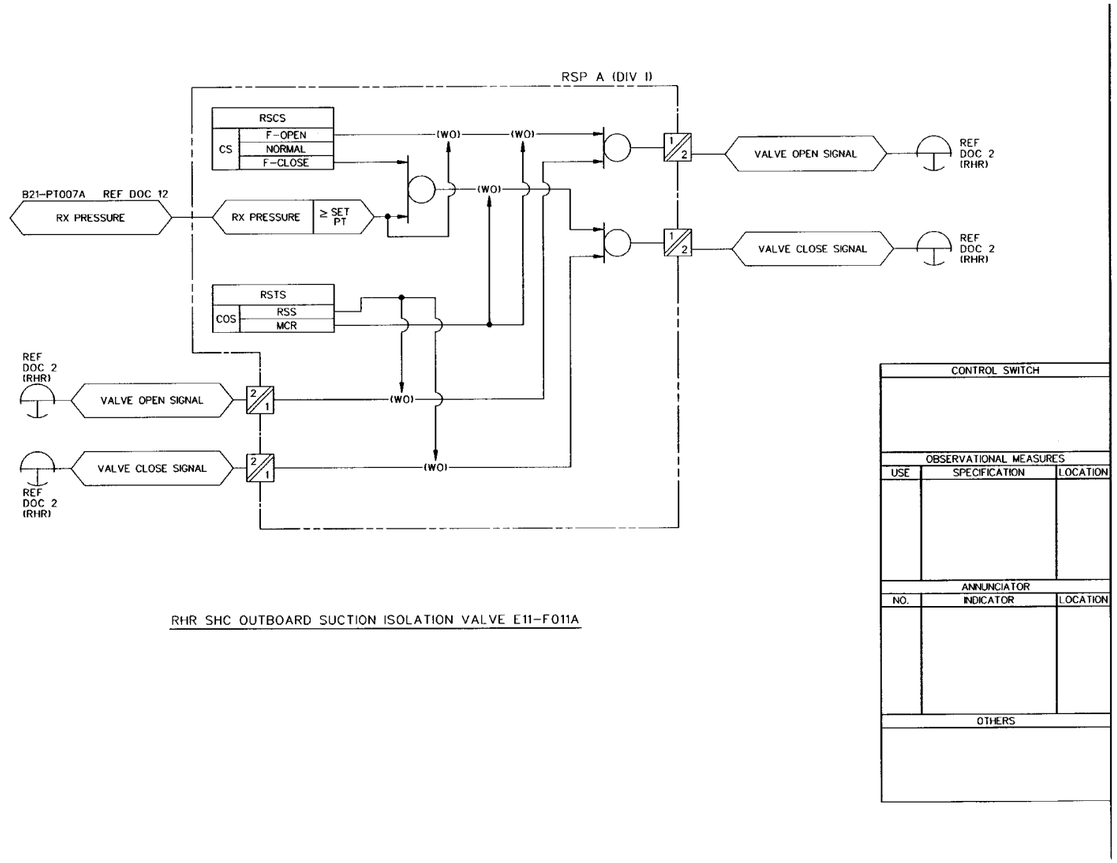
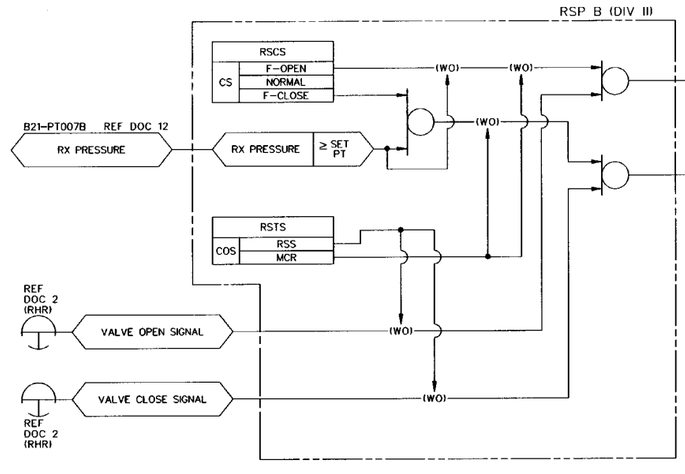
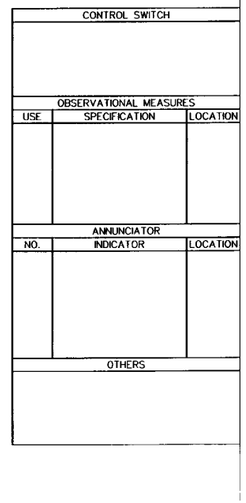


Figure 7.4-3 Remote Shutdown System IBD (Sheet 22 of 27)





RHR SHC INBOARD SUCTION ISOLATION VALVE E11-F010B

Figure 7.4-3 Remote Shutdown System IBD (Sheet 23 of 27)

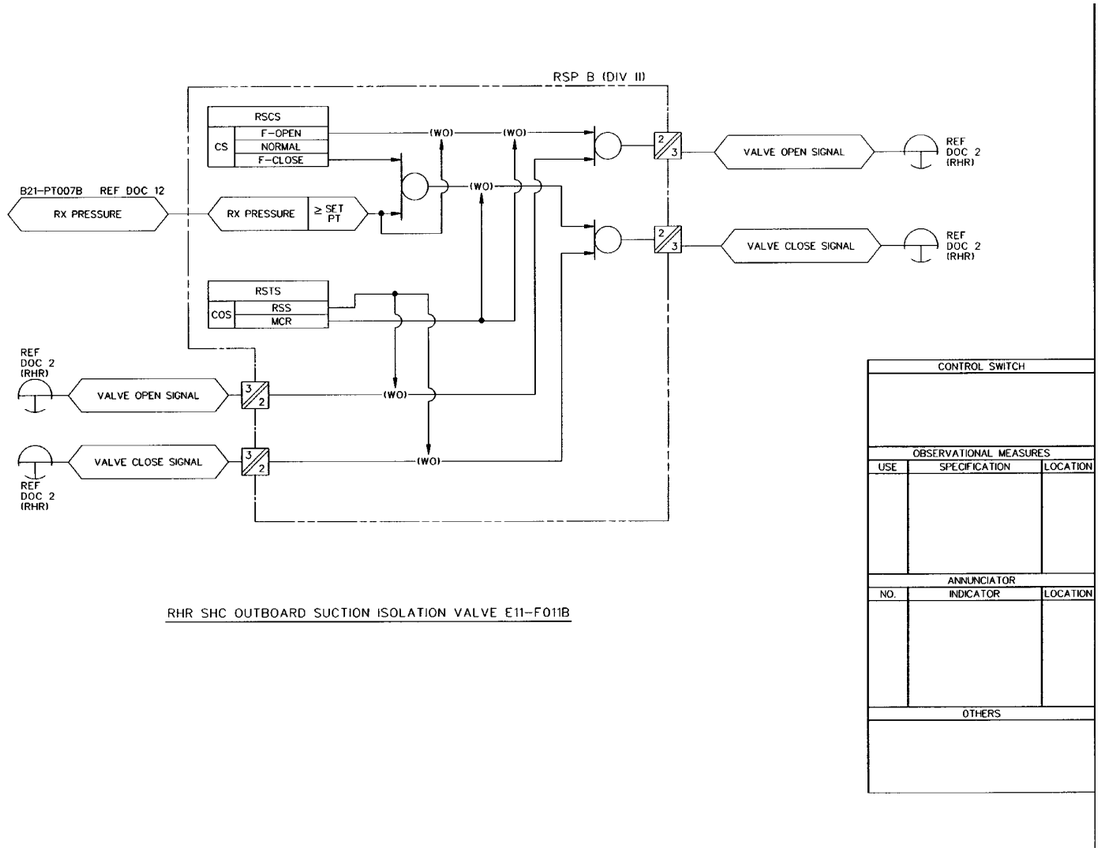
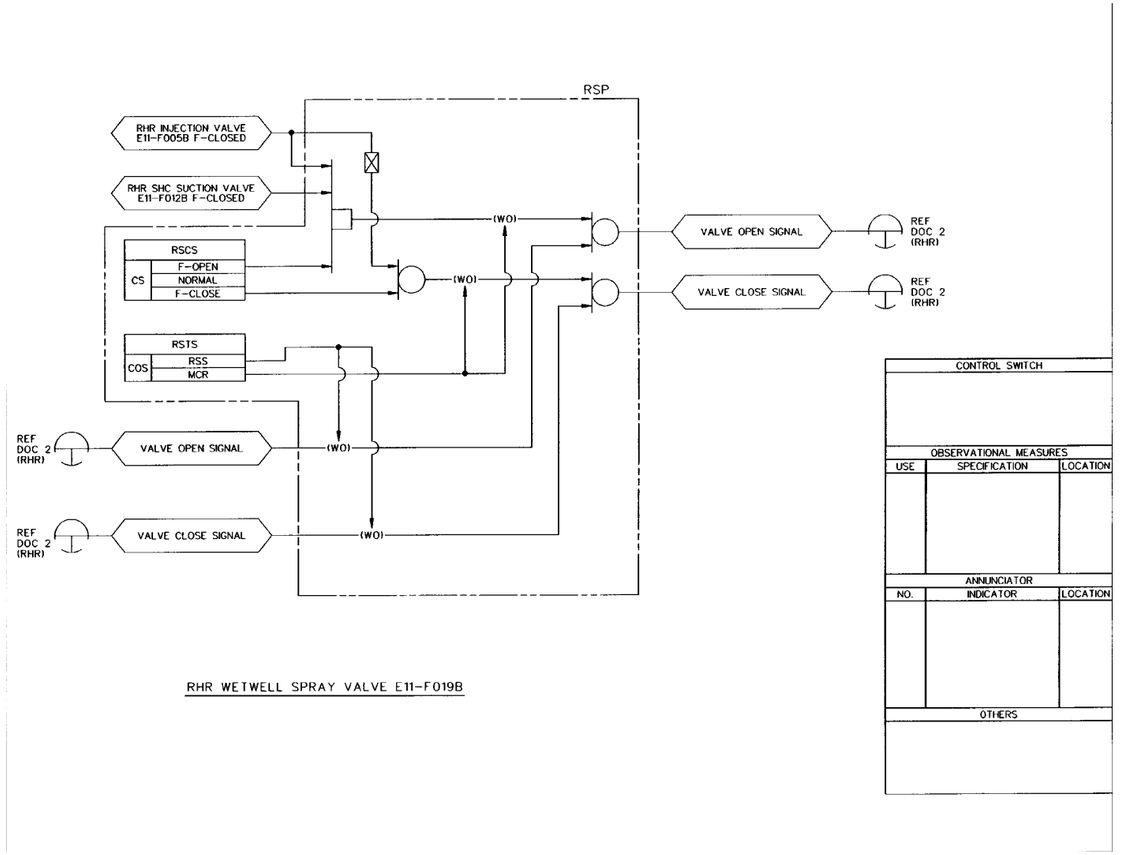
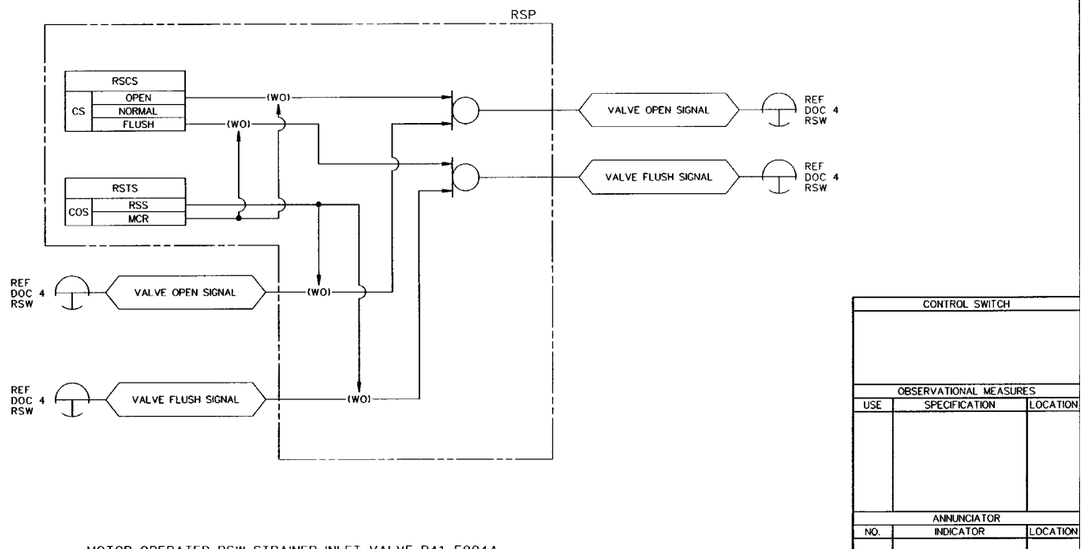


Figure 7.4-3 Remote Shutdown System IBD (Sheet 24 of 27)



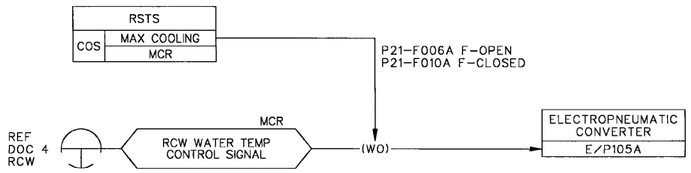
RHR WETWELL SPRAY VALVE E11-F019B

Figure 7.4-3 Remote Shutdown System IBD (Sheet 25 of 27)



MOTOR OPERATED RSW STRAINER INLET VALVE P41–F004A
TYPICAL FOR P41–F004B, P41–F004D AND P41–F004E

Figure 7.4-3 Remote Shutdown System IBD (Sheet 26 of 27)



P21–F006A: RCW COOLING WATER TEMPERATURE CONTROL VALVE (HX SIDE) (A)

P21–F010A: RCW COOLING WATER TEMPERATURE CONTROL VALVE (HX BYPASS SIDE) (A)

RCW COOLING WATER TEMPERATURE CONTROL VALVES

TYPICAL FOR P21–F006B AND P21–F010B

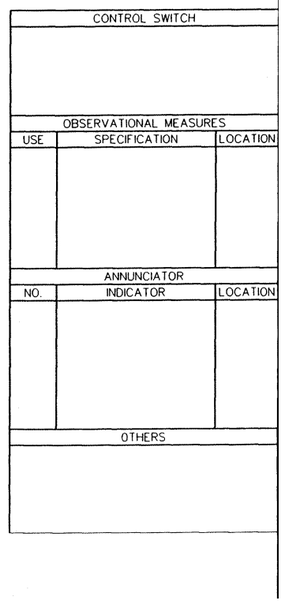


Figure 7.4-3 Remote Shutdown System IBD (Sheet 27 of 27)

TABLE 1 LPRM TO APRM ASSIGNMENTS

DET AND LPRM LOCATION	APRM CHANNEL A	B	C	D	MUX UNIT NO.
20-61	B	C	D	A	1
28-61	C	D	A	B	2
36-61	B	C	D	A	3
44-61	C	D	A	B	4
52-61	B	C	D	A	1
12-53	D	A	B	C	1
20-53	A	B	C	D	4
28-53	D	A	B	C	3
36-53	A	B	C	D	2
44-53	D	A	B	C	1
52-53	A	B	C	D	4
60-53	D	A	B	C	3
04-45	B	C	D	A	4
12-45	C	D	A	B	3
20-45	B	C	D	A	2
28-45	C	D	A	B	1
36-45	B	C	D	A	4
44-45	C	D	A	B	3
52-45	B	C	D	A	2
60-45	C	D	A	B	1
04-37	A	B	C	D	2
12-37	D	A	B	C	2
20-37	A	B	C	D	3
28-37	D	A	B	C	4
36-37	A	B	C	D	1
44-37	D	A	B	C	2
52-37	A	B	C	D	3
60-37	D	A	B	C	4
04-29	B	C	D	A	3
12-29	C	D	A	B	4
20-29	B	C	D	A	1
28-29	C	D	A	B	2
36-29	B	C	D	A	3
44-29	C	D	A	B	4
52-29	B	C	D	A	1
60-29	C	D	A	B	2

TABLE 1 LPRM TO APRM ASSIGNMENTS (CONT'D)

DET AND LPRM LOCATION	APRM CHANNEL A	B	C	D	MUX UNIT NO.
12-21	D	A	B	C	1
20-21	A	B	C	D	4
28-21	D	A	B	C	3
36-21	A	B	C	D	2
44-21	D	A	B	C	1
52-21	A	B	C	D	4
60-21	D	A	B	C	3
12-13	C	D	A	B	3
20-13	B	C	D	A	2
28-13	C	D	A	B	1
36-13	B	C	D	A	4
44-13	C	D	A	B	3
52-13	B	C	D	A	2
28-05	D	A	B	C	4
36-05	A	B	C	D	1
44-05	D	A	B	C	2

(NOTE 9)

TABLE 2 LPRM STRING ASSIGNMENT TO ATIP MACHINES

ATIP A		ATIP B		ATIP C	
POSITION #	LPRM LOC.	POSITION #	LPRM LOC.	POSITION #	LPRM LOC.
1	04-29	1	28-05	1	44-13
2	04-37	2	28-13	2	44-21
3	04-45	3	28-21	3	44-29
4	12-13	4	28-29	4	44-37
5	12-21	5	28-37	5	44-45
6	12-29	6	28-45	6	44-53
7	12-37	7	28-53	7	44-61
8	12-45	8	28-61	8	52-13
9	12-53	9	36-05	9	52-21
10	20-13	10	36-13	10	52-29
11	20-21	11	36-21	11	52-37
12	20-29	12	36-29	12	52-45
13	20-37	13	36-45	13	52-53
14	20-45	14	36-53	14	52-61
15	20-53	15	36-61	15	60-21
16	20-61	16	44-05	16	60-29
17	–	17	–	17	60-37
18	–	18	–	18	60-45
19	–	19	–	19	60-53
20	36-37	20	36-37	20	36-37

TABLE 3 POWER DISTRIBUTION

	120V AC DIVISIONAL UPS BUS A	B	C	D
DIVISION	I	II	III	IV
SRNM CH'S	A,E,J	B,F	C,G,L	D,H
APRM CH'S	A	B	C	D
	120V AC NON-DIVISIONAL UPS A	B	C	D
MRBM CH'S	A	B		
SRNM RECORDERS	A,E,J	B,F	C,G,L	D,H
APRM RECORDERS	A	B	C	D
SRNM RECORDERS	A	B	A	B
460V, 3 Ø 3KVA:	ATIP DRIVE MECHANISMS			
120V AC:	ATIP INSTR. PANEL			

LEGEND:

- ○ – LPRM DETECTOR ASM (52)
- + – CONTROL RODS (205)
- □ – SRNM DETECTORS (10)
- △ – NEUTRON SOURCES (5)
- ⊟ – SIGNAL ISOLATION
- ⟨2⟩ – COMPUTER INPUTS
- ⟨1⟩ – TRANSIENT TEST PANEL INPUTS
- ⟹ – MULTIPLEXING TRANSMISSION (VIA OPTIC FIBER OR METALLIC CONDUCTOR)
- ⟶ – SINGLE TRANSMISSION

SUPPLEMENTAL DOCUMENTS UNDER THE FOLLOWING IDENTITIES ARE TO BE USED IN CONJUNCTION WITH THIS DRAWING:

	MPL NO.
1. RECIRCULATION FLOW CONTROL SYS, IED	C81-1040
2. PMCS INPUT/OUTPUT LIST	C90-1060
3. PIPING AND INSTRUMENT SYMBOLS DIAGRAM	A10-3030
4. REACTOR PROTECTION SYS, IED	C71-1040
5. ROD CONTROL AND INFORMATION SYS, IED	C11-1040
6. PMCS IED	C90-1040
7. MCRP SYSTEM IED	H11-1040
8. AUTOMATIC POWER REGULATOR SYS IED	C82-1040
9. NEUTRON MONITORING SYSTEM, IBD	C51-1030
10. NEUTRON MONITORING SYS ARGMT	C51-1070

ABBREVIATIONS

RPS – – – REACTOR PROTECTION SYSTEM
SRNM – – – STARTUP RANGE NEUTRON MONITOR
LPRM – – – LOCAL POWER RANGE MONITOR
APRM – – – AVERAGE POWER RANGE MONITOR
ATIP – – – AUTOMATED TRAVERSING INCORE PROBE
MRBM – – – MULTI-CHANNEL ROD BLOCK MONITOR
UPS – – – UNINTERRUPTABLE POWER SUPPLY
NMS – – – NEUTRON MONITORING SYSTEM
RC&IS – – – ROD CONTROL AND INFORMATION SYSTEM
MCRP – – – MAIN CONTROL ROOM PANEL
PMCS – – – PERFORMANCE MONITORING CONTROL SYSTEM
APRS – – – AUTOMATIC POWER REGULATOR SYSTEM
MSV – – – MEAN SQUARE VOLTAGE
ATLM – – – AUTOMATED THERMAL LIMIT MONITOR
OPRM – – – OSCILLATION POWER RANGE MONITOR

NOTES:

1. THIS DOCUMENT PRESENTS THE BASIC REQUIREMENTS OF FUNCTIONAL UNITS ALLOCATION OF THE NMS INSTRUMENTS, THEIR BASIC FUNCTIONS, AND THEIR INPUT AND OUTPUT REQUIREMENTS TO OTHER SYSTEMS. IT ALSO INCLUDES REQUIREMENTS OF DETECTOR LOCATION ASSIGNMENTS IN CORE AS WELL AS THEIR ASSIGNMENTS TO DIFFERENT DIVISIONS.
2. ALL EQUIPMENT, INSTRUMENTS AND DISPLAY CONTROL SYSTEM INPUT SIGNALS ARE PREFIXED BY C51– UNLESS OTHERWISE NOTED. THE PART NUMBERS ARE LOCATED ADJACENT TO OR ON THE SIGNAL CONDITIONING EQUIPMENT PERFORMING THE FUNCTION INDICATED.
3. AN AREA RADIATION MONITOR IS RECOMMENDED TO BE INSTALLED IN THE TIP DRIVE MECHANISM ROOM, AND THE OUTSIDE OF THE PERSONNEL HATCH DOOR (TO THE DRYWELL).
4. REMOTE DISPLAY MEANS DISPLAY ON MAIN CONTROL ROOM PANEL. FOR DISPLAY DEVICE TYPE, REFER TO C51-5030.
5. REMOTE RECORDING DEVICE SHALL BE BASED ON THAT SPECIFIED IN H11-4010.
6. SRNM NON-COINCIDENT UPSCALE LEVEL TRIP IS ONLY ACTIVATED BY MANUAL SWITCH IN RPS.
7. THESE ARE SAFETY RELATED CORE PLATE DIFFERENTIAL PRESSURE (C81-DPT301A-D) SIGNALS OF THE RFCS ESSENTIAL CORE PLATE DIFFERENTIAL PRESSURE SIGNALS.
8. COMMAND AND CONTROL SIGNALS BETWEEN THE PROCESS COMPUTER AND THE ATIP OTHER THAN ATIP MEASURED DATA ARE TRANSMITTED THROUGH THIS DATA ENTRY POINT.
9. IN CASE OF USING MULTIPLEXING UNITS OR SUB-APRM UNITS, DETECTORS SIGNALS ARE DISTRIBUTED TO FOUR MULTIPLEXER UNITS, IN EACH DIVISION ACCORDING TO TABLE 1 ARRANGEMENT. THE MULTIPLEXER UNIT ASSIGNMENT ONLY DEPENDS ON LPRM STRING LOCATION AND ARE IDENTICAL FOR ALL FOUR DIVISIONS.
10. THE DATA COMMUNICATION FUNCTION (DCF) REFERS TO THE INPUT/OUTPUT FUNCTION OF THE SRNM AND THE APRM. THIS IED DOES NOT SPECIFY THE ACTUAL HARDWARE IMPLEMENTATION OF THIS DCF.
11. FOR DETAIL TRIP SIGNAL FUNCTIONAL INTERFACES WITH RC&IS & RPS, REFER TO SUPPL DOC 9. THERE SHOULD BE A SEPARATE RC&IS AND RPS TRIP LOGIC FUNCTION INDEPENDENT OF EACH INDIVIDUAL SRNM CHANNEL IN THE DIVISION. THE SSLC INTERLOCK SIGNAL IS THE "ATWS PERMISSIVE" SIGNAL.
12. THIS IED INCLUDES ALL MAIN INPUT/OUTPUT SIGNALS REQUIRED TO BE INCLUDED IN THE INSTRUMENT DESIGN. FOR DETAIL BINARY TRIP SIGNALS, REFER TO NMS IBD, SUPPLEMENTAL DOCUMENT 9.
13. THE SIGNAL TRANSMISSION PATH CAN BE EITHER THROUGH MULTIPLEXING OR THROUGH DEDICATED CONDUCTORS.
14. TRIP SIGNALS FROM THE NMS TO THE PMCS SHALL BE TRANSMITTED VIA DEDICATED CONDUCTORS (E.G. METAL CABLE WITH PROPER ISOLATION) TO AVOID UNNECESSARY TIME DELAY FOR TRIP SEQUENCE RECORDING.
15. THE OPRM IS A FUNCTIONAL SUBSYSTEM OF THE APRM. IT RECEIVES THE SAME LPRM SIGNALS THE APRM OF THE SAME DIVISION RECEIVES AS INPUT, AS SHOWN IN TABLE 1. THE OPRM LOGIC IS DESCRIBED IN SUPPL DOC 9.

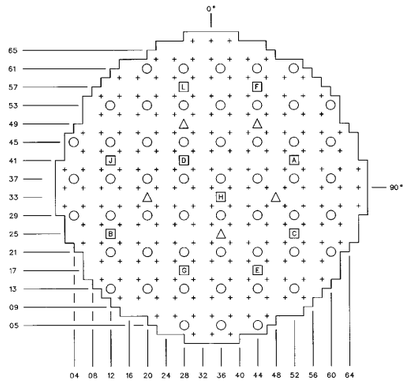


FIGURE 1: DETECTOR AND CONTROL ELEMENT ARRANGEMENT (TOP VIEW OF CORE)

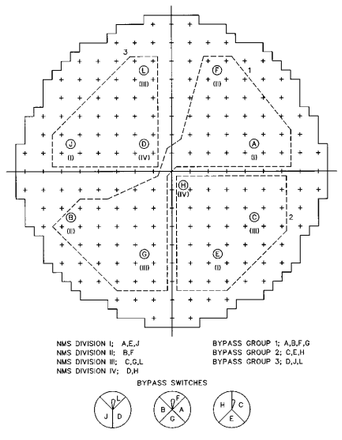


FIGURE 2: SRNM DIVISION & BYPASS GROUP ASSIGNMENTS

MPL NO. C51-1040

Figure 7.6-1 Neutron Monitoring System IED (Sheet 1 of 4)

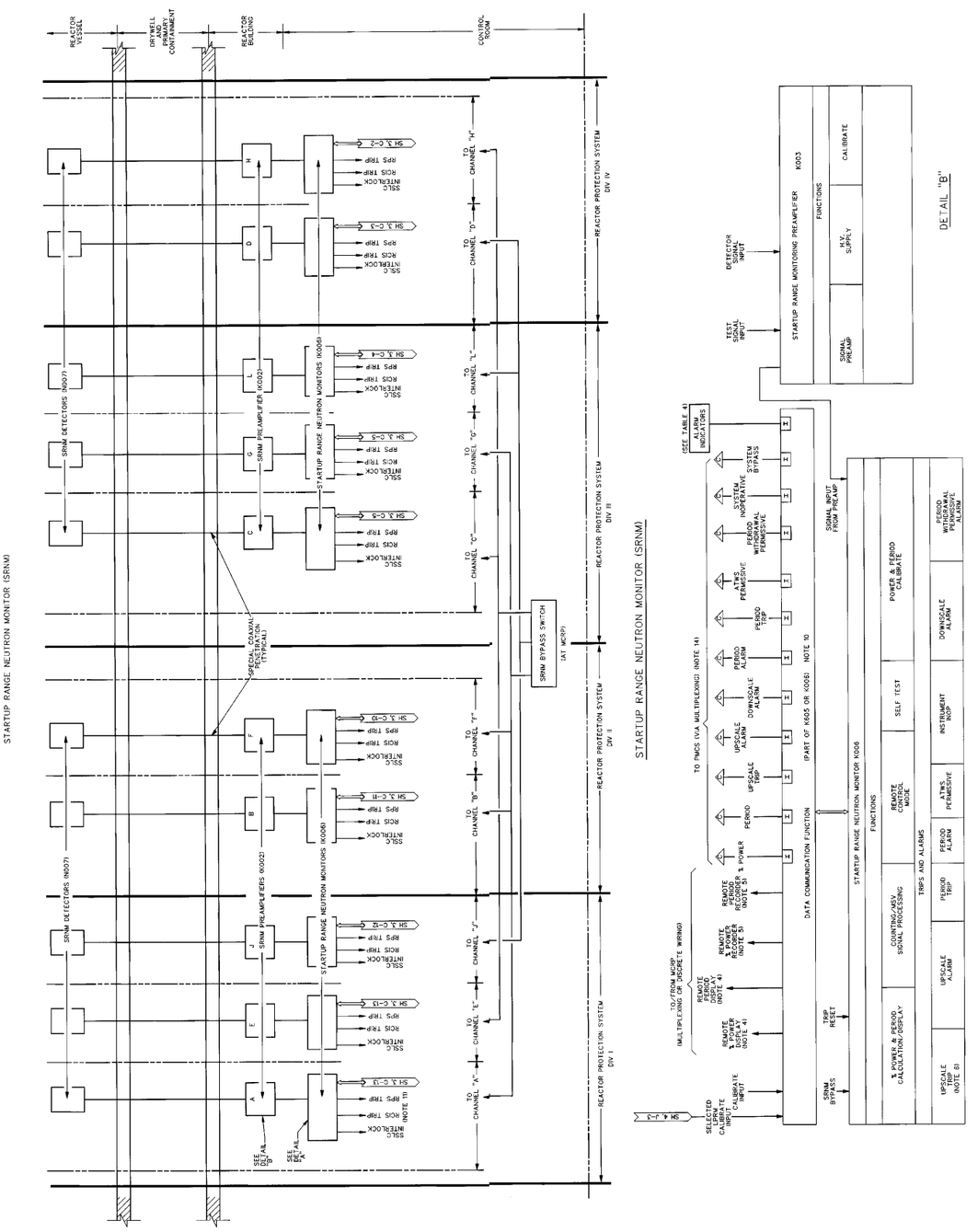


Figure 7.6-1 Neutron Monitoring System IED (Sheet 2 of 4)

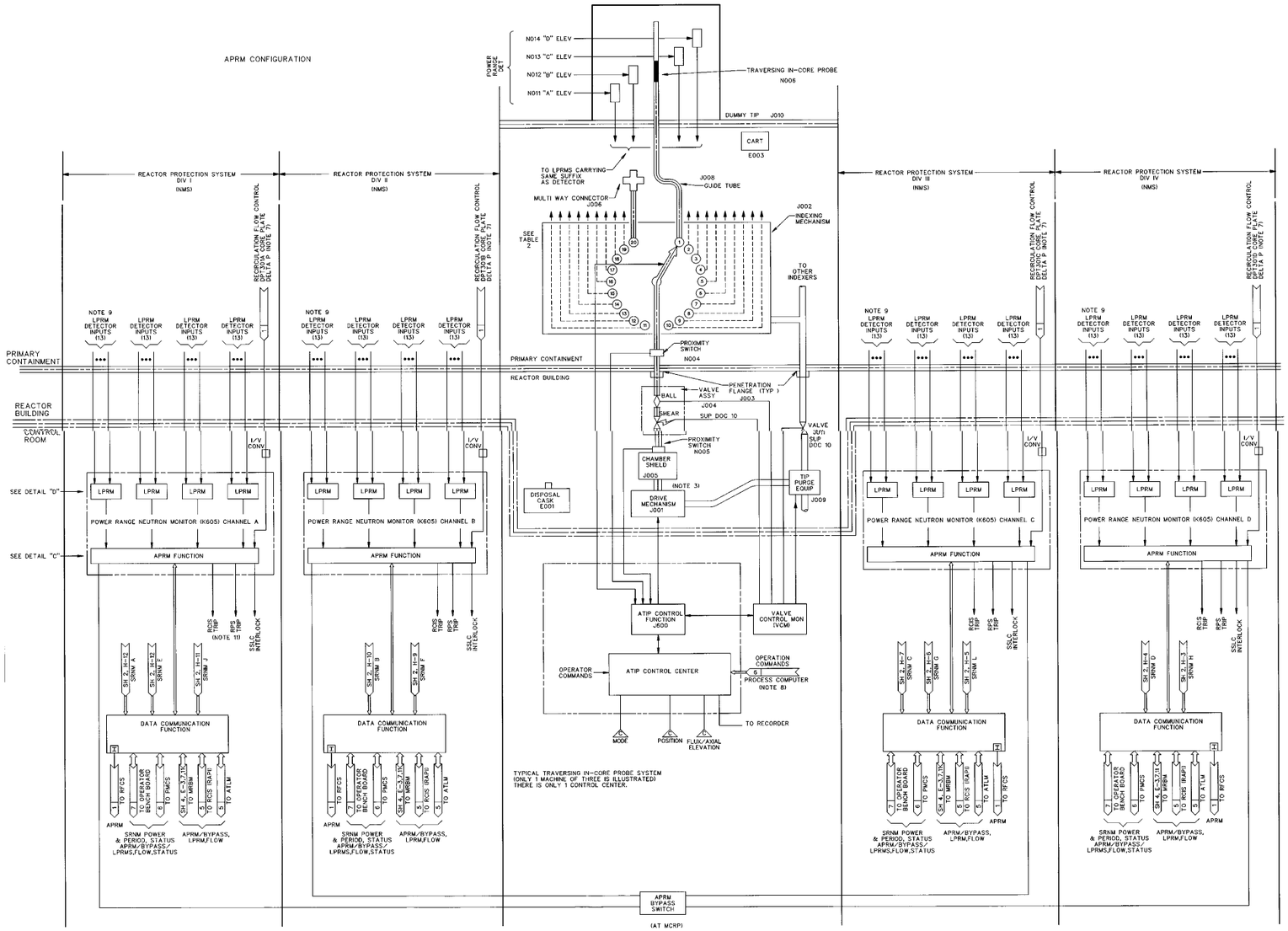
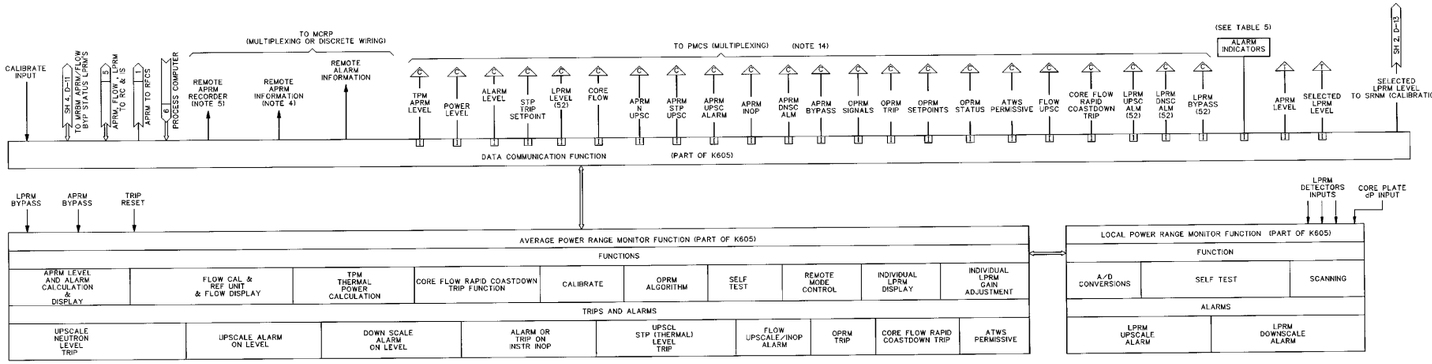
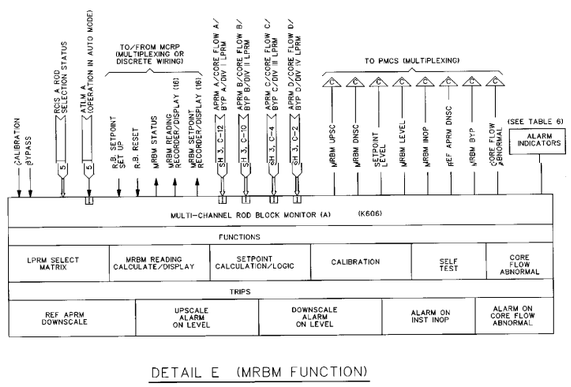


Figure 7.6-1 Neutron Monitoring System IED (Sheet 3 of 4)



DETAIL "C" (APRM FUNCTION)

DETAIL "D" (LPRM FUNCTION)



DETAIL E (MRBM FUNCTION)

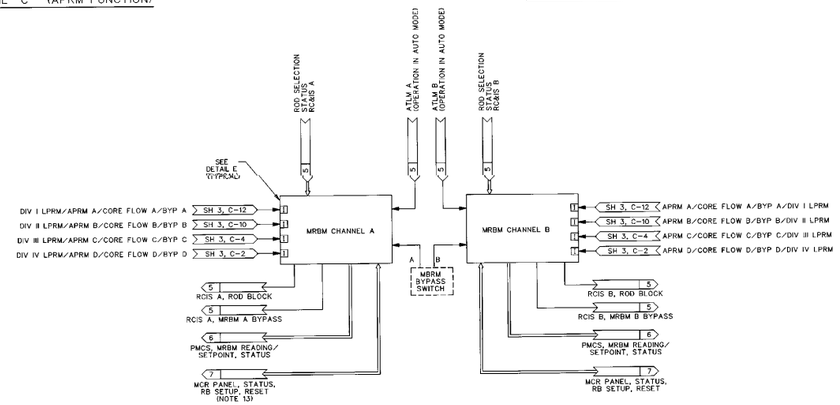


TABLE 4
SRNM TRIP & ALARM INDICATIONS

TRIP/ALARM FUNCTION	OUTPUT TO:	MCRP INDICATION	MCRP ANNUNCIATION	COMPUTER INPUT
UPSCALE TRIP	RPS	EACH CHANNEL	EACH DIV	EACH CHANNEL
UPSCALE ALARM	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
INOP	RPS/RCIS	EACH CHANNEL	EACH DIV	EACH CHANNEL
DOWNSCALE ALARM	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
PERIOD TRIP	RPS	EACH CHANNEL	EACH DIV	EACH CHANNEL
PERIOD ALARM	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
BYPASS	-----	EACH CHANNEL	NO	EACH CHANNEL
PERIOD WITHDRAWAL PERMISSIVE	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
ATWS PERMISSIVE	SSLC	EACH DIVISION	----	EACH DIVISION

TABLE 5
APRM/LPRM TRIP & ALARM INDICATIONS

TRIP/ALARM FUNCTION	OUTPUT TO:	MCRP INDICATION	MCRP ANNUNCIATION	COMPUTER INPUT
APRM NEUTRON UPSC TRIP	RPS	EACH DIV *	EACH DIV *	EACH DIV
APRM THERMAL UPSC TRIP	RPS	EACH DIV *	EACH DIV *	EACH DIV
APRM UPSC ALARM	RCIS	EACH DIV	NON-DIV	EACH DIV
APRM INOP	RPS/RCIS	EACH DIV *	EACH DIV *	EACH DIV
APRM DOWNSC ALARM	RCIS	EACH DIV	NON DIV	EACH DIV
APRM BYPASS	----	EACH DIV	NO	EACH DIV
FLOW UPSC ALARM	RCIS	EACH DIV	NON-DIV	EACH DIV
FLOW INOP	RCIS	EACH DIV	NON-DIV	EACH DIV
CORE FLOW RAPID COASTDOWN	RPS	EACH DIV	EACH DIV	EACH DIV
LPRM UPSC ALARM	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
LPRM DOWNSC ALARM	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
LPRM BYPASS	----	EACH CHANNEL	NO	EACH CHANNEL
ATWS PERMISSIVE	SSLC	EACH DIV	----	EACH DIV
OPRM TRIP	RPS	EACH DIV	EACH DIV	EACH DIV

* - SHARED AMONG APRM NEUTRON UPSC TRIP, THERMAL UPSC TRIP & INOP.

TABLE 6
MRBM ALARM INDICATIONS

ALARM FUNCTION	OUTPUT TO:	MCRP INDICATION	MCRP ANNUNCIATION	COMPUTER INPUT
REF APRM DOWNSCALE	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
UPSCALE ALARM	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
DOWNSCALE ALARM	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
ALARM INST INOP	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL
MRBM BYPASS	RCIS	EACH CHANNEL	NO	EACH CHANNEL
CORE FLOW ABNORMAL ALARM	RCIS	EACH CHANNEL	NON-DIV	EACH CHANNEL

Figure 7.6-1 Neutron Monitoring System IED (Sheet 4 of 4)

NOTES:

1. THIS IBD PRESENTS THE BASIC FUNCTIONAL REQUIREMENTS OF THE NEUTRON MONITORING SYSTEM (NMS) OF THE APPLIED PROJECT. IT CONTAINS THE SUBSYSTEMS OF SRNM, APRM & LPRM, ATIP AND MRBM. IT DOES NOT NECESSARILY REFLECT THE ACTUAL PHYSICAL LOCATIONS OF LOGICS TO BE IMPLEMENTED TO THE HARDWARE OR SOFTWARE LEVEL. (FOR INSTANCE, THE LOCATION OF THE SRNM OR APRM CHANNEL BYPASS FUNCTION MAY BE AT DIFFERENT LOCATION OR MORE THAN ONE LOCATION AS SHOWN IN THIS IBD).

2. FAIL SAFE LOGIC: ALL OUTPUT CONNECTIONS FROM LOGIC UNITS EXCEPT ATIP AND MRBM IBD ARE DEFINED AS LOGIC "1" DURING NORMAL REACTOR OPERATION. THEY CHANGE TO LOGIC "0" UPON A TRIP CONDITION. ANY "LOSS OF SIGNAL" CONDITION WILL ALSO CAUSE THE STATE TO BE CHANGED TO "0".

3. ONE RESET SWITCH SHALL BE USED FOR EACH CHANNEL ON THE MCR BACK PANEL.

4. THE PRESENCE OF AN OPERATOR INPUT, SUCH AS RESET, BYPASS, AUTO CALIBRATION, ETC., IMPLIES LOGIC "1".

5. TIME CONSTANT REFERS TO THE FILTER TIME CONSTANT WHERE THE FILTERED SIGNAL IS LAGGED BEHIND THE ORIGINAL SIGNAL BY THIS TIME CONSTANT AFTER SIGNIFICANT TIME ELAPSE. THIS IS SHOWN IN THE LEGEND SECTION.

6. R – S FLIP FLOPS ARE SET AND RESET BY POSITIVE LOGIC.

TRUTH TABLE

R	S	OUTPUT
0	0	PREVIOUS STATE
0	1	1
1	0	0
1	1	0

7. FAIL SAFE LOGIC: EXCEPT ATIP AND MRBM IBD, THE OUTPUT OF THE COMPARATOR IS DEFINED AS ZERO WHEN A TRIP OCCURS (FAIL SAFE LOGIC), I.E., WHEN THE COMPARISON EQUATION IS TRUE. OTHERWISE IT IS "1" DURING NORMAL CONDITION. HOWEVER, ALARMS, ANNUNCIATORS ARE ACTIVATED WITH LOGIC "1".

8. THE FAULT CONDITION RESULTED FROM A CHANNEL SELF–TEST IS LOGIC "0", SO IS THE CONDITION OF AN INSTRUMENT INOPERATIVE TRIP. THE SCOPE OF "CRITICAL SELF TEST" ITEMS IS TO BE REFERENCED IN NMS HARDWARE & SOFTWARE SYSTEM SPEC, C51–4010.

9. SETPOINTS FOR NMS LOGICS (NOMINAL) (I.E., SP 1 TO SP 22, MRBM AND SRNM PERIOD TRIP SETPOINTS) ARE INCLUDED IN AND SHALL BE GOVERNED BY THE NMS SYSTEM DESIGN SPEC, C51–4010.

10. CORE FLOW CONVERSION, FLOW REFERENCE LOGIC AND CORE FLOW RAPID COASTDOWN TRIP ALGORITHMS, MRBM CORE FLOW COMPARISON ALGORITHM AND OPRM TRIP ALGORITHM ARE DEFINED IN THE NMS HARDWARE AND SOFTWARE SYSTEM SPEC, C51–4010. ALSO THE TIME DELAY IN ATIP AUTO PARK LOGIC IS REFERENCED IN THIS DOCUMENT.

11. FOR ATIP IBD, IN DRIVE MECHANISM LOGIC,
X = 1 INDICATES "MOVE", X = 0 INDICATES "STOP",
Y = 1 INDICATES "FORWARD", Y = 0 INDICATES "REVERSE"
Z = 1 INDICATES "FAST", Z = 0 INDICATES "SLOW"

12. FOR ATIP IBD, THE DESCRIPTION OF AUTO MECHANISM IS PROVIDED.

13. STATUS INDICATORS CAN BE APPLIED BY ELECTRO LUMINESCENT TYPE OR CATHODE RAY TUBE DISPLAY, ETC., WHICH ARE INSTALLED ON THE UNITS. THE NOTE "LOCAL" REFERS TO CONTROL ROOM BACK BACK; THE NOTE "MCRP" REFERS TO MAIN CONTROL ROOM OPERATOR MAIN PANELS.

14. INDICATIONS IN MAIN CONTROL ROOM PANEL (MCRP) CAN BE PROVIDED USING THE NMS SIGNALS VIA THE PERFORMANCE MONITORING AND CONTROL SYSTEM (PMCS) OF THE PROCESS COMPUTER, OR DIRECTLY FROM THE NMS.

15. SRNM PERIOD WITHDRAWAL PERMISSIVE SIGNALS TO APRS ARE FOR INTERRUPT OF AUTOMATED CONTROL ROD WITHDRAWAL DURING AUTOMATED OPERATION.

16. THE OR GATE IS LOCATED IN THE MCRP SYSTEM.

SUPPLEMENTAL DOCUMENTS UNDER THE FOLLOWING IDENTITIES ARE TO BE USED IN CONJUNCTION WITH THIS DRAWING.

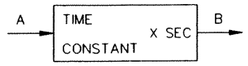
		MPL NO.
1.	AUTOMATIC POWER REGULATOR SYS, IBD	C82–1030
2.	ROD CONTROL & INFORMATION SYS, IBD	C11–1030
3.	REACTOR PROTECTION SYSTEM, IBD	C71–1030
4.	RECIRCULATION FLOW CONTROL SYS, IED	C81–1040
5.	ROD CONTROL & INFORMATION SYS, IED	C11–1040
6.	NEUTRON MONITORING SYSTEM, IED	C51–1040
7.	LEAK DETECTION AND ISOLATION SYS, IBD	E31–1030
8.	SAFETY SYSTEM LOGIC & CONTROL SYSTEM IBD	C74–1030

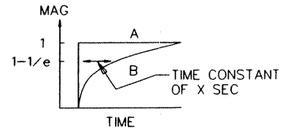
SUPPORTING DOCUMENTS

		MPL NO.
1.	INTERLOCK BLOCK DIAGRAM (IBD) STANDARDS	A10–1030

LEGEND:

1. FILTERED TIME CONSTANT





ABBREVIATIONS

NMS–NEUTRON MONITORING SYSTEM
RPS– REACTOR PROTECTION SYSTEM
SRNM–STARTUP RANGE NEUTRON MONITOR
LPRM–LOCAL POWER RANGE MONITOR
APRM–AVERAGE POWER RANGE MONITOR
ATIP–AUTOMATED TRAVERSING IN–CORE PROBE
MRBM–MULTI CHANNEL ROD BLOCK MONITOR
RC&IS–ROD CONTROL & INFORMATION SYSTEM
MCRP–MAIN CONTROL ROOM PANEL
PMCS–PERFORMANCE MONITORING CONTROL SYSTEM
ATCF–AUTOMATED TIP CONTROL FUNCTION
OPRM – OSCILLATION POWER RANGE MONITOR
ATWS – ANTICIPATED TRANSIENT WITHOUT SCRAM
UPSC–UPSCALE
INOP–INOPERABLE
DNSC–DOWNSCALE

MPL NO. C51–1030

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 1 of 28)

TABLE OF CONTENTS

SH NO.	TITLE
1	REFERENCES, NOTES, ABBREVIATIONS, LEGEND
2	TABLE OF CONTENTS
3	SRNM INTERFACE TO RPS
4	SRNM INTERFACE TO RC&IS
5	SRNM INTERFACE TO RC&IS
6	SRNM CHANNEL A (TYPICAL OF 10)
7	SRNM CHANNEL A (TYPICAL OF 10)
8	SRNM CHANNEL A (TYPICAL OF 10)
9	APRM INTERFACE TO RPS & TO RC&IS
10	APRM CHANNEL A (LPRM) (TYPICAL OF 4)
11	APRM CHANNEL A (TYPICAL OF 4)
12	APRM CHANNEL A (TYPICAL OF 4)
13	APRM CHANNEL A (TYPICAL OF 4)
14	ATIP FUNCTIONAL CONFIGURATION
15	ATCF LOGIC OF ATIP (TYPICAL OF 3)
16	ATCF LOGIC OF ATIP (TYPICAL OF 3)
17	ATCF LOGIC OF ATIP (TYPICAL OF 3)
18	SRNM & APRM BYPASS SWITCH ASSIGNMENT
19	MRBM FUNCTIONAL CONFIGURATION
20	MRBM CONFIGURATION DESCRIPTION
21	MRBM CHANNEL A ROD BLOCK LOGIC (TYP FOR MRBM CH B)
22	MRBM CHANNEL A ROD BLOCK LOGIC (TYP FOR MRBM CH B)
23	MRBM CHANNEL A ROD BLOCK LOGIC (TYP FOR MRBM CH B)
24	MRBM ROD BLOCK SETPOINT SETUP LOGIC
25	SRNM "ATWS PERMISSIVE" INTERFACE TO SSLC
26	APRM "ATWS PERMISSIVE" INTERFACE TO SSLC
27	OPRM CHANNEL A (TYPICAL OF 4)
28	OPRM CONFIGURATION DESCRIPTION

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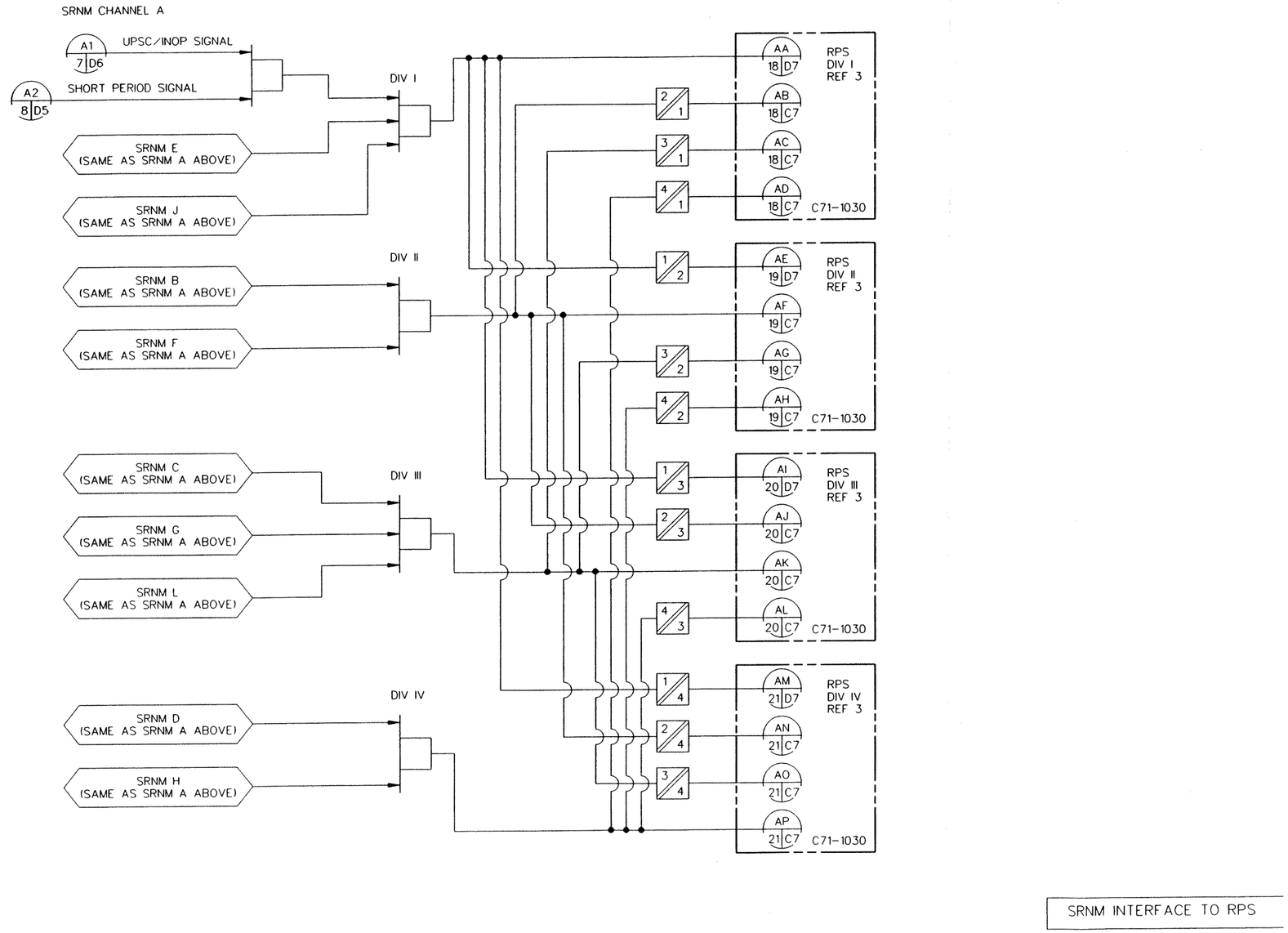


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 3 of 28)

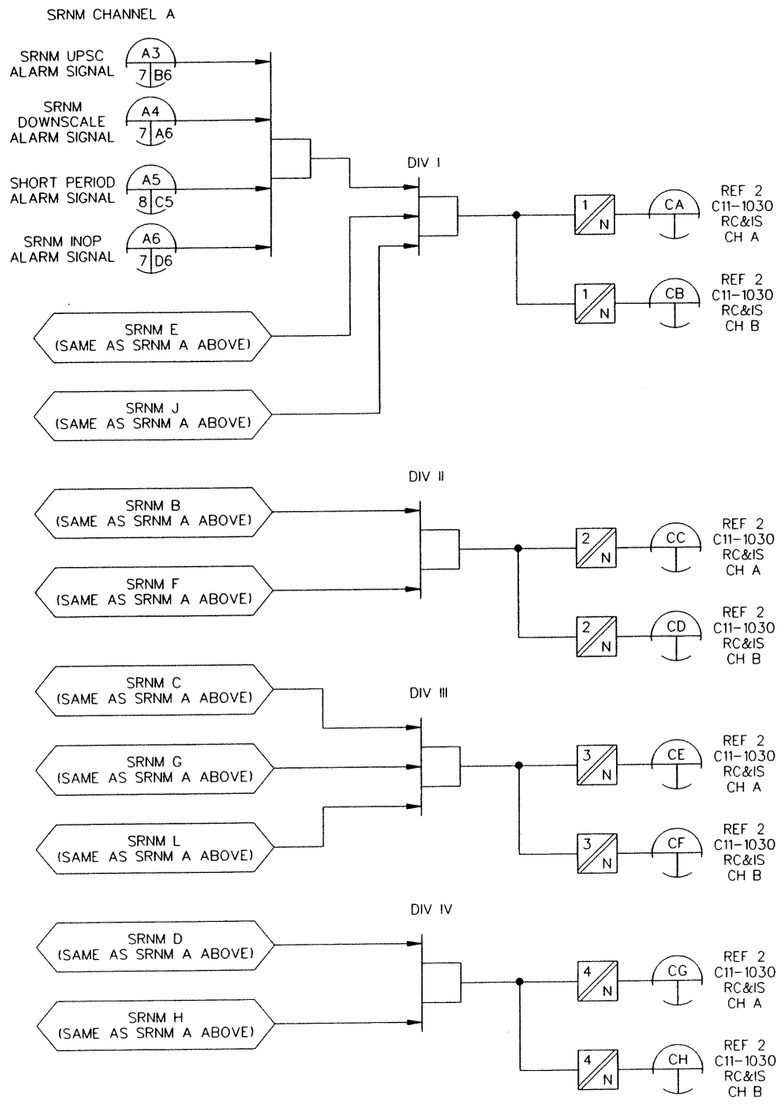


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 4 of 28)

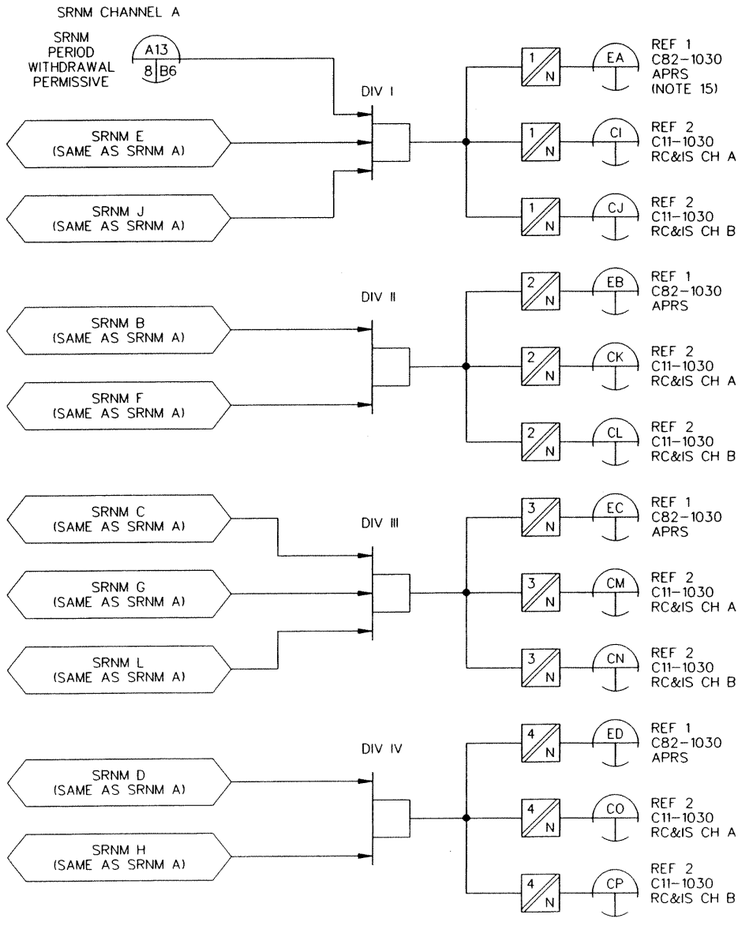


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 5 of 28)

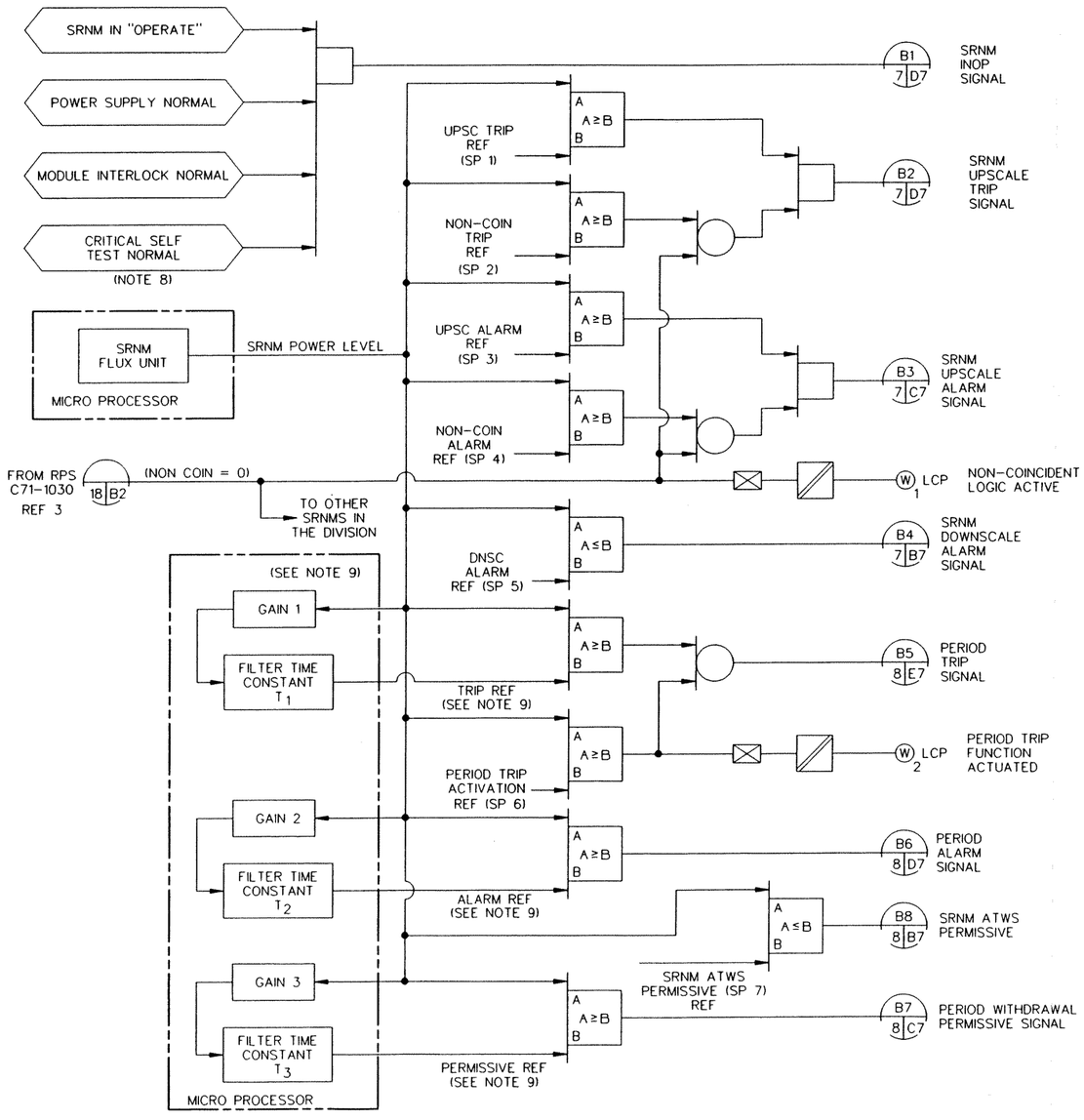
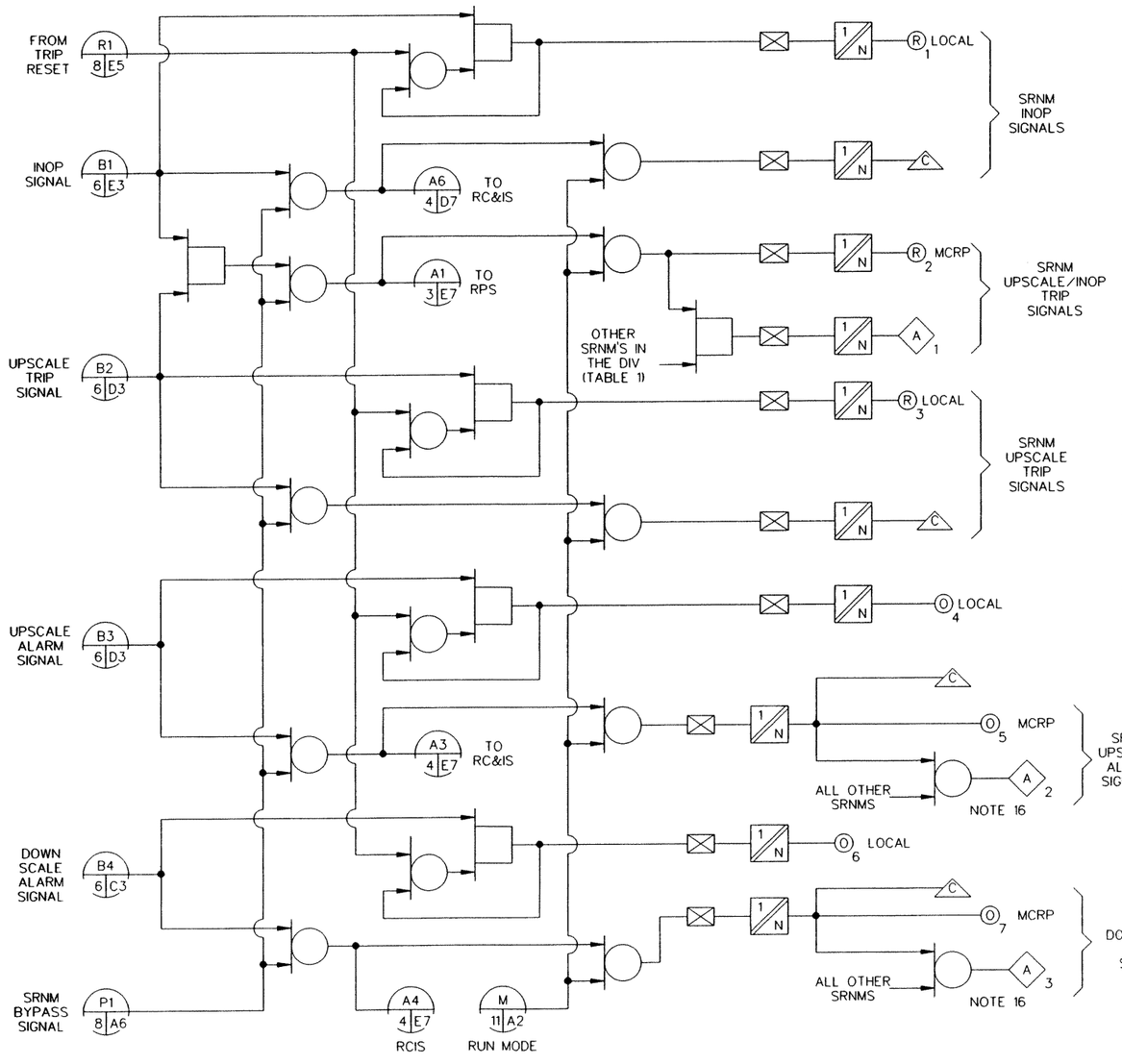


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 6 of 28)



CONTROL SWITCH		

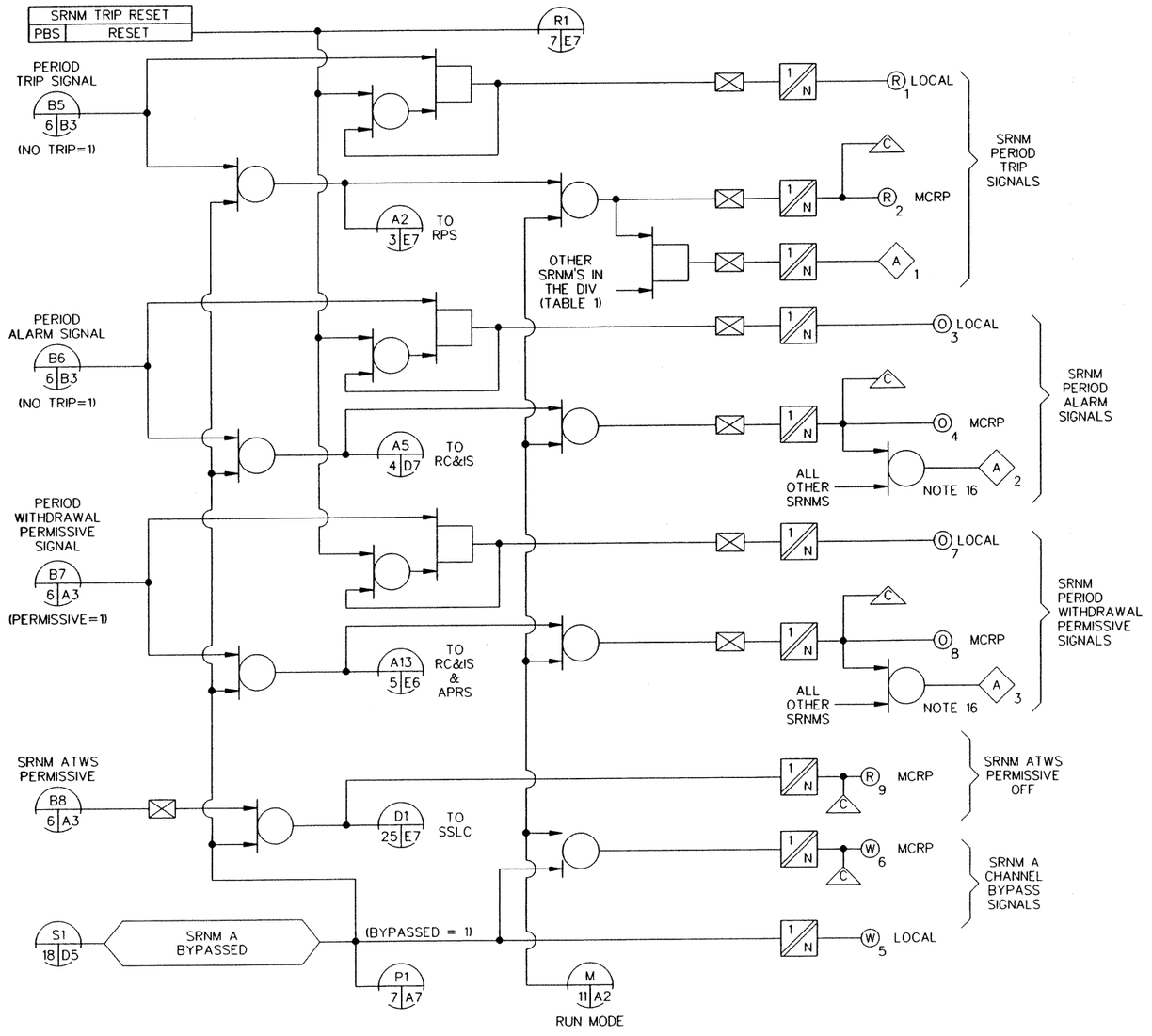
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
STATUS INDICATOR	R 1, R 3, O 4, O 6	LCP
STATUS INDICATOR	R 2, O 5, O 7	MCRP

ANNUNCIATOR		
NO.	INDICATOR	LOCATION
1	SRNM UPSCALE/INOP TRIP, DIV I	MCRP
2	SRNM UPSCALE ALARM	MCRP
3	SRNM DOWNSCALE ALARM	MCRP

OTHERS

SRNM CHANNEL A
(TYPICAL OF 10)

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 7 of 28)



CONTROL SWITCH		
SRNM TRIP RESET		
PUSH BUTTON FOR TRIP RESET		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
STATUS INDICATOR	R 1, O 3, W 5, O 7	LCP
STATUS INDICATOR	R 2, O 4, W 6, O 8, R 9	MCRP
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
1	SRNM PERIOD TRIP, DIV I	MCRP
2	SRNM PERIOD ALARM	MCRP
3	SRNM PERIOD-BASED PERMISSIVE	MCRP
OTHERS		
SRNM CHANNEL A (TYPICAL OF 10)		

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 8 of 28)

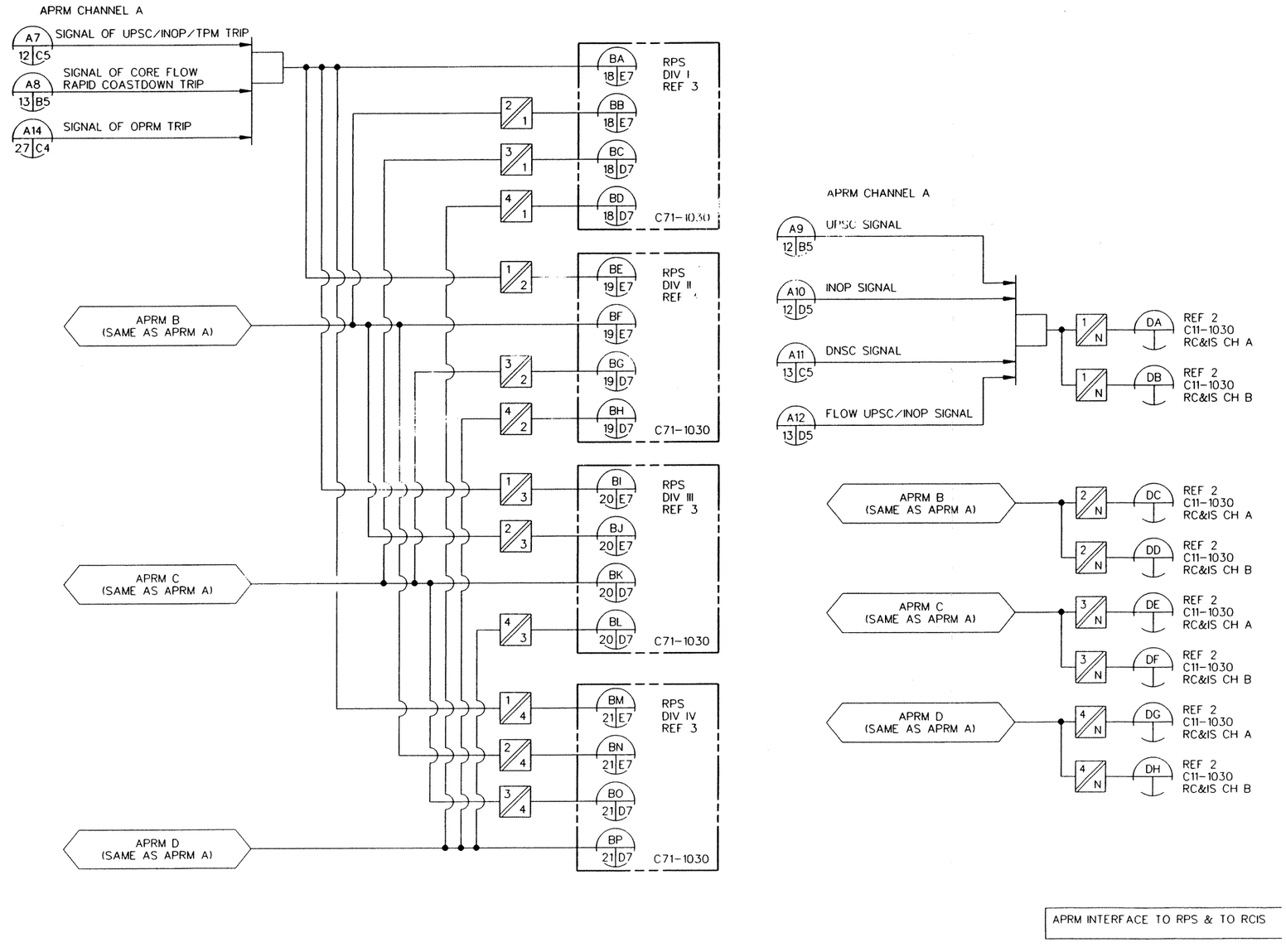
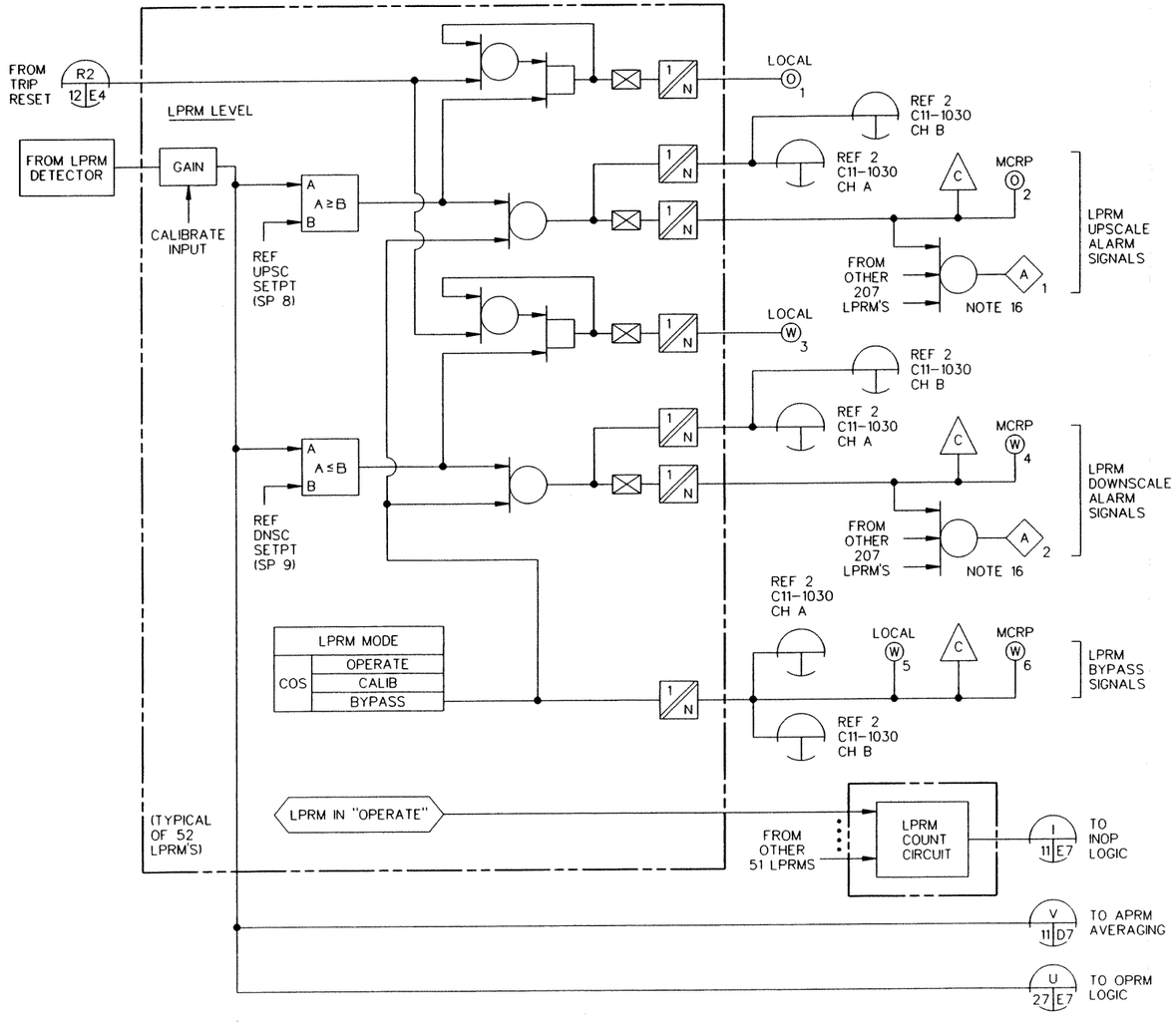


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 9 of 28)



CONTROL SWITCH
LPRM BYPASS SWITCH CAN BE VIA CARD TOGGLE SWITCH OR VIA DMC UNIT SOFTWARE INPUT

OBSERVATIONAL MEASURES

USE	SPECIFICATION	LOCATION
STATUS INDI-CATOR	O 1, W 3, W 5	LCP
STATUS INDI-CATOR	O 2, W 4, W 6	MCRP

ANNUNCIATOR

NO.	INDICATOR	LOCATION
1	LPRM UPSCALE ALARM	MCRP
2	LPRM DOWNSCALE ALARM	MCRP

OTHERS

APRM CHANNEL A (LPRM) (TYPICAL OF 4)

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 10 of 28)

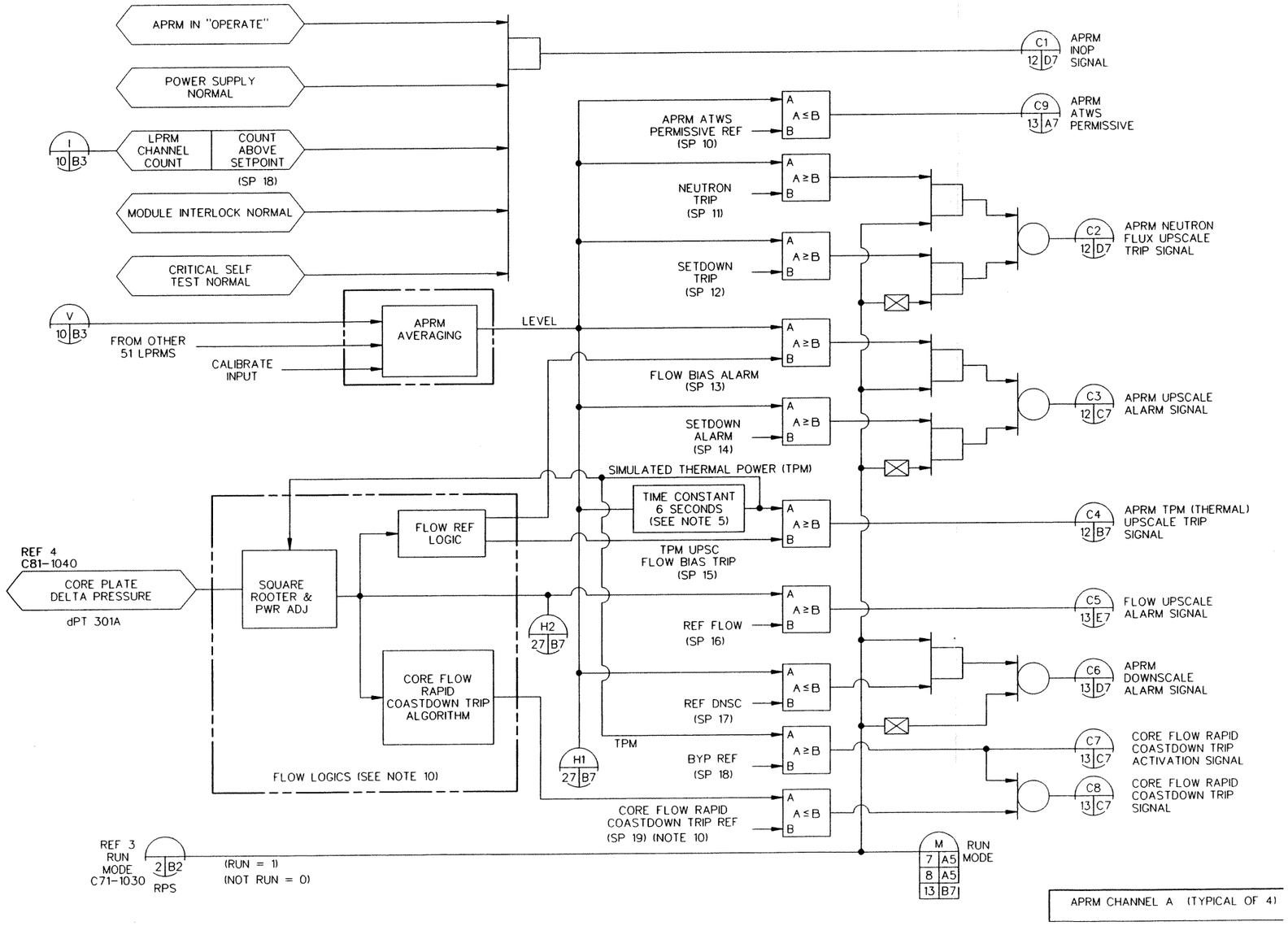
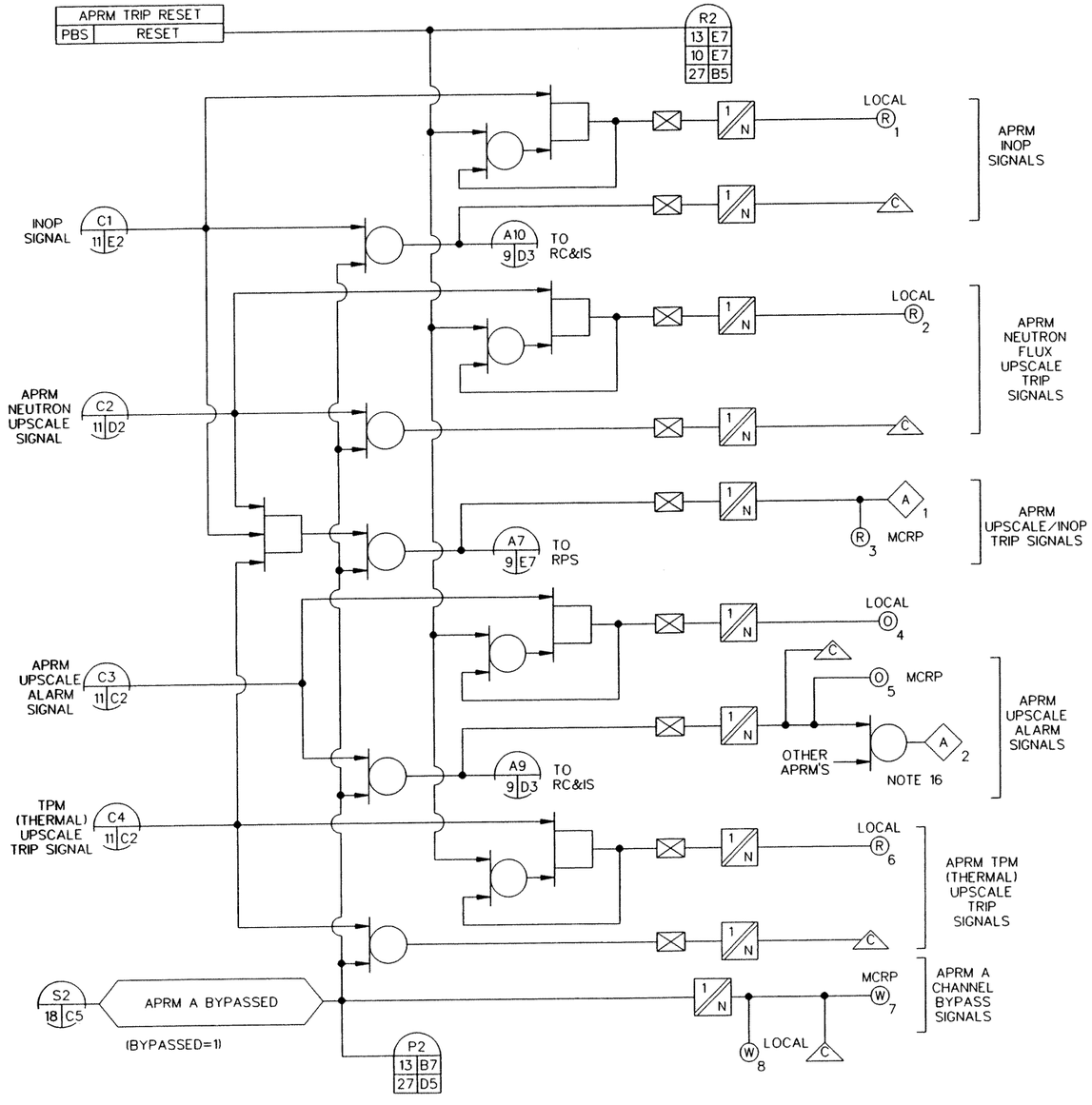
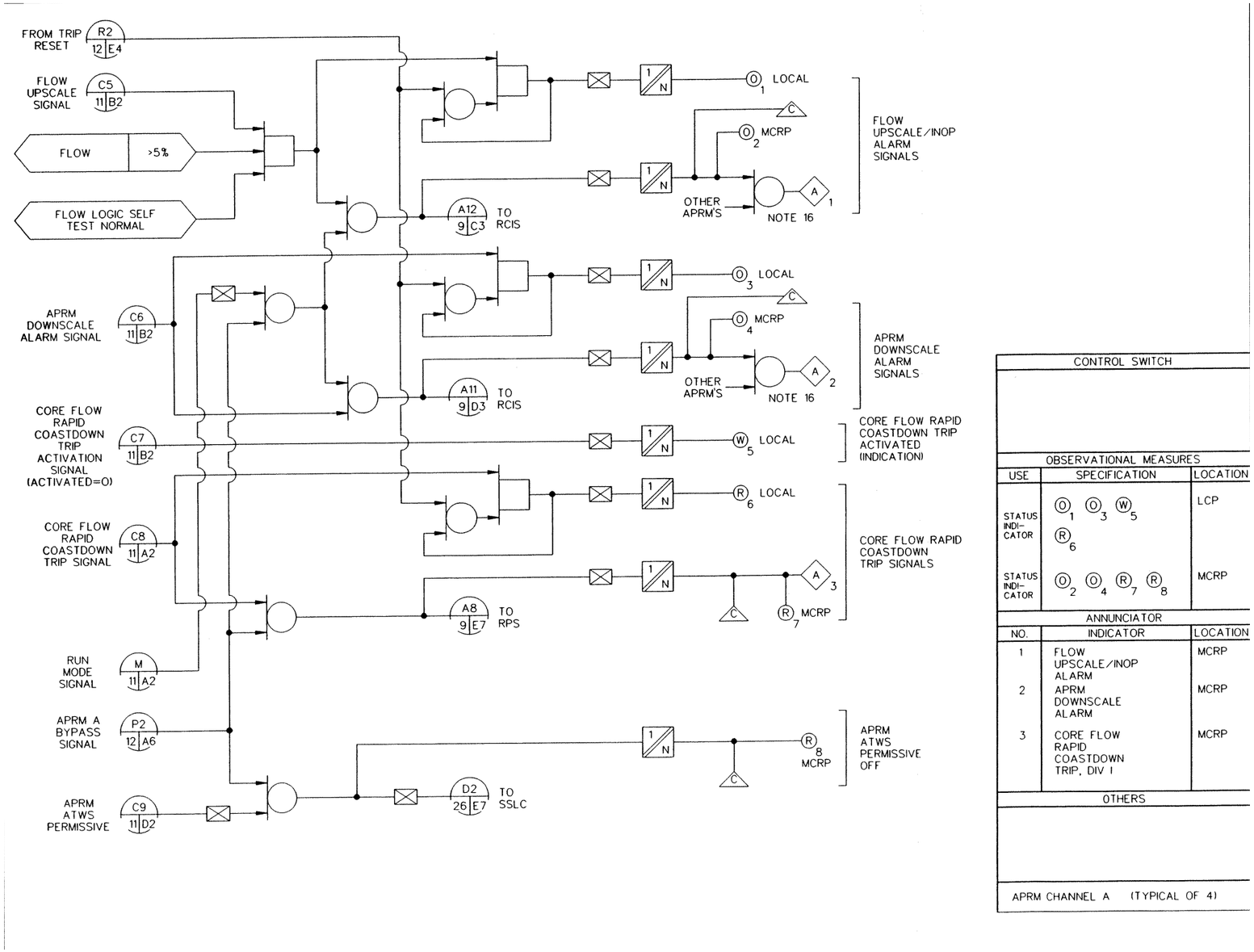


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 11 of 28)



CONTROL SWITCH		
APRM TRIP RESET PUSH BUTTON FOR RESET		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
STATUS INDICATOR	R 1, R 2, O 4, R 6, W 8	LCP
STATUS INDICATOR	R 3, O 5, W 7	MCRP
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
1	APRM UPSCALE/INOP TRIP, DIV I	MCRP
2	APRM UPSCALE ALARM	MCRP
OTHERS		
APRM CHANNEL A (TYPICAL OF 4)		

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 12 of 28)



CONTROL SWITCH		

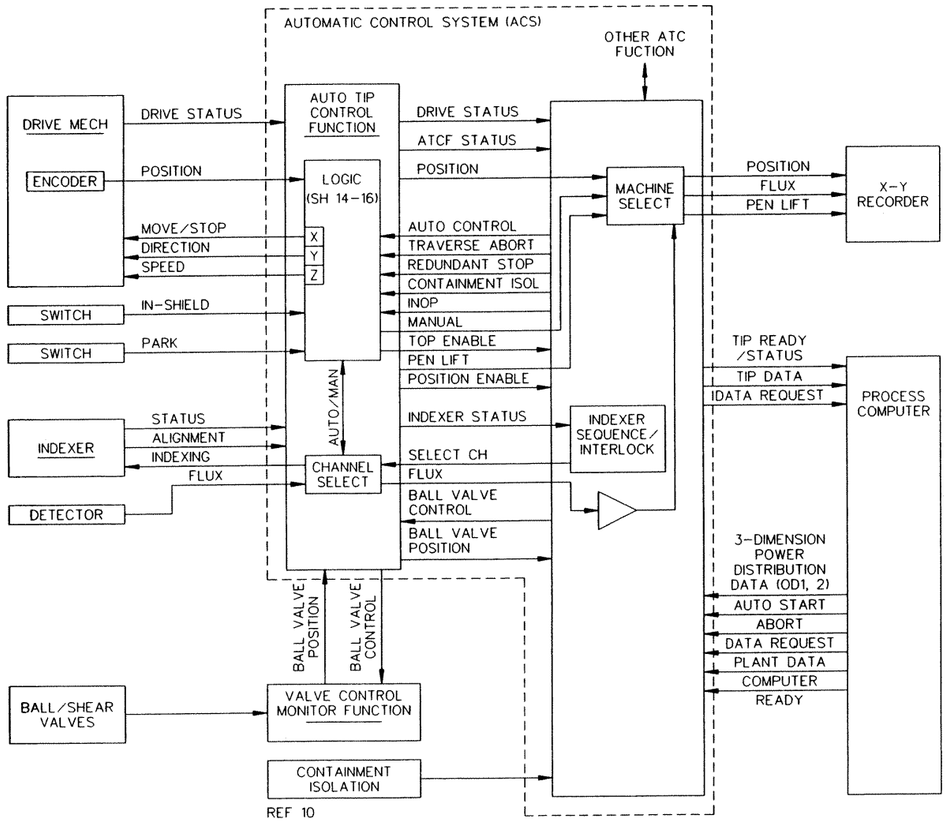
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
STATUS INDICATOR	(O) 1 (O) 3 (W) 5 (R) 6	LCP
STATUS INDICATOR	(O) 2 (O) 4 (R) 7 (R) 8	MCRP

ANNUNCIATOR		
NO.	INDICATOR	LOCATION
1	FLOW UPSCALE/INOP ALARM	MCRP
2	APRM DOWNSCALE ALARM	MCRP
3	CORE FLOW RAPID COASTDOWN TRIP, DIV I	MCRP

OTHERS

APRM CHANNEL A (TYPICAL OF 4)

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 13 of 28)



SUPPLEMENT TO ATIP IBD

AUTO TIP MECHANISM DESCRIPTION

1. COMMAND FOR AUTO TIP FROM PROCESS COMPUTER IS TRANSFERRED TO THE ATCF'S THROUGH THE ACS. THIS INITIATES AUTO-TIP COMMAND SEQUENCE.
2. EACH ATCF BEGINS SCANS FOR ALL OF ITS GUIDE TUBES. TIP DATA ARE RETAINED IN MEMORY UNIT FOR LATER ACCESS. INDEXING AND TRAVERSING IS AUTOMATICALLY SEQUENCED. THE INDEXING SEQUENCE/INTERLOCK IS CONTROLLED BY THE ACS. THE TRAVERSING LOGIC FOR EACH SCAN IS FROM THE ATCF LOGIC.
3. ACS CONTROLS THE USE OF THE COMMON (REFERENCE) TUBE TO PROTECT AGAINST MULTIPLE ENTRY AND TO COORDINATE THE REFERENCE TUBE CROSS CALIBRATION.
4. WHEN ALL ATCFS HAVE COMPLETED THEIR SCANS, A SIGNAL IS RETURNED TO THE PROCESS COMPUTER NOTIFYING IT THAT THE NEW TIP DATA IS AVAILABLE.
5. PROCESS COMPUTER CAN THEN REQUEST FOR THE TIP DATA TO BE TRANSFERED.
6. AN AUTO TIP WILL BE ABORTED FOR ANY OF THE FOLLOWING REASONS:
   A. IMPROPER INDEXER OPERATION
   B. CONTAINMENT ISOLATION
   C. EXCESSIVE WAITING FOR COMMON CHANNEL
   D. MANUAL ABORT

ATIP FUNCTIONAL CONFIGURATION

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 14 of 28)

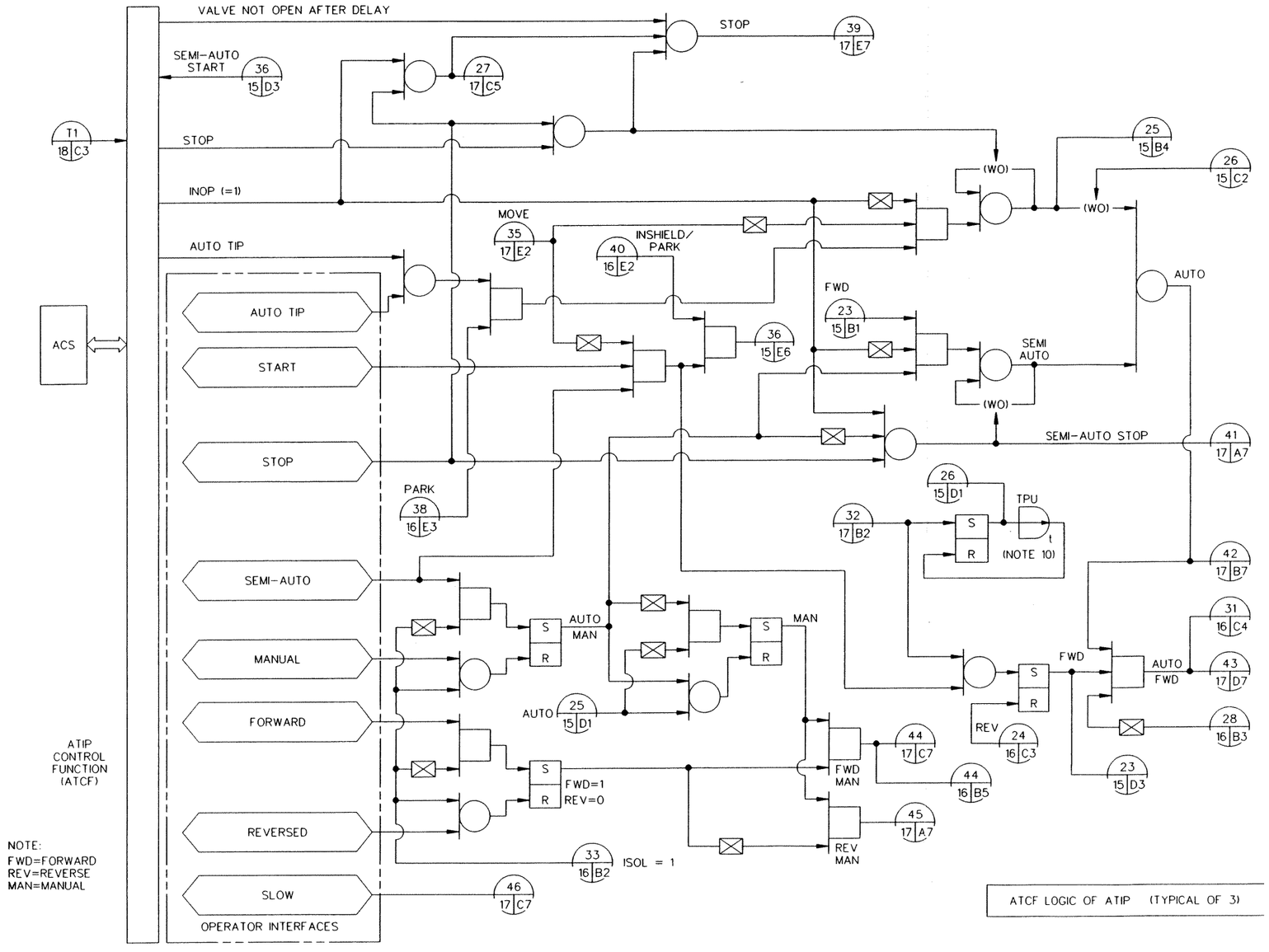


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 15 of 28)

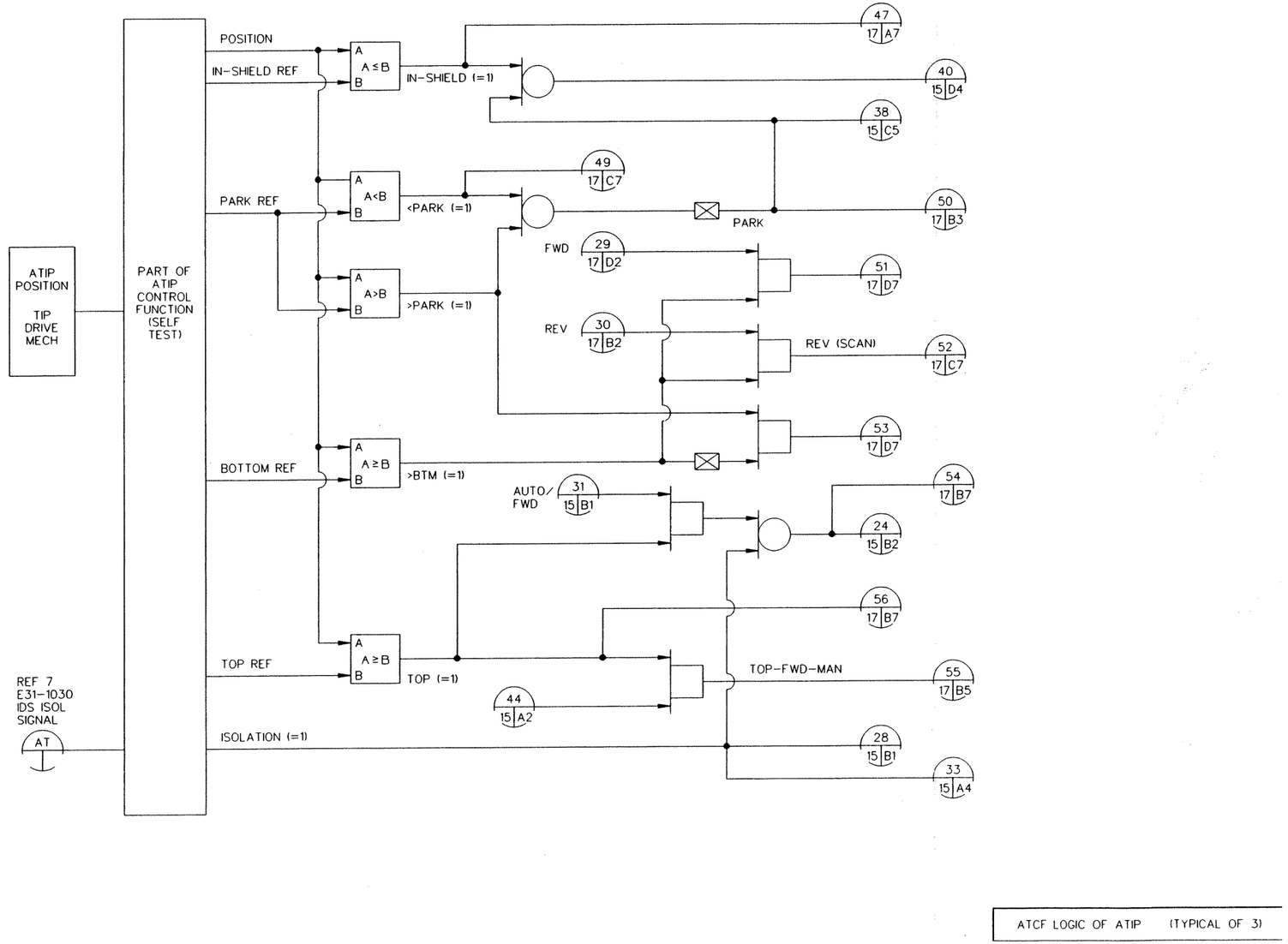


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 16 of 28)

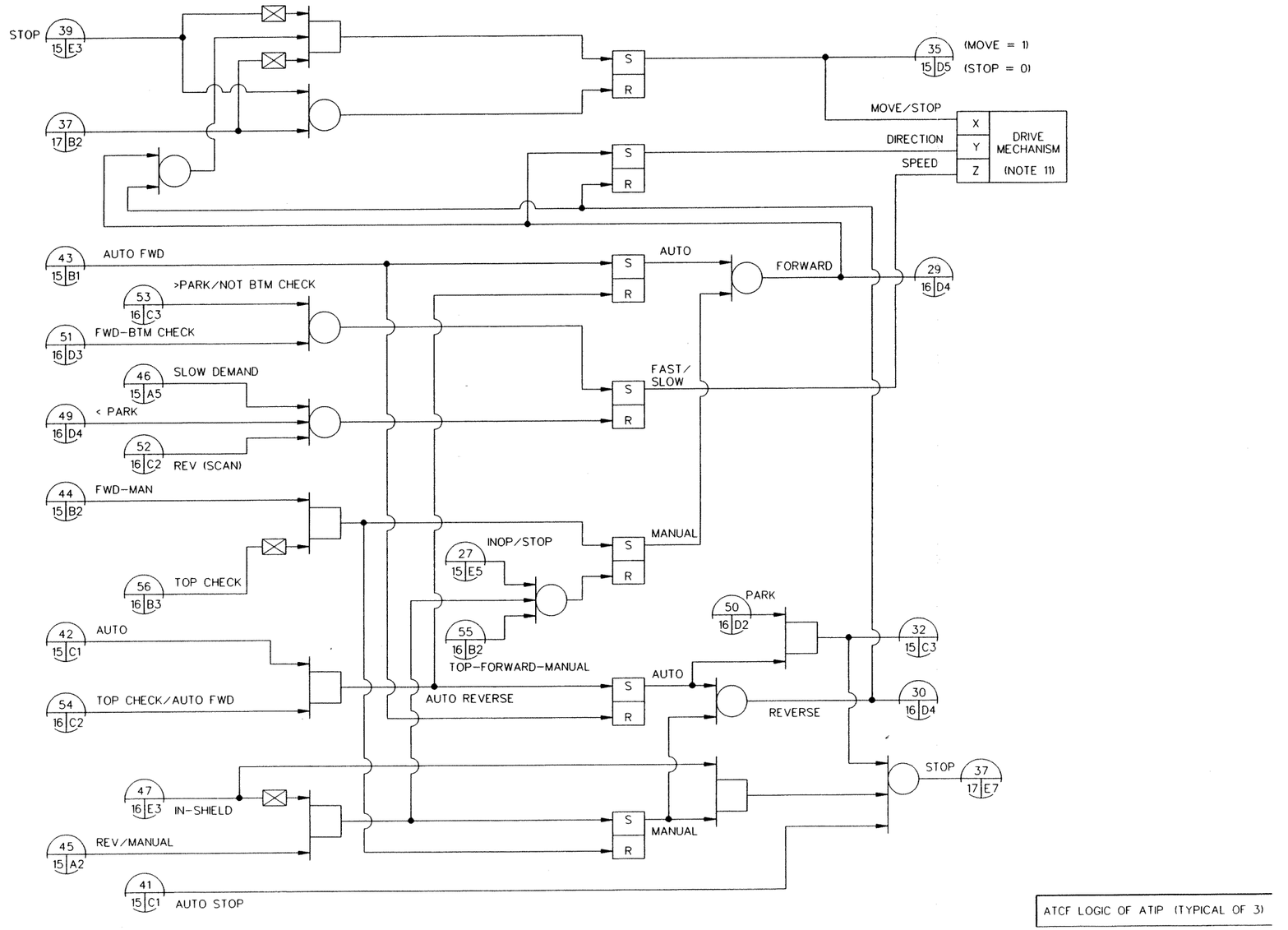
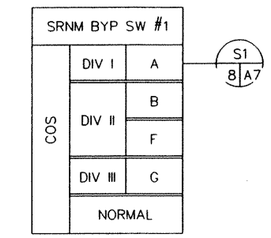


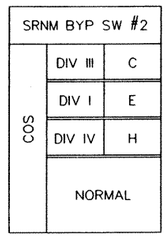
Figure 7.6-2 Neutron Monitoring System IBD (Sheet 17 of 28)

TABLE 1

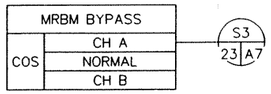
SRNM CH #	DIV	BYP GP
A	I	1
B	II	1
C	III	2
D	IV	3
E	I	2
F	II	1
G	III	1
H	IV	2
J	I	3
L	III	3



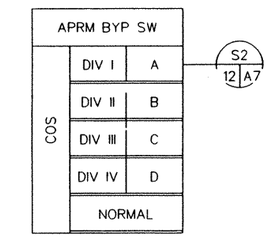
5–POSITION JOYSTICK SW
(WITH SEPARATION BARRIER
BETWEEN DIFFERENT DIVISION)



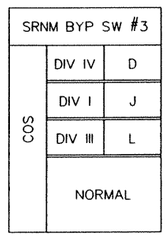
4–POSITION JOYSTICK SW
(WITH SEPARATION BARRIER
BETWEEN DIFFERENT DIVISION)



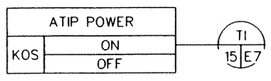
3–POSITION
CONTROL SWITCH



5–POSITION JOYSTICK SW
(WITH SEPARATION BARRIER
BETWEEN DIFFERENT DIVISION)



4–POSITION JOYSTICK SW
(WITH SEPARATION BARRIER
BETWEEN DIFFERENT DIVISION)



SRNM AND APRM BYPASS
SWITCH ASSIGNMENT

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 18 of 28)

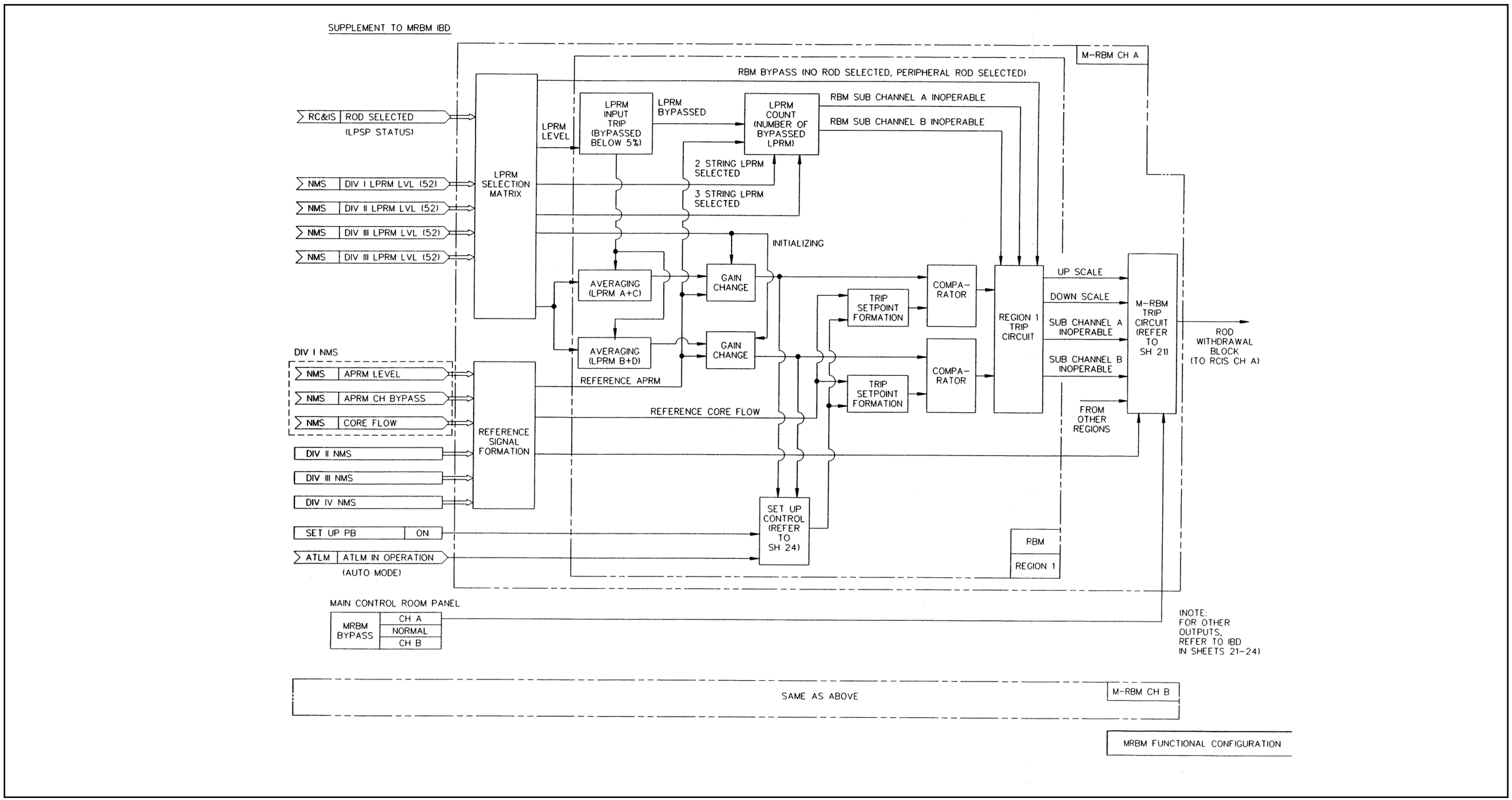


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 19 of 28)

SUPPLEMENT TO MRBM IBD

MRBM BASIC CONFIGURATION:

EACH MRBM CHANNEL HAS EIGHT RBM'S THAT COVER EIGHT CORE REGIONS, CORRESPONDING TO THE EIGHT CONTROL RODS BEING WITHDRAWN. MRBM GENERATES ROD BLOCK TRIP ACCORDING TO EACH RBM TRIP CONDITIONS. CONTROL ROD REGION ASSIGNMENT IS SHOWN IN THE FIGURE ON THIS SHEET. FOR DETAIL DESCRIPTION OF MRBM FUNCTION, REFER TO NMS HARDWARE AND SOFTWARE SYSTEM SPEC, C51-4010.

SUBSYSTEMS OF THE MRBM:

LPRM SELECTION MATRIX

WHEN ROD(S) ARE SELECTED, A MAXIMUM OF 16 LPRMS OF EACH REGION IS SELECTED WITH THE LPRM READINGS TRANSFERRED TO THE AVERAGING UNIT.

LPRM AVERAGING FUNCTION

ACTIVE LPRM SIGNALS OF EACH REGION ARE DIVIDED INTO TWO SUBCHANNELS "A & C" LEVELS AND "B & D" LEVELS. THE SIGNALS ARE SUMMED AND AVERAGE, RESPECTIVELY.

LPRM INPUT TRIP FUNCTION

EACH LPRM SIGNAL MUST BE GREATER THAN THE PRESET VALUE (5%) TO AVOID INPUT TRIP.

LPRM COUNT FUNCTION

IF THE NUMBER OF TRIPPED LPRMS EXCEEDS THE SETPOINT (SHEET 21) THIS SUBCHANNEL BECOMES INOPERABLE. CONDITIONS FOR MRBM CHANNEL INOPERABLE: 1) BOTH SUBCHANNEL A AND B IN ONE REGION ARE INOPERABLE; 2) ALL SUBCHANNEL A'S (OR B) IN ALL REGIONS ARE INOPERABLE; 3) SINGLE ROD CASE FOLLOWS CONDITION 1 ABOVE.

REFERENCE SIGNAL FORMATION FUNCTION

IT FORMS THE REFERENCE APRM SIGNAL AND THE CORE FLOW SIGNAL BY TAKING THE AVERAGE OF THE FOUR DIVISIONAL INPUTS.

GAIN CHANGE FUNCTION

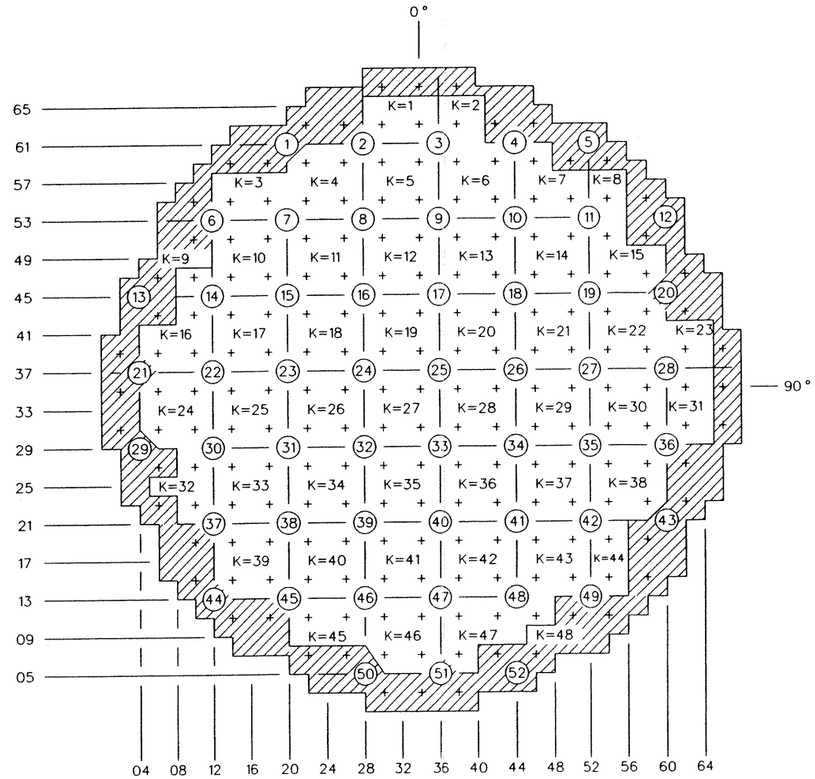
THE AVERAGED RBM SUBCHANNEL SIGNAL IS ADJUSTED TO BE EQUAL TO OR GREATER THAN THE REFERENCE APRM. SEE NMS HARDWARE AND SOFTWARE SYSTEM SPEC, C51-4010.

TRIP SETPOINT FORMATION AND TRIP FUNCTION

RBM TRIP SETPOINTS ARE CORE FLOW BIASED AND HAVE MULTIPLE ROD BLOCK LINES.

CORE FLOW COMPARISON FUNCTION

IT PERFORMS CORE FLOW COMPARISON FUNCTION BETWEEN EACH INDIVIDUAL PAIR OF CORE FLOW VALUES. IT ISSUES ROD BLOCK SIGNAL IF ABNORMAL CORE FLOW CONDITION EXISTS.

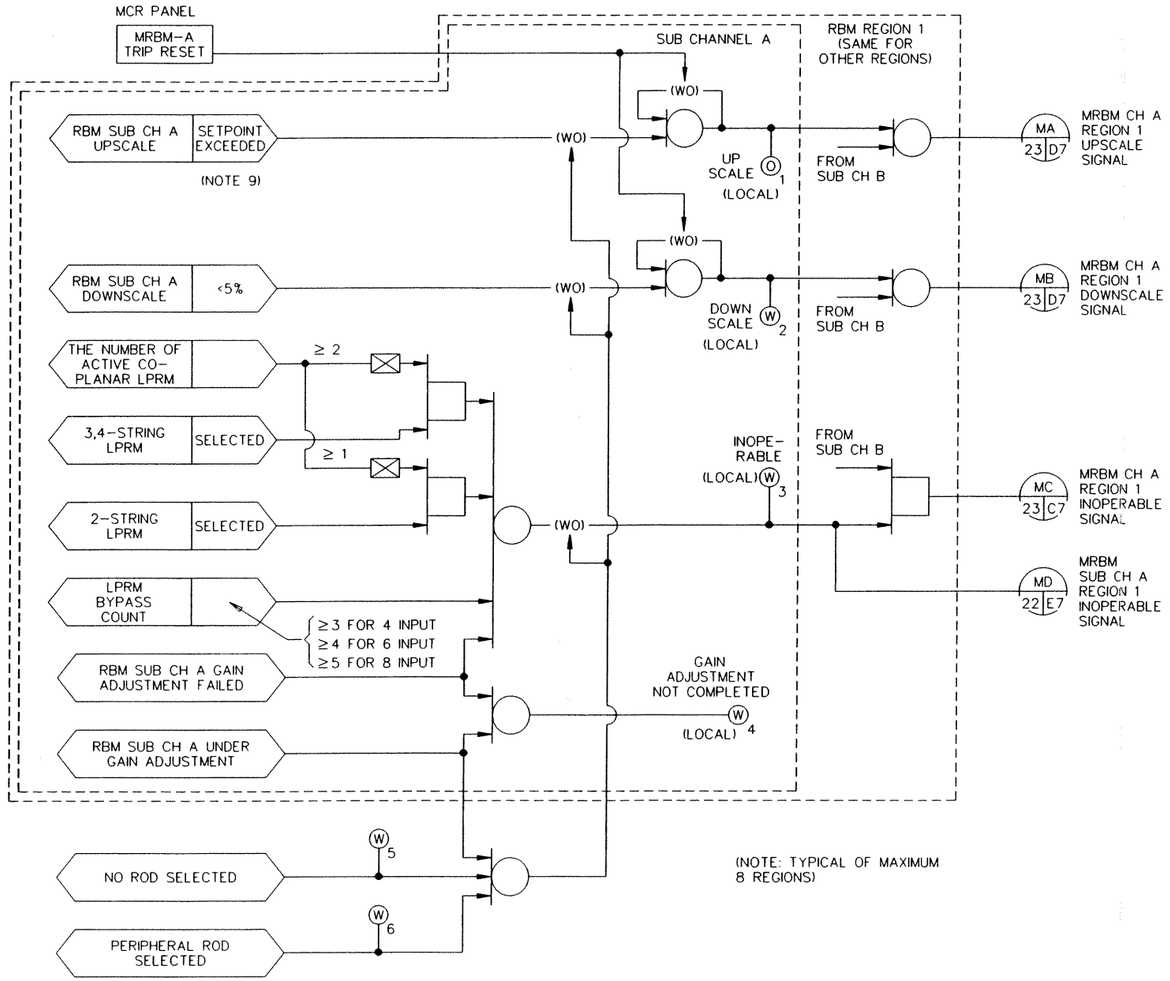


LEGEND:

+ : CONTROL ROD
O : LPRM
K = 1-48: SUFFIX STANDS FOR 16-BUNDLES
SHADOWED AREA : PERIPHERAL CONTROL ROD

MRBM CONFIGURATION DESCRIPTION

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 20 of 28)



CONTROL SWITCH		
MRBM-A TRIP RESET PUSH BUTTON FOR RESET, CH A		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
STATUS INDI-CATOR	(O) 1 (W) 2 (W) 3 (W) 4	LCP (EACH SUB CH)
STATUS INDI-CATOR	(W) 5 (W) 6	LCP
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
OTHERS		
MRBM CHANNEL A ROD BLOCK LOGIC (TYPICAL FOR MRBM CH B)		

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 21 of 28)

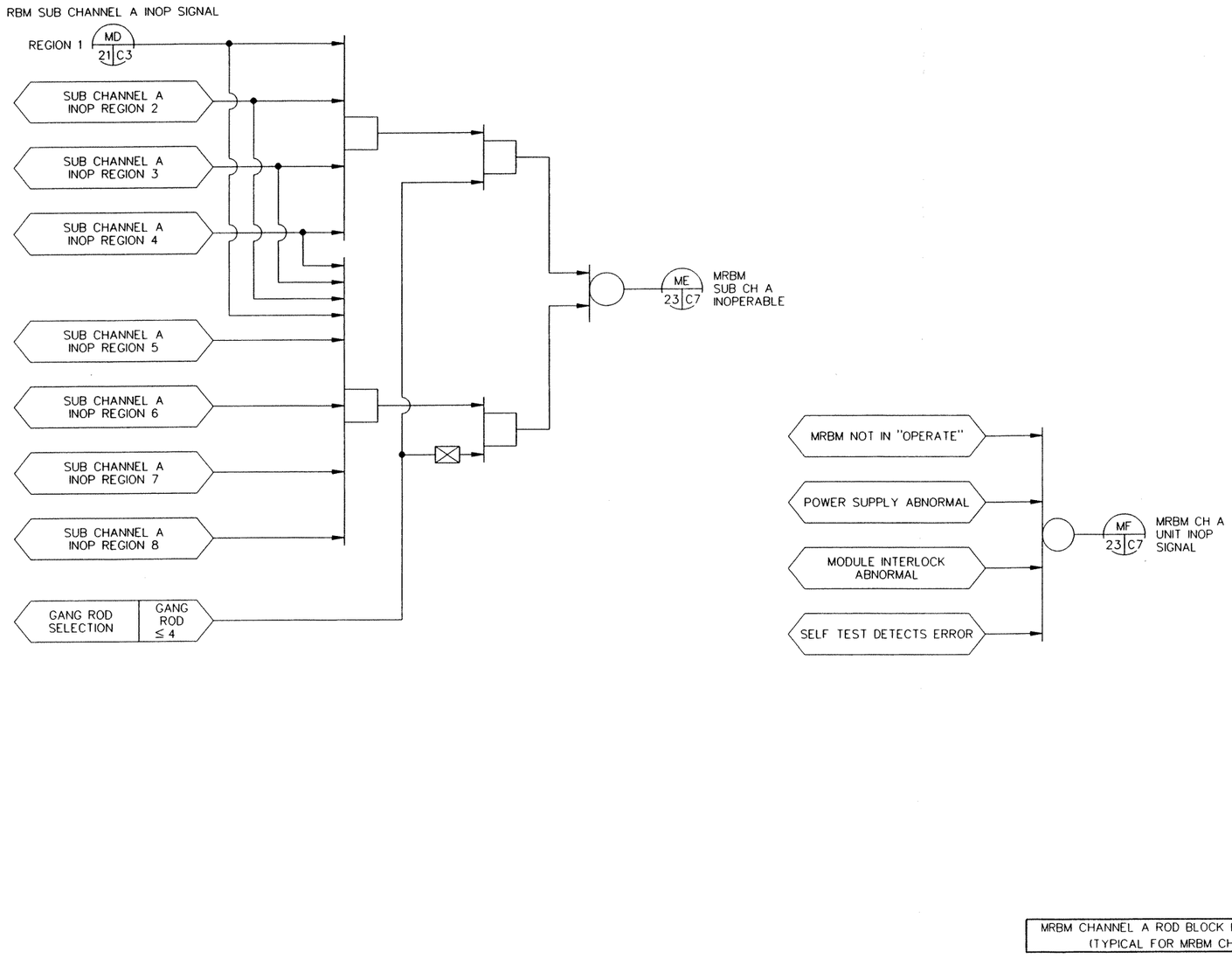
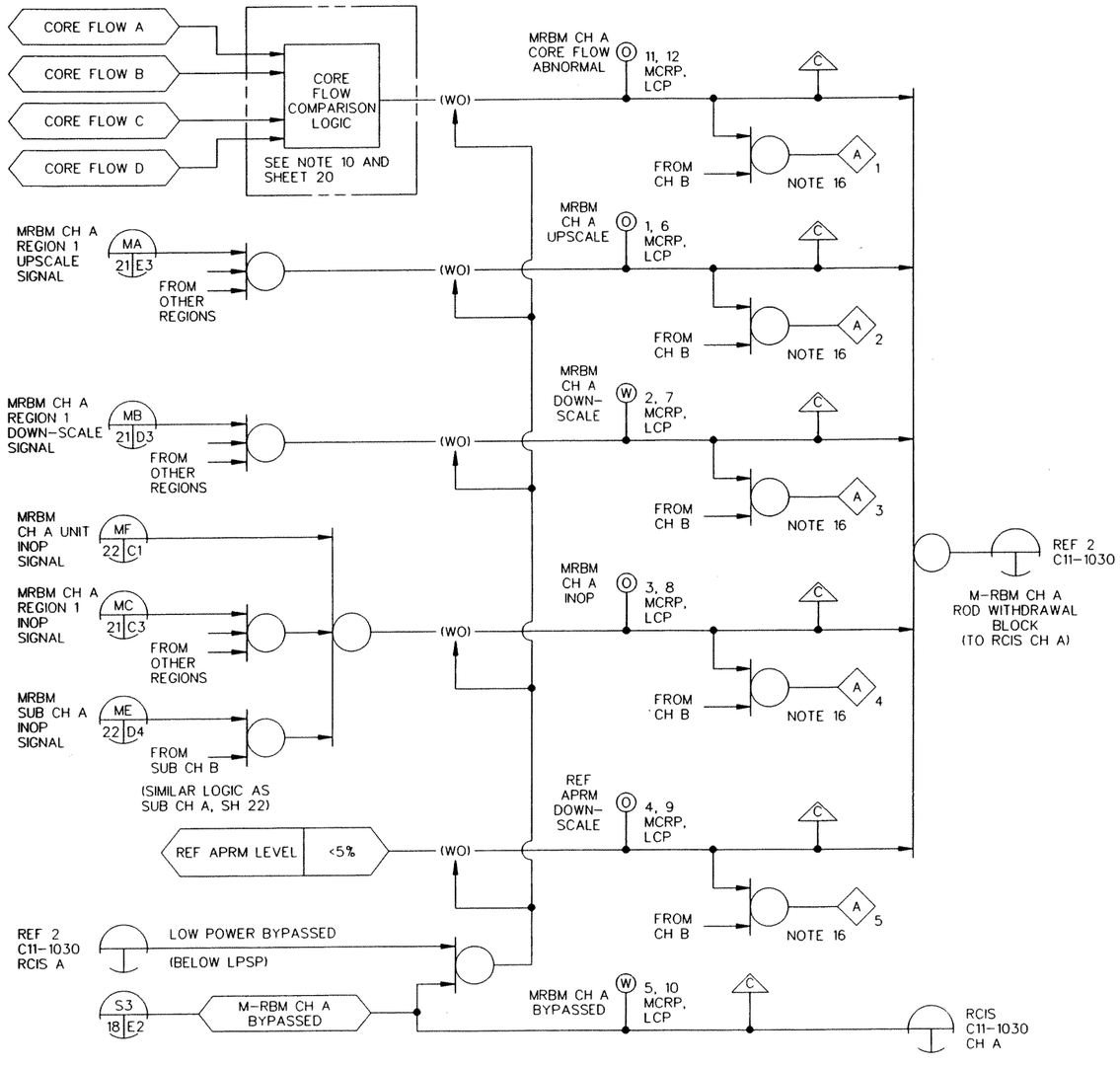


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 22 of 28)



CONTROL SWITCH		

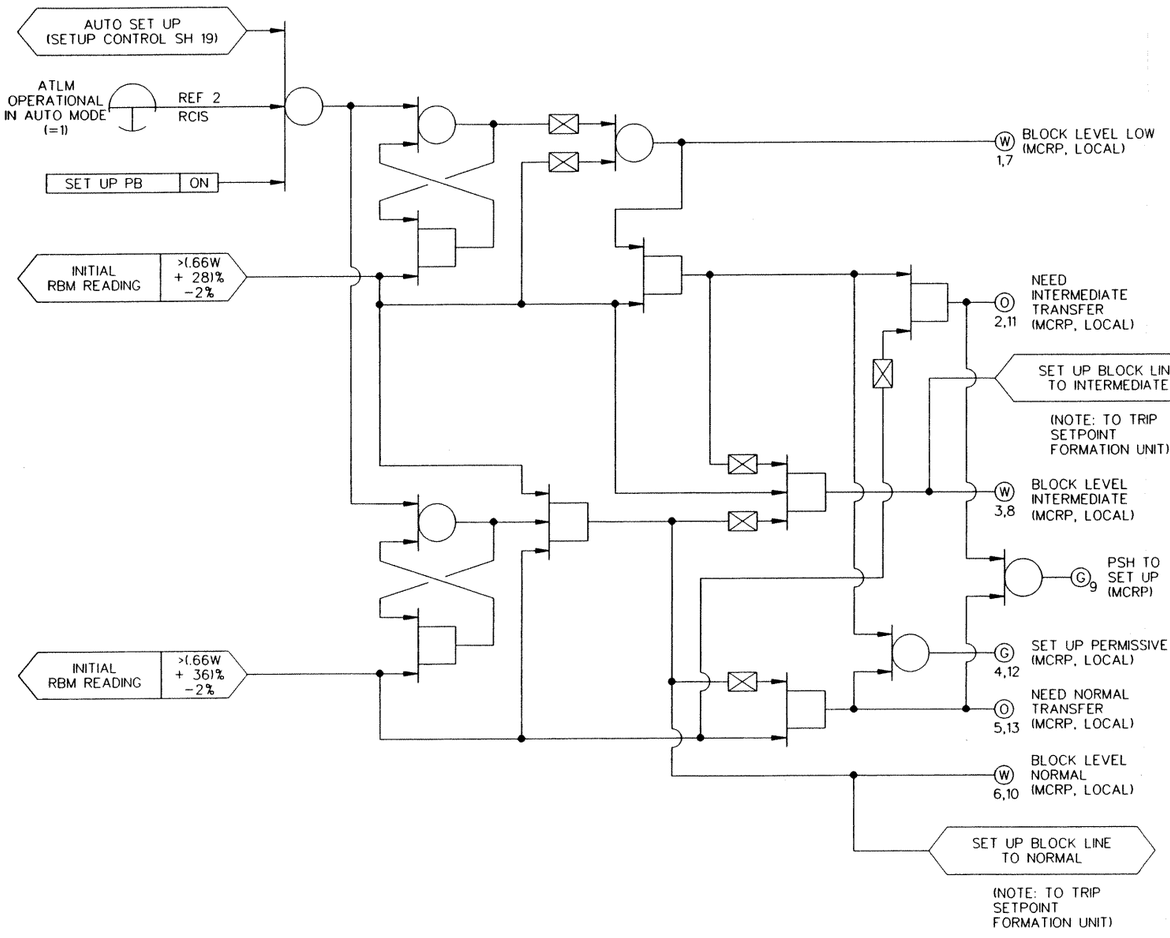
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
STATUS INDI-CATOR	O 1 W 2 O 3 O 4 W 5 O 11	MCRP
STATUS INDI-CATOR	O 6 W 7 O 8 O 9 W 10 O 12	LCP

ANNUNCIATOR		
NO.	INDICATOR	LOCATION
1	M-RBM CORE FLOW ABNORMAL	MCRP
2	M-RBM UPSCALE	MCRP
3	M-RBM DOWNSCALE	MCRP
4	M-RBM INOPERABLE	MCRP
5	REF APRM DOWNSCALE	MCRP

OTHERS

MRBM CHANNEL A ROD BLOCK LOGIC
(TYPICAL FOR MRBM CH B)

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 23 of 28)



NOTE:

THIS IS SUB CHANNEL A OF REGION 1, MRBM A

THIS IS A TYPICAL ONE OF 32

CONTROL SWITCH		
MRBM−A SUB CH−A REGION−1 PUSH BUTTON TO SET UP		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
STATUS INDI−CATOR	W 1, G 9, W 3, W 6 O 11, G 12, O 13	MCRP
STATUS INDI−CATOR	W 7, O 2, W 8 G 4, O 5, W 10	LCP
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
OTHERS		
MRBM ROD BLOCK SETPOINT SETUP LOGIC		

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 24 of 28)

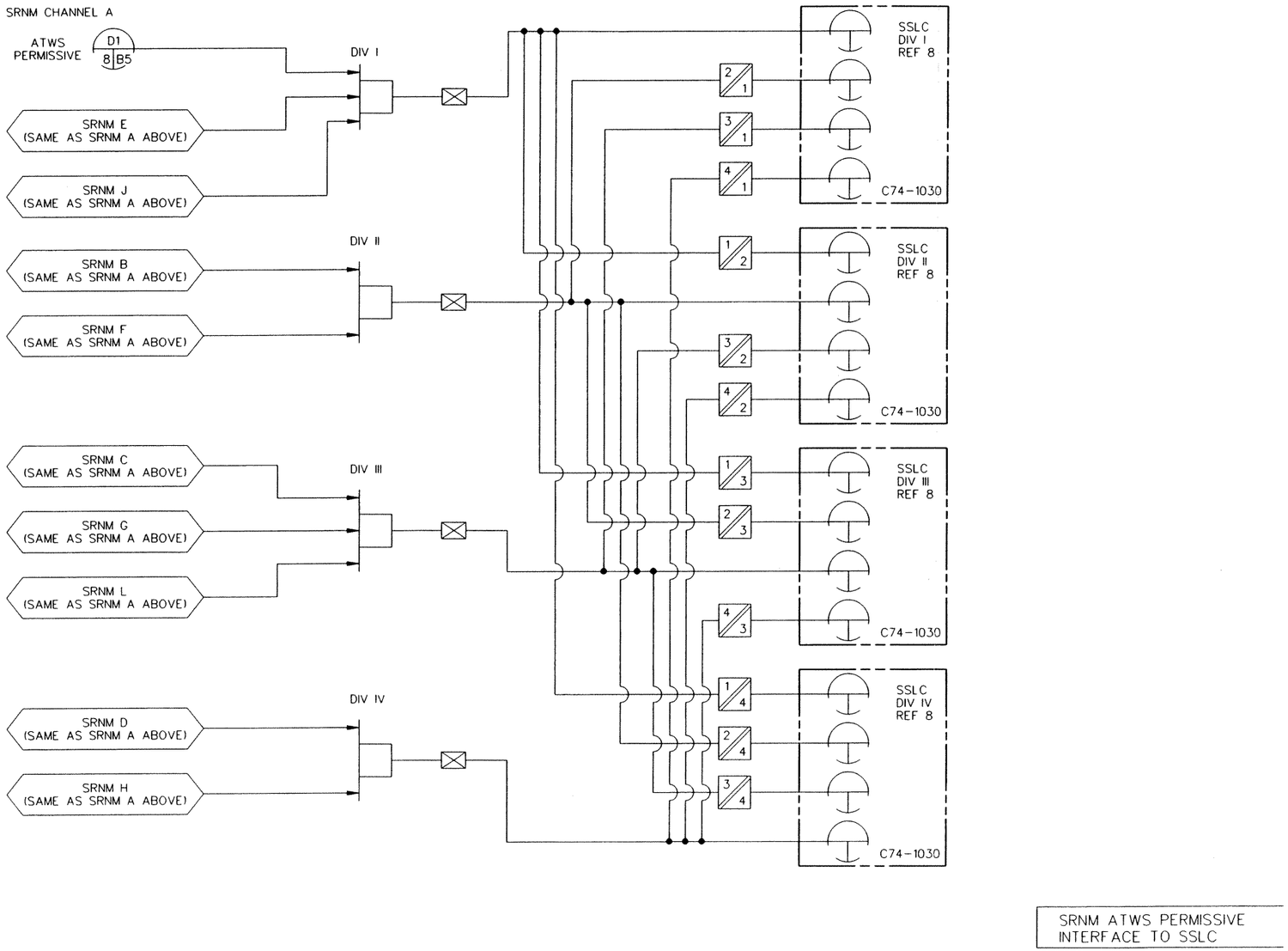


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 25 of 28)

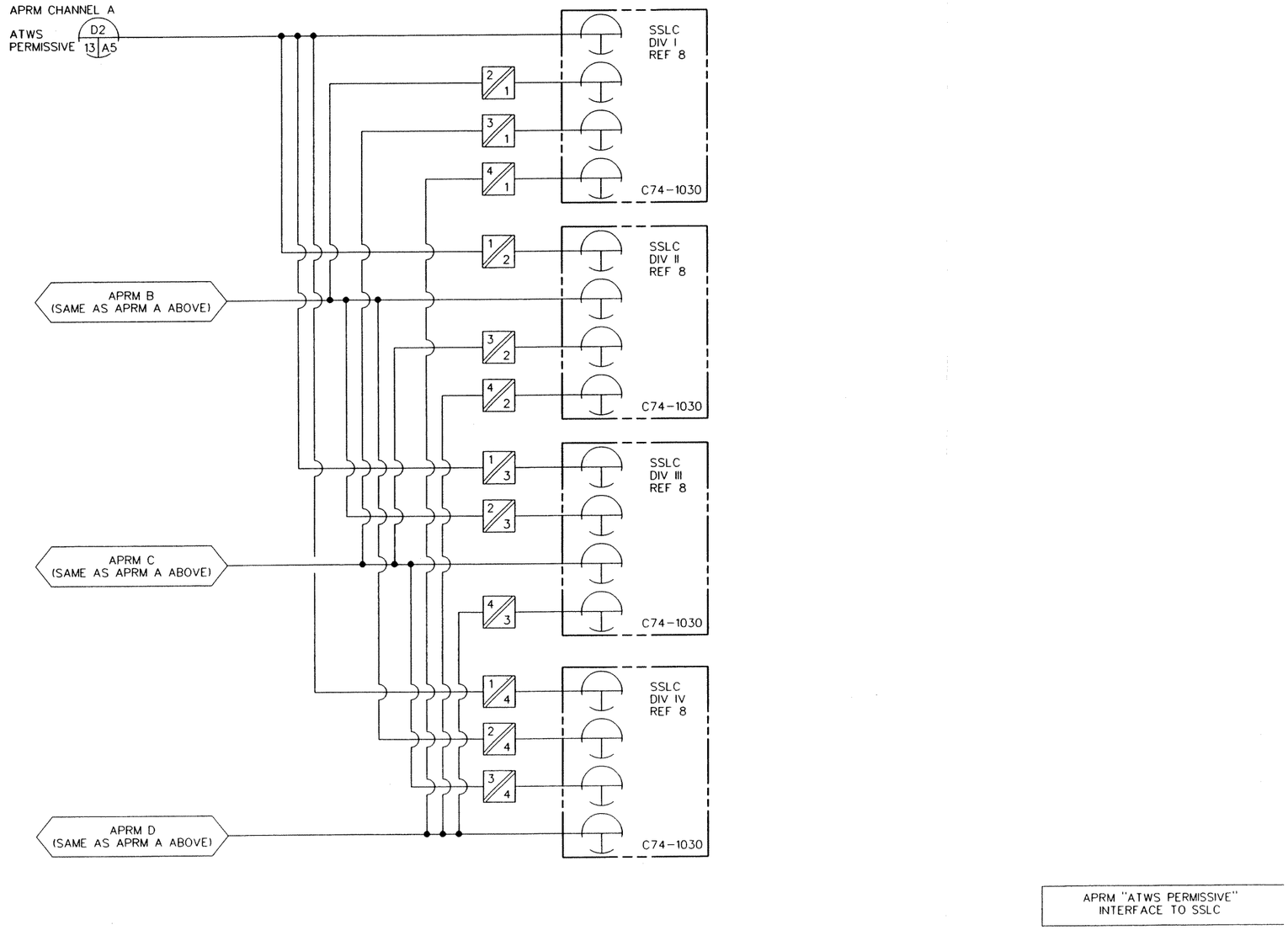


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 26 of 28)

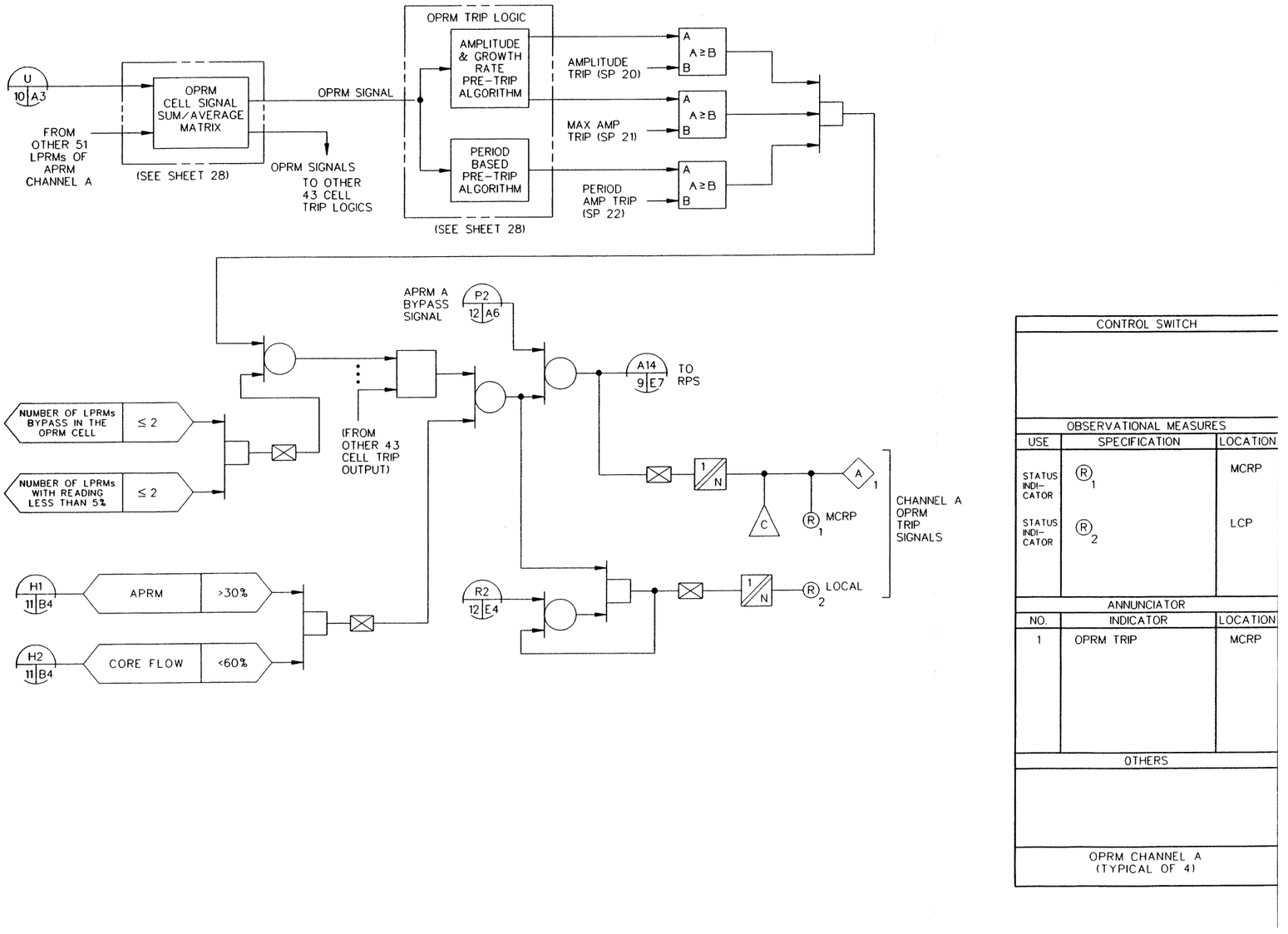


Figure 7.6-2 Neutron Monitoring System IBD (Sheet 27 of 28)

SUPPLEMENT TO OPRM IBD

A. OPRM BASIC CONFIGURATION:

THE ASSIGNMENT OF LPRM SIGNALS TO DIFFERENT OPRM CHANNELS IS SHOWN IN THE RIGHT FIGURE. THE OPRM CHANNEL A RECEIVES THE SAME 52 LPRM SIGNALS AS FROM THE SAME APRM CHANNEL A. THERE ARE 44 OPRM CELLS. EACH CELL TAKES FOUR LPRM SIGNALS AS INPUT, EXCEPT NEAR THE PERIPHERY WHERE THREE LPRMS ARE USED. THE FOUR LPRMs ARE FROM THE LPRM STRINGS AT THE FOUR CORNERS OF A 4X4 FUEL BUNDLE SQUARE REGION. EACH OPRM CELL MONITORS THE NEUTRON FLUX IN THE ASSIGNED CORE REGION AND ISSUES TRIP SIGNAL AS AN OPRM TRIP IF THE TRIP SETPOINT IS EXCEEDED.

B. OPRM DESIGN LOGICS & ALGORITHM

OPRM CELL SIGNAL CALCULATION

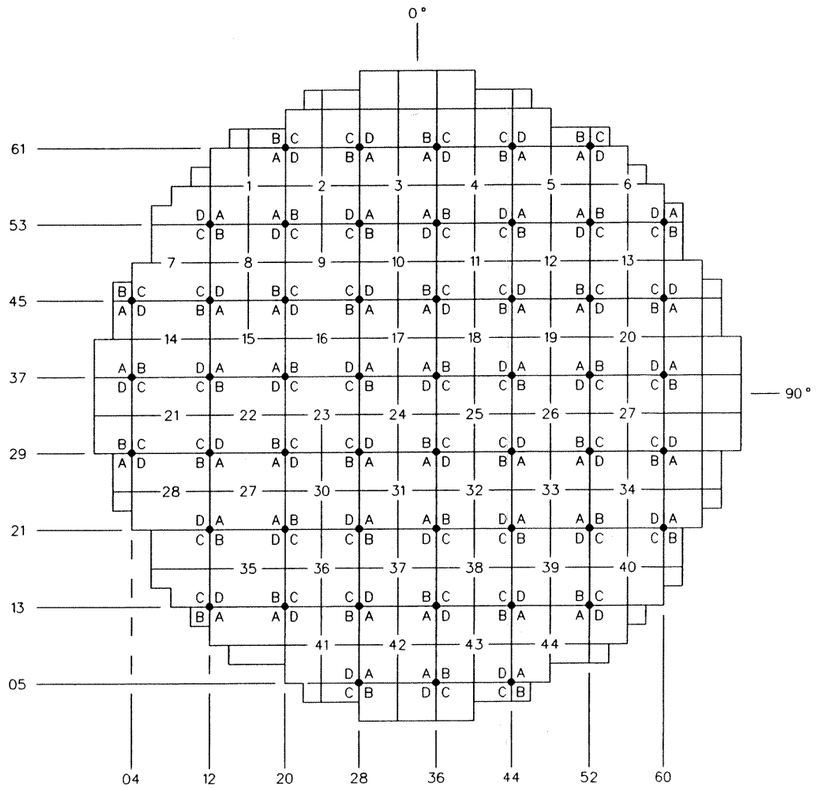
FOR EACH CELL, THE LPRM SIGNALS ARE FIRST FILTERED TO ELIMINATE HIGH FREQUENCY NOISES AND THEN NORMALIZED WITH RESPECT TO A TIME-AVERAGED SIGNAL OF THIS LPRM. THE FOUR (OR THREE) PROCESSED LPRM SIGNALS ARE THEN SUMMED AND AVERAGE TO PROVIDE A RELATIVE OPRM SIGNAL FOR THIS CELL.

OPRM CELL TRIP ALGORITHM

THERE ARE TWO INDEPENDENT OPRM TRIP ALGORITHMS. ONE IS THE AMPLITUDE AND GROWTH RATE BASED ALGORITHM, WHERE THE ALGORITHM IS TO FIRST DETECT A FLUX OSCILLATION WITHIN A DEFINED PERIOD RANGE FOR ONE CYCLE AND THEN DETECT THE OSCILLATING FLUX MAGNITUDE FOR TRIP. THE SECOND ONE IS THE PERIOD BASED ALGORITHM WHERE IT MUST DETECT A DEFINED NUMBER OF OSCILLATIONS BEFORE IT WILL ISSUE TRIP BASED ON A DEFINED OSCILLATING MAGNITUDE. FOR DETAILED DESCRIPTION OF THE ALGORITHM, REFER TO NMS HARDWARE AND SOFTWARE SYSTEM SPEC, C51-4010.

OPRM TRIP BYPASS FUNCTION

FOR EACH CELL, IF THE NUMBER OF BYPASS LPRMs IS GREATER THAN TWO OR IF THE NUMBER OF LPRMs WITH A READING OF 5% OR LESS IS GREATER THAN TWO THEN THIS OPRM CELL IS AUTOMATICALLY BYPASSED FOR TRIP OUTPUT. THE OPRM CHANNEL TRIP IS BYPASSED IF THE APRM IS LESS THAN 30% OR IF THE CORE FLOW IS GREATER THAN 60%. ALSO, THE APRM CHANNEL BYPASS WILL AUTOMATICALLY BYPASS THE TRIP OUTPUT OF THE OPRM OF THIS APRM CHANNEL.



A B / D C LPRMs PROVIDING INPUT TO OPRM CHANNELS A,B,C,D

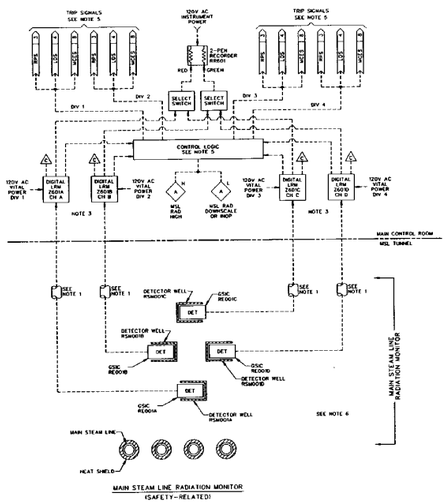
UPPER LEFT LETTER = INPUT FOR OPRM CHANNEL A
UPPER RIGHT LETTER = INPUT FOR OPRM CHANNEL B
LOWER RIGHT LETTER = INPUT FOR OPRM CHANNEL C
LOWER LEFT LETTER = INPUT FOR OPRM CHANNEL D
(LETTERS IN THE MAP REFER TO LPRM DETECTORS A,B,C,D PER ASSEMBLY)

OPRM CELL

n = CELL NUMBER

OPRM CONFIGURATION DESCRIPTION

Figure 7.6-2 Neutron Monitoring System IBD (Sheet 28 of 28)



(SAFETY-RELATED)

REFERENCE DOCUMENTS

		REFERENCE DESIGNATOR
1.	SPECIAL WIRE & CABLE REQUIREMENTS SPEC	A11-5085
2.	ELECTRICAL EQUIPMENT SEPARATION SPEC	A11-3120
3.	REACTOR PROTECTION SYSTEM IED	C71-1040
4.	LEAK DETECTION AND ISOLATION SYSTEM IED	E31-1040
5.	RADWASTE SYSTEM P&ID	K17-1010
6.	MAKEUP WATER SYSTEM (PURIFIED) P&ID	P11-1010
7.	REACTOR BUILDING COOLING WATER SYSTEM P&ID	P21-1010
8.	MAIN CONDENSER EVACUATION SYSTEM P&ID	N63-1010
9.	OFFGAS SYSTEM P&ID	N62-1010
10.	INSTRUMENT AIR SYSTEM P&ID	P52-1010
11.	STANDBY GAS TREATMENT SYSTEM P&ID	T22-1010
12.	HEATING, VENTILATING & AIR CONDITIONING SYSTEM P&ID	U41-1010

LEGEND:

ARM - AREA RADIATION MONITOR
LCRM - DIGITAL LOG COUNT RATE METER
GM-B - BETA SENSITIVE GM DETECTOR
GSC - GAMMA SENSITIVE ION CHAMBER
S/C - DIGITAL GAMMA SENSITIVE GM DETECTOR
LRM - LOG RADIATION MONITOR
USC - ULTRASONIC CLEANING
⊐⊏ - SERIAL MULTIPLEXED SIGNALS

NOTES:

1. ALL CABLES AND WIRING SHALL CONFORM TO THE SPECIAL WIRE AND CABLE REQUIREMENTS AS SPECIFIED IN REF DOC 1.
2. THE SAFETY RELATED SUBSYSTEM OF THE PROCESS RADIATION MONITORING SYSTEM SHALL BE DESIGNED TO THE CRITERIA AND REQUIREMENTS FOR ELECTRICAL SEPARATION AS DEFINED IN REF DOC 2.
3. FIBER OPTIC CABLES MAY BE USED IN THE DESIGN OF THIS SYSTEM PROVIDED THESE CABLES CONFORM TO THE REQUIREMENTS STIPULATED IN REF DOCNO 182.
4. EACH ENGRAL ARM (2600A/B/C/D & 2603) AND LCRM (2701 TO 2706) CAN ACCOMODATE MULTIPLE CHANNELS. THESE MONITORS ARE SHARED WITH THE OTHER SUBSYSTEMS AS INDICATED IN THIS DRAWING.
5. EACH MSL RADIATION MONITOR SHALL PROVIDE A DIVISIONAL TRIP SIGNAL TO ITS ASSOCIATED DIVISIONAL LOGIC SYSTEM FOR ISOLATION IN ORDER TO INITIATE THE FOLLOWING FUNCTIONS ON A COINCIDENCE VOTE OF ANY TWO OUT OF FOUR CHANNEL TRIPS:
   A. REACTOR SCRAM
   B. CLOSURE OF THE MSIVs AND MS DRAIN LINE VALVES
   C. SHUTDOWN OF THE MAIN CONDENSER MECHANICAL VACUUM PUMP AND CLOSURE OF THE EXIT LINE ISOLATION VALVE
6. THE MSL ION CHAMBERS SHALL BE SENSITIVE TO GAMMA RAYS (CO60) AND SHALL BE ARRANGED INSIDE THE MSL TUNNEL IN A MANNER SO EACH ZAM PROVIDE APPROXIMATELY THE SAME RESPONSE FROM ALL THE STEAM LINES. EACH DETECTOR ASSEMBLY SHALL BE INSERTED INTO A SEALED PIPE WELL TO BE RETRIEVABLE FROM OUTSIDE THE TUNNEL.
7. THESE DETECTORS ARE PROVIDED TO MONITOR RADIATION THAT MAY RESULT FROM A FUEL HANDLING ACCIDENT IN THE FUEL POOL OR THE REACTOR WELL.
8. EACH HVAC AIR EXHAUST RADIATION MONITOR IN THE REACTOR BUILDING AND IN THE FUEL HANDLING AREA PROVIDES A CHANNEL TRIP SIGNAL TO INITIATE THE FOLLOWING FUNCTIONS ON A COINCIDENCE VOTE OF ANY TWO OUT OF FOUR CHANNEL TRIPS:
   A. INITIATE OPERATION OF THE STANDBY GAS TREATMENT SYSTEM (SGTS)
   B. ISOLATE THE AIR INTAKE AND EXHAUST DUCTS OF THE HVAC SYSTEM
   C. ISOLATE THE PURGE AND VENT VALVES OF SECONDARY CONTAINMENT

   THE CHANNEL TRIP SIGNAL FROM EACH MONITOR SHALL CONSIST OF EITHER RADIATION HIGH-HIGH (HH) OR RADIATION DOWNSCALE/INOPERATIVE (MOP) TRIP.
9. THE OFF-GAS SAMPLE CHAMBER SHALL BE MOUNTED VERTICALLY AND SHALL BE SLOPED FROM THE INLET TO THE CHAMBER TO PERMIT THE CONDENSATE TO DRAIN TO THE PROCESS LINE. A DRAIN SHALL BE PROVIDED AT THE BOTTOM OF THE SAMPLE CHAMBER.
10. EACH RADIATION MONITOR SHALL PROVIDE TRIP SIGNALS TO THE OFF-GAS SYSTEM TO PERFORM THE FOLLOWING FUNCTIONS:
   A. BASED ON ONE-OUT-TWO LOGIC SIGNAL, THE RADIATION HIGH-HIGH TRIP SIGNAL FROM EITHER MONITOR SHALL INITIATE VALVE ALIGNMENT OF THE OFF-GAS SYSTEM TO FORCE THE GASEOUS EFFLUENTS THROUGH THE CHARCOAL VAULT FOR TREATMENT PRIOR TO RELEASE TO THE STACK.
   B. BASED ON TWO-OUT-OF TWO LOGIC SIGNALS,THE RADIATION MONITOR CHANNEL TRIP SIGNALS SHALL INITIATE HIGH-HIGH (HH) OR DOWNSCALE/INOPERATIVE (MOP) TRIP. THE HH OR MOP CHANNEL TRIP FROM BOTH MONITORS, OR ONE HH OR DOWNSCALE/INOPERATIVE CHANNEL TRIP FROM ONE MONITOR AND ONE DOWNSCALE/INOPERATIVE CHANNEL TRIP FROM THE SECOND MONITOR.
11. HEATING OF THESE LINES MAY BE REQUIRED TO PREVENT CONDENSATION. HEATERS SHALL BE SIZED SO THE TEMPERATURE IS KEPT ABOVE THE DEW POINT.
12. THE RADIATION HIGH-HIGH TRIP SIGNAL FROM EACH MONITOR SHALL INITIATE CLOSURE OF ITS RESPECTIVE LCW AND HCW OUTBOARD DRAIN LINE ISOLATION VALVE.
13. THE RADIATION HIGH-HIGH TRIP, THE DOWNSCALE/INOPERATIVE, OR A NOT SAMPLING CONDITION SHALL CAUSE SHUTDOWN OF THE RADWASTE SYSTEM LIQUID EFFLUENT DISCHARGE PUMPS AND CLOSURE OF THE OUTLET VALVE IN THE DISCHARGE LINE.
14. THE RADIATION MONITORS OF EACH SUBSYSTEM SHALL ISOLATE ITS RESPECTIVE AIR INTAKE DUCTS TO THE CONTROL BUILDING AND START THE EMERGENCY AIR CIRCULATING FAN ON A COINCIDENCE VOTE OF ANY TWO OUT OF FOUR CHANNEL TRIPS FROM THE RADIATION HIGH-HIGH OR DOWNSCALE/INOPERATIVE INDICATION.
15. TEE SHALL BE UNION TEE SWAGELOCK TYPE SS-1610-3
16. THE SAMPLE LINE SHALL BE 25.4mm x 1.47mm WALL THICKNESS SEAMLESS STAINLESS STEEL TUBING. THE TUBING MINIMUM BEND RADIUS SHALL BE 508mm. THE TUBING LENGTH SHALL BE KEPT AS SHORT AS POSSIBLE. THE SAMPLE LINE SHALL BE TUBING SHALL SLOPE SO THAT THE CONDENSATE WILL RUN TO DRAIN TEE
17. REMOVABLE SECTION SHALL BE PROVIDED NEAR THE ISOKINETIC PROBE TO PERMIT CLEANING OF THE PROBE AND THE LINE IF SIGNIFICANT DEPOSITION IS EXPECTED. THE FITTINGS ETC. SHALL PROVIDE SMOOTH TRANSITIONS WITHOUT EITHER INTRODUCING DISCONTINUITIES OR REDUCING THE CROSS SECTIONAL AREA OF THE FLOW STREAM.
18. HEATED AND CONDENSATE DRAIN WITH TRAP TO BE SIZED SO THAT TEMPERATURE OF SAMPLE STREAM IS KEPT ABOVE DEW POINT
19. CONTROL OF THE CHECK SOURCE CAN BE INTEGRATED INTO THE DIGITAL LCRM AS PART OF THE MONITOR
20. THE RADIATION HIGH-HIGH TRIP OR THE DOWNSCALE/INOPERATIVE TRIP SHALL TERMINATE OPERATION OF THE INTERGRATOR FANS

MFL NO. 011-1010

Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 1 of 11)

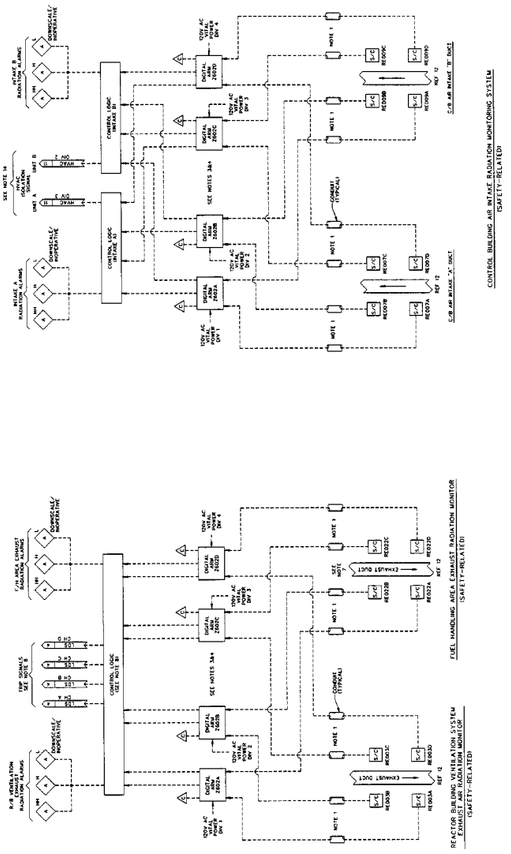
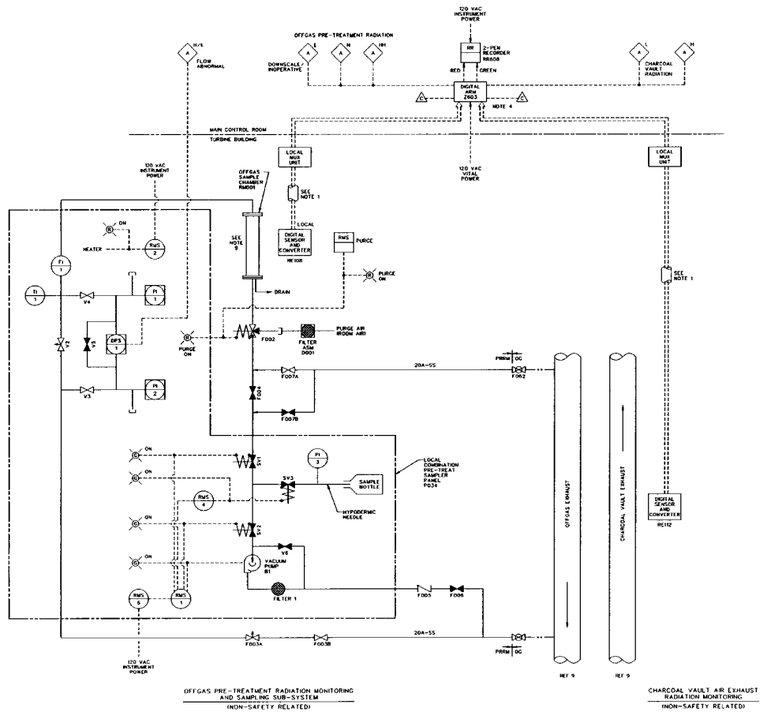


Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 2 of 11)



OFFGAS PRE-TREATMENT RADIATION MONITORING AND SAMPLING SUB-SYSTEM
(NON-SAFETY RELATED)

CHARCOAL VAULT AIR EXHAUST RADIATION MONITORING
(NON-SAFETY RELATED)

Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 3 of 11)

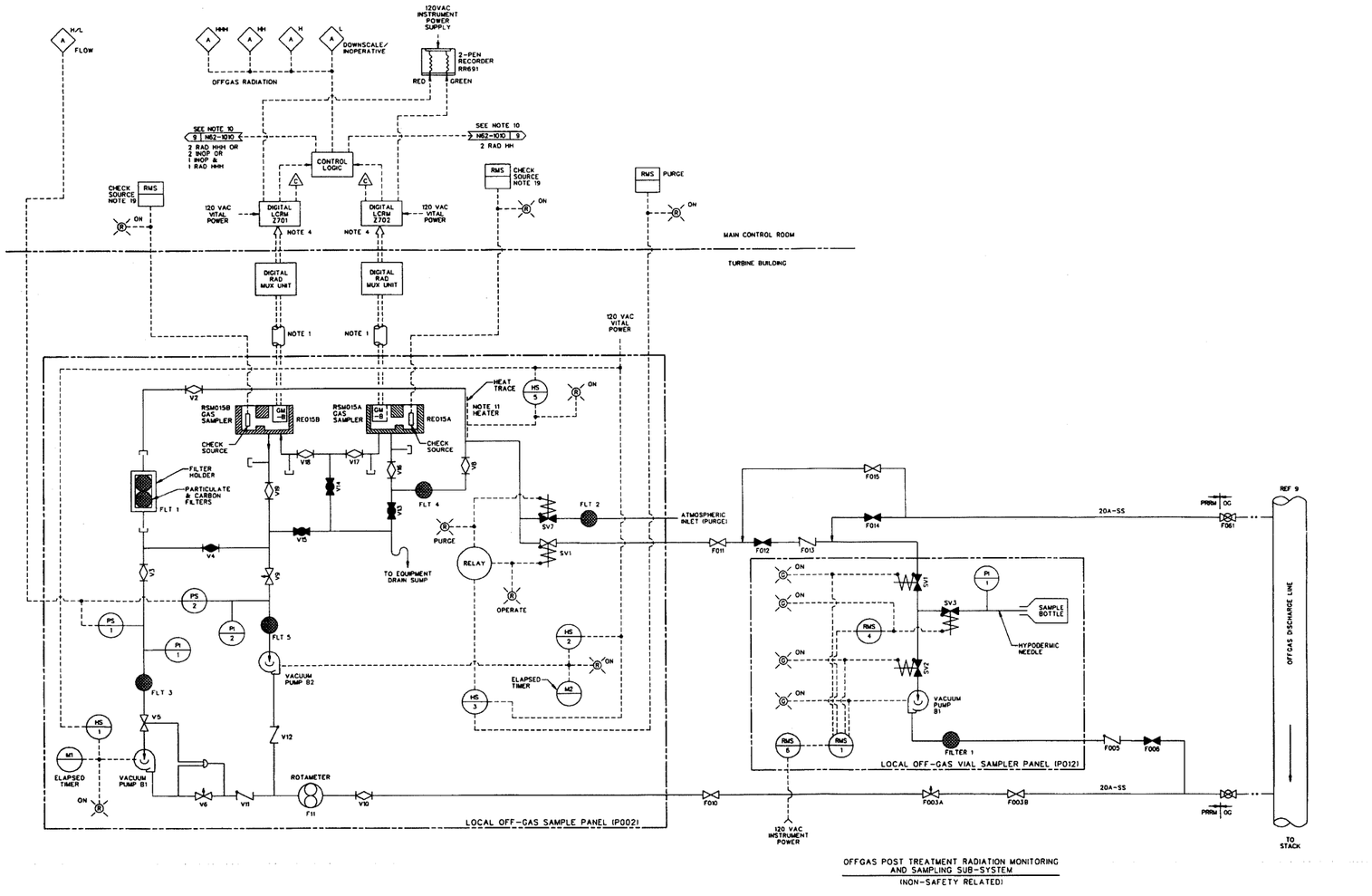
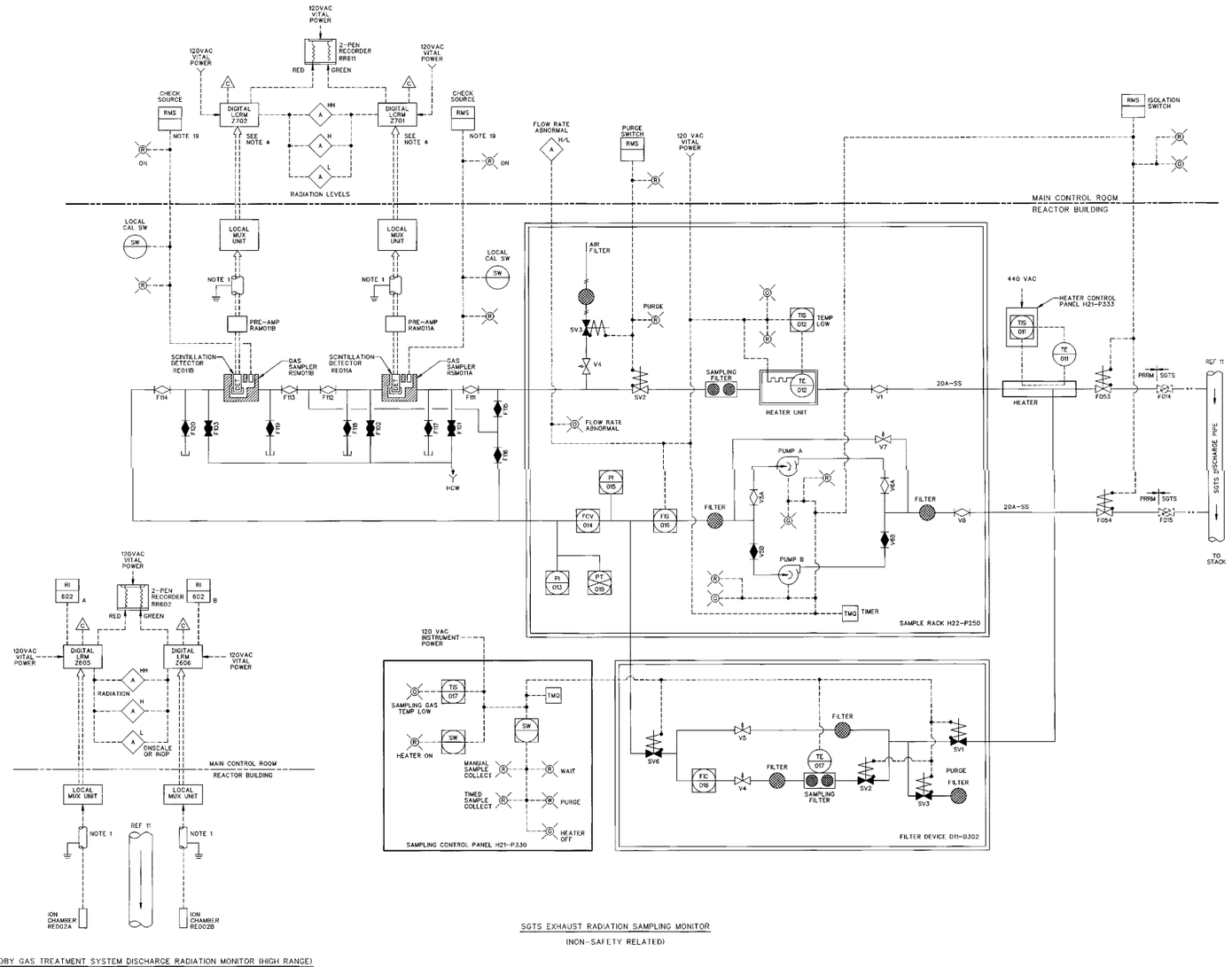


Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 4 of 11)



STANDBY GAS TREATMENT SYSTEM DISCHARGE RADIATION MONITOR (HIGH RANGE)
(NON-SAFETY RELATED)

SGTS EXHAUST RADIATION SAMPLING MONITOR
(NON-SAFETY RELATED)

Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 5 of 11)

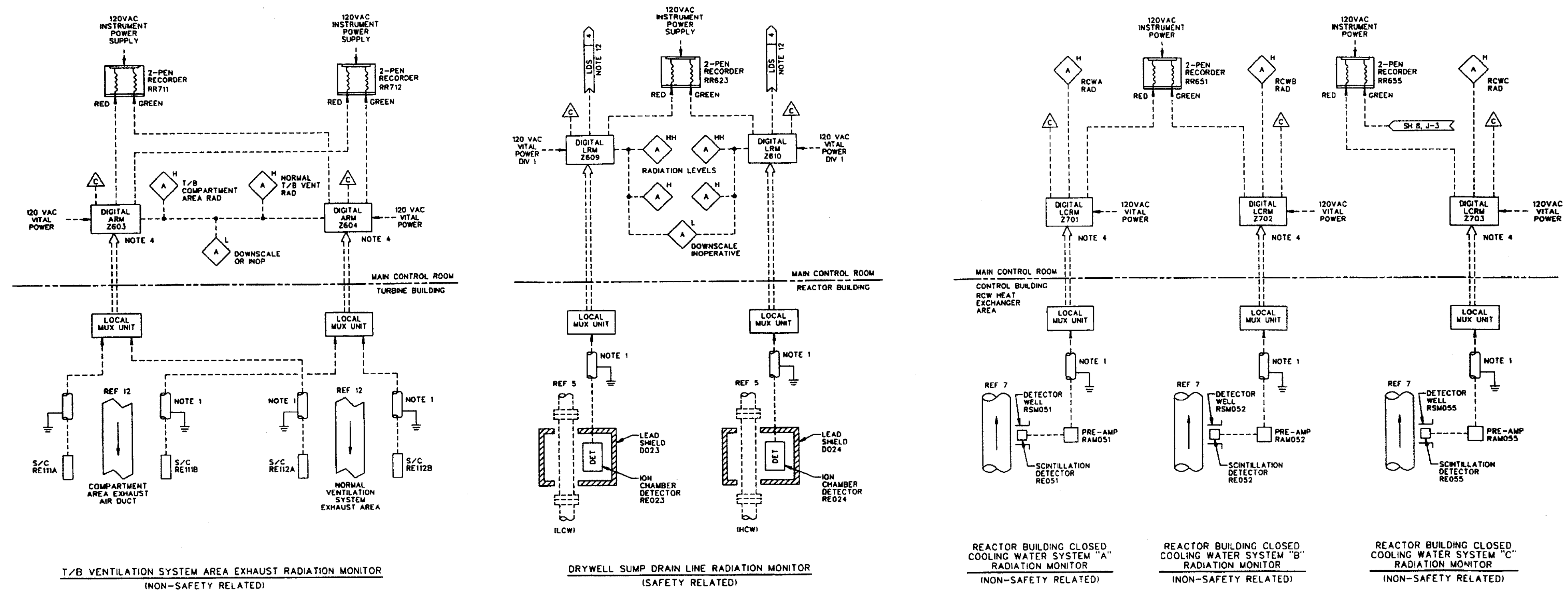


Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 6 of 11)

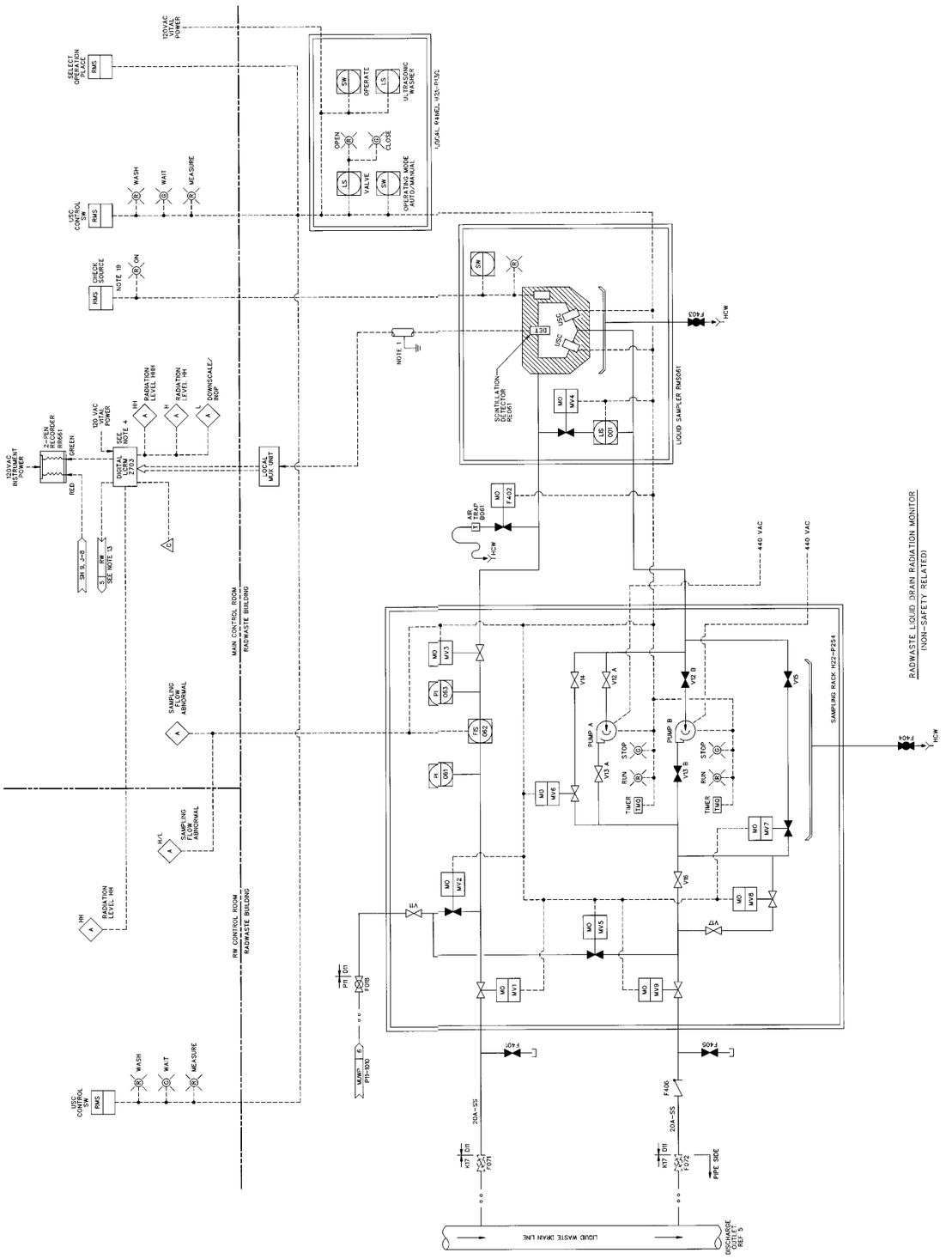


Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 7 of 11)

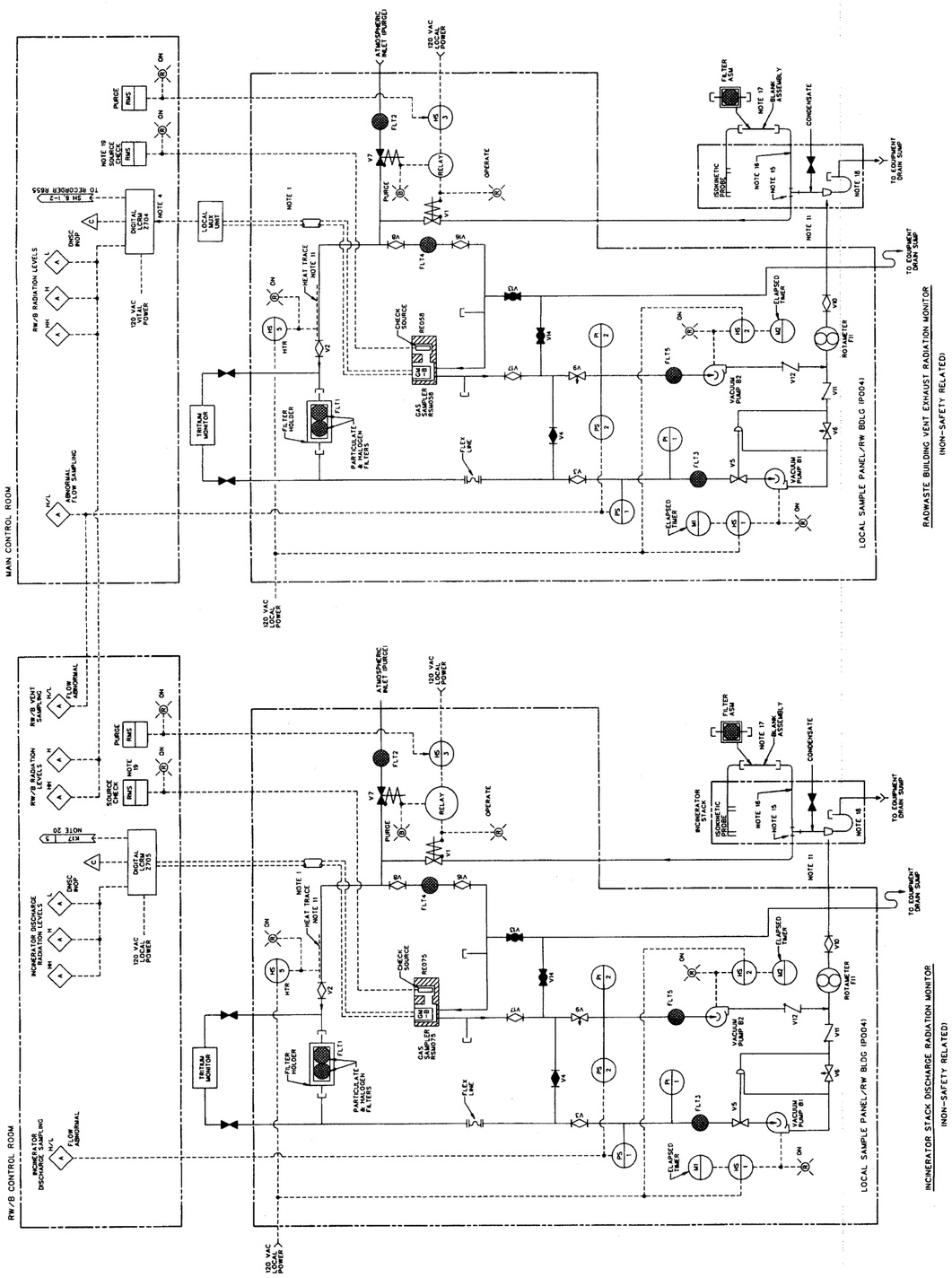


Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 8 of 11)

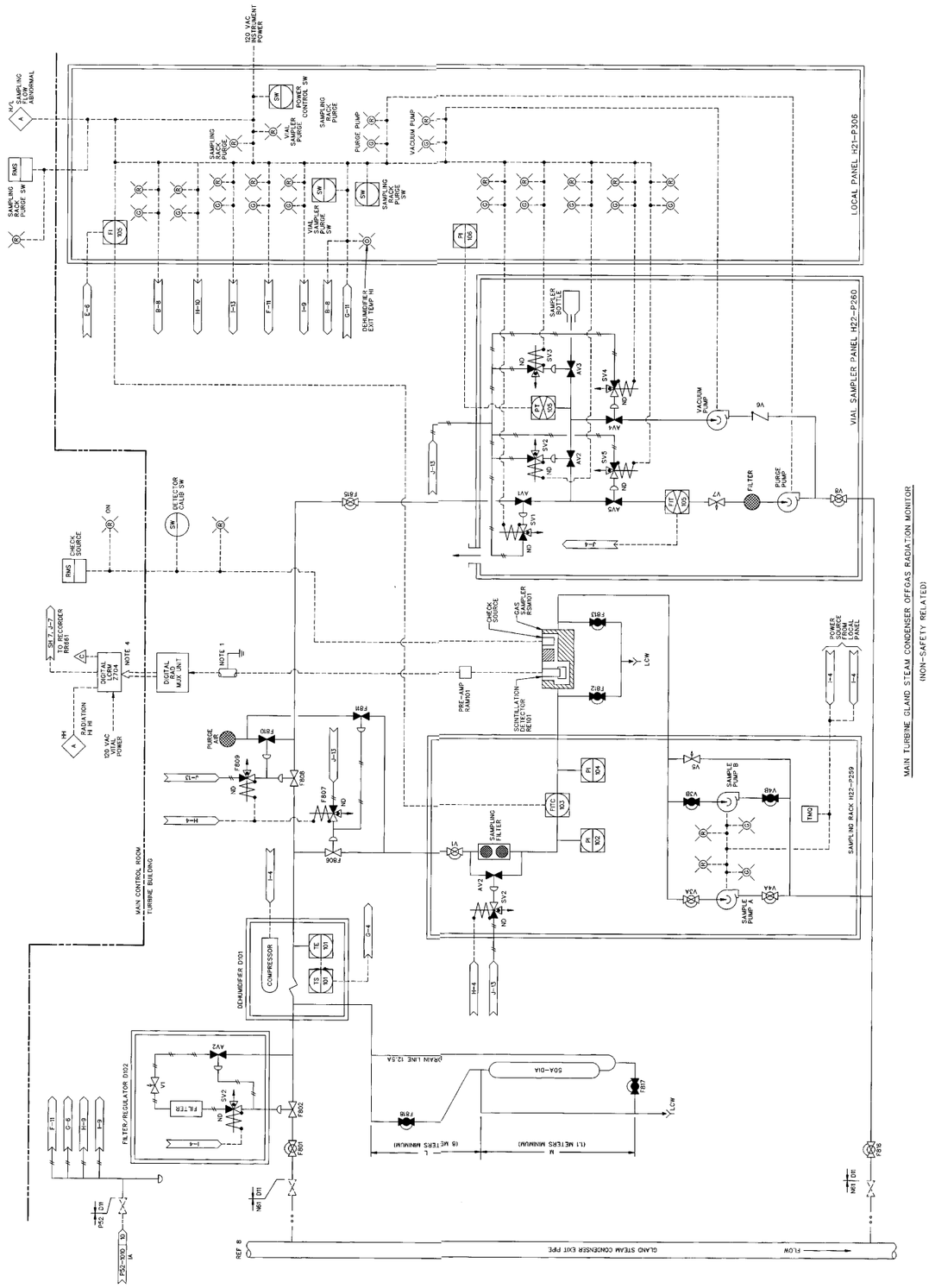


Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 9 of 11)

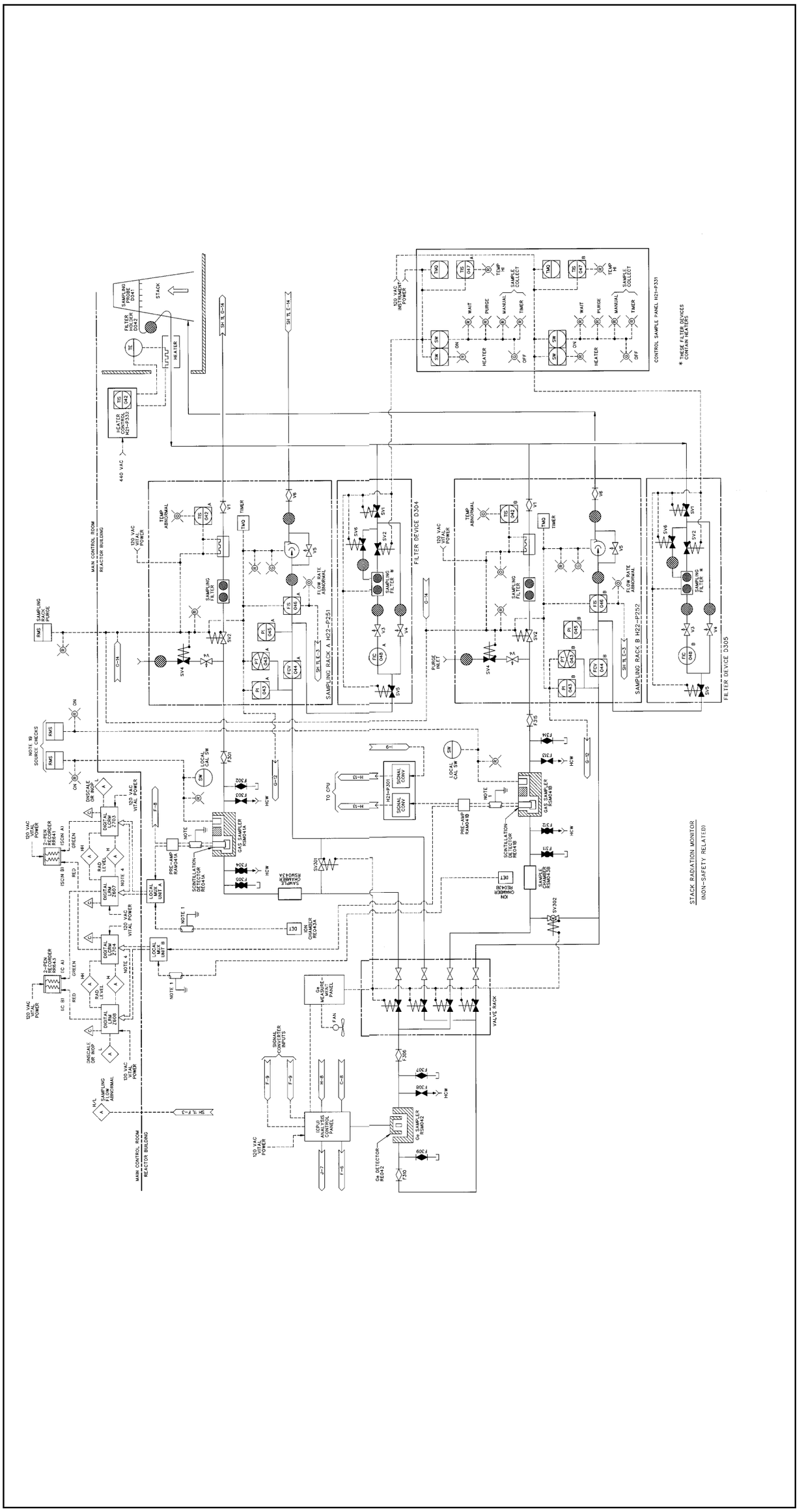


Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 10 of 11)

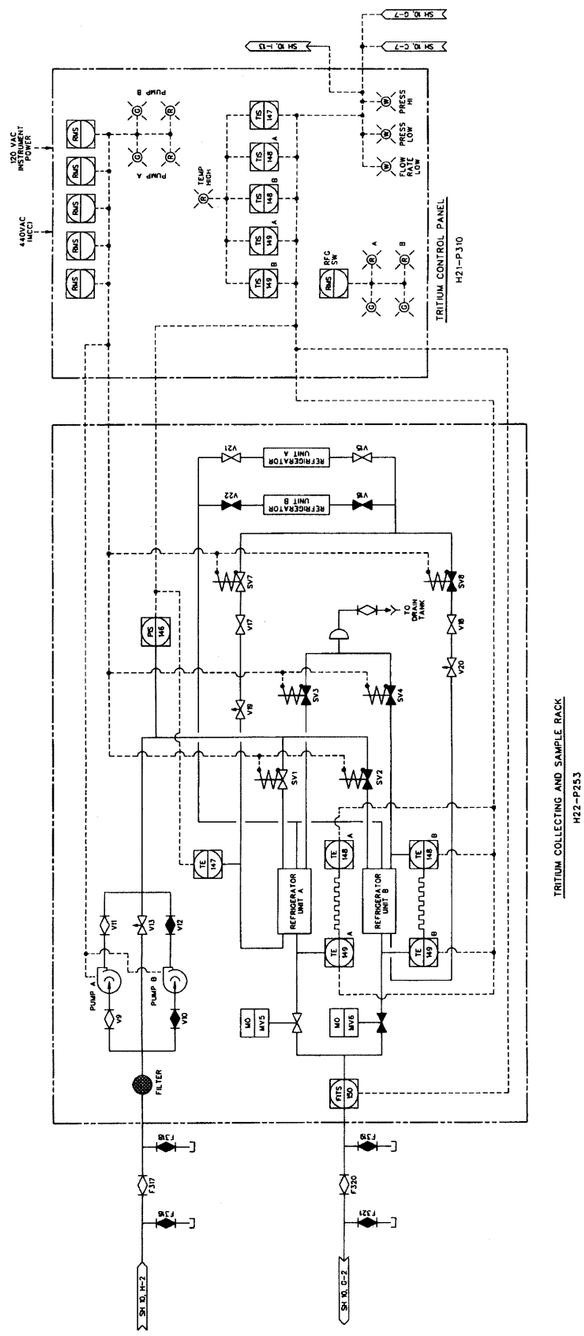
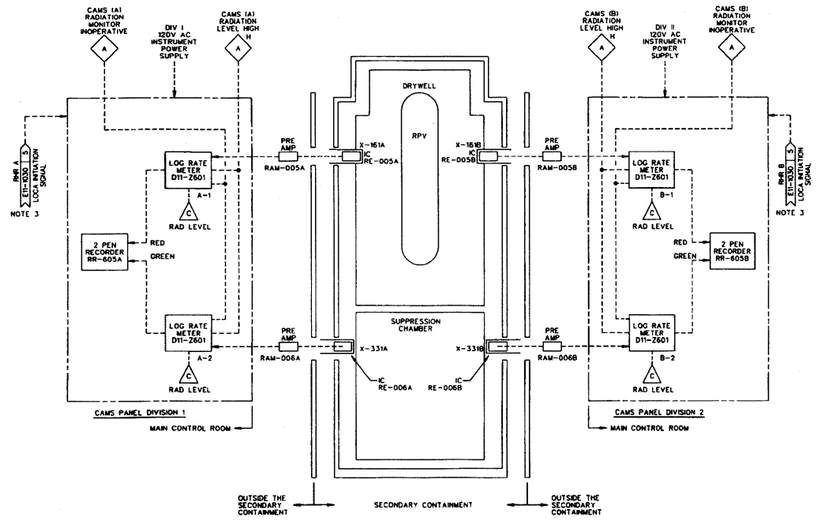


Figure 7.6-5 Process Radiation Monitoring System IED (Sheet 11 of 11)



NOTES:

1. ALL CONNECTING PIPING TO THE RACKS ARE SCHEDULE 40 SS.
2. THE SAMPLING PUMPS ARE IDENTICAL AND CAN BE USED DURING NORMAL OR ACCIDENT OPERATION.
3. THE LOCA SIGNAL SHALL AUTOMATICALLY TURN ON THE OPERATION OF THE RADIATION MONITOR, THE ACCIDENT SAMPLING PUMPS, AND LINE UP THE ASSOCIATED SYSTEM VALVES.

REFERENCE DOCUMENT UNDER THE FOLLOWING IDENTITIES ARE TO BE USED IN CONJUNCTION WITH THIS DRAWING:

	MPL NO.
1. PIPING AND INSTRUMENT DIAGRAM SYMBOLS	A10-3030
2. REACTOR BLDG COOLING WATER SYS P&ID	P21-1010
3. INSTRUMENT AIR SYS P&ID	P52-1010
4. POST ACCIDENT, SAMPLING SYS P&ID	P91-1010 (PART OF SAM)
5. RHR SYS IBD	E11-1030

LEGEND:

X PENETRATION NUMBER

MPL NO. D23-1010

Figure 7.6-7 Containment Atmospheric Monitoring System IED (Sheet 1 of 4)

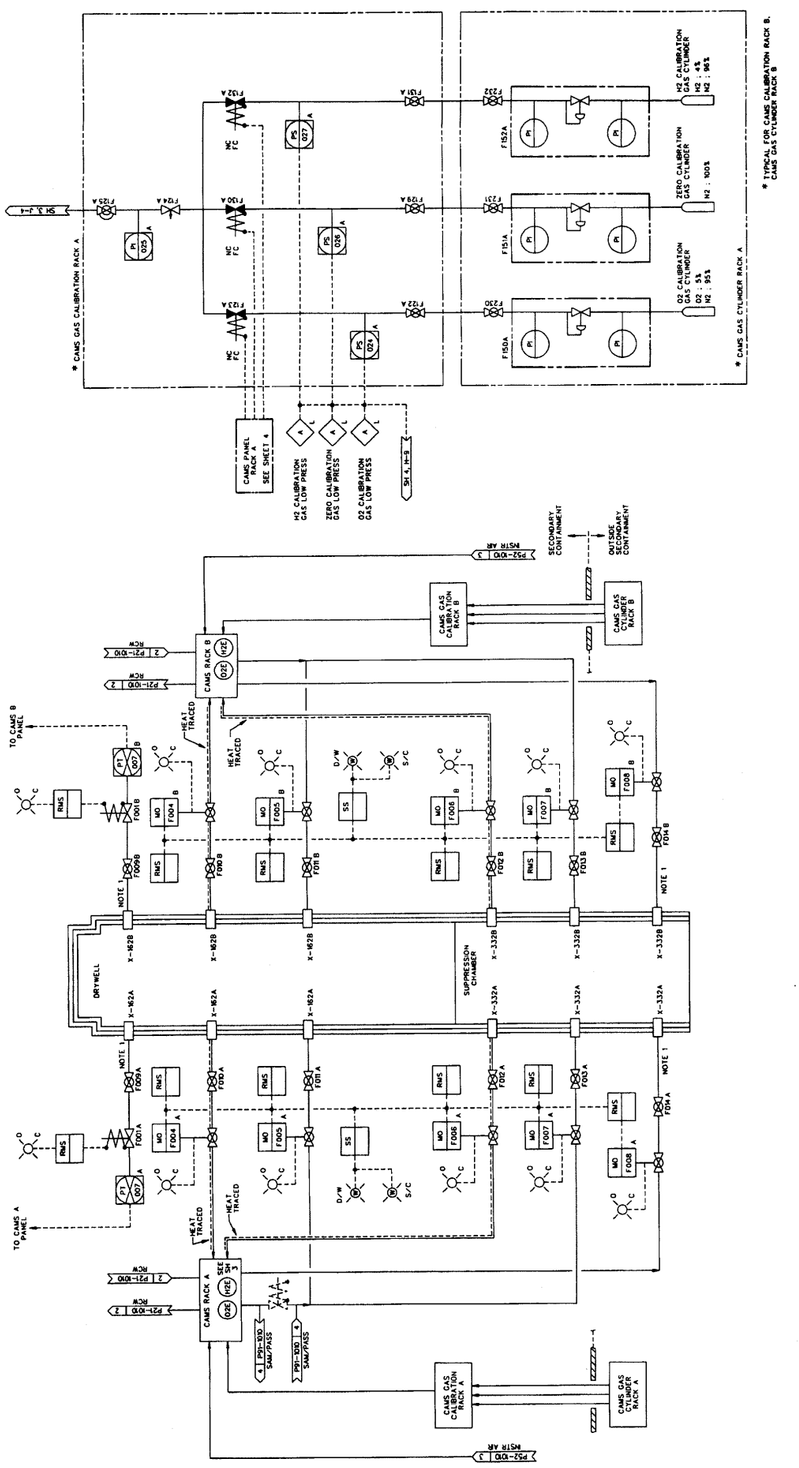


Figure 7.6-7 Containment Atmospheric Monitoring System IED (Sheet 2 of 4)

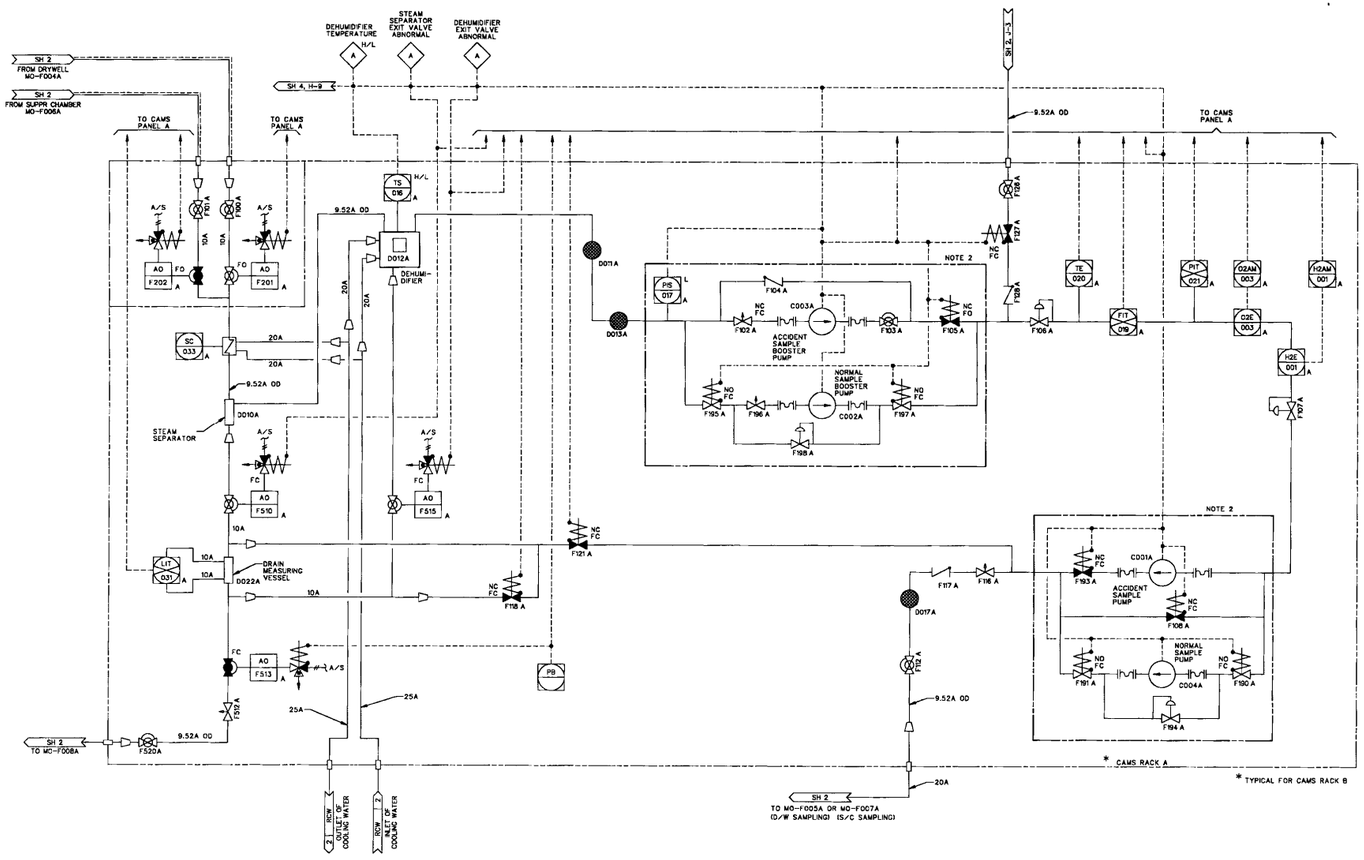


Figure 7.6-7 Containment Atmospheric Monitoring System IED (Sheet 3 of 4)

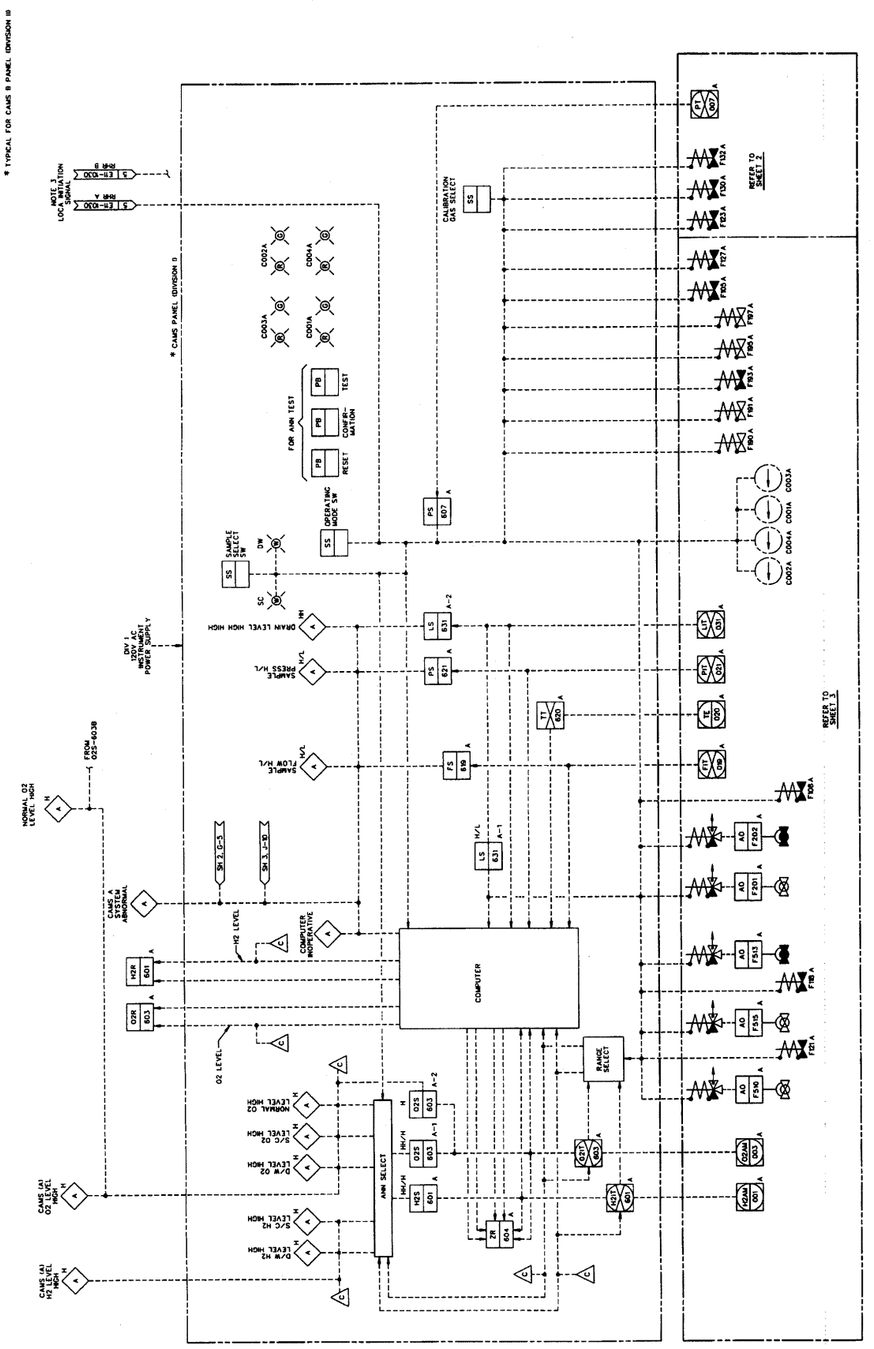


Figure 7.6-7 Containment Atmospheric Monitoring System IED (Sheet 4 of 4)

TABLE OF CONTENTS

SH NO.	TITLE
1	TITLE SHEET, NOTES, CONTENTS
2	CAMS A, (B) ISOLATION VALVES CONTROL LOGIC
3	CAMS A (B) INITIATION & CONTROL LOGIC
4	CAMS A (B) SAMPLE PUMPS CONTROL LOGIC
5	CAMS A (B) GAS CALIBRATION & CONTROL
6	CAMS A (B) RACK DRAIN CONTROL
7	CAMS A (B) POWER-ON CONTROL
8	CAMS A (B) ANNUNCIATORS
9	CAMS A (B) ANNUNCIATORS (CONT'D)
10	CAMS A (B) ANNUNCIATORS (CONT'D)

NOTES:

1. THE SAMPLING PUMPS ARE IDENTICAL AND CAN BE USED DURING NORMAL OR ACCIDENT OPERATION.

REFERENCE DOCUMENTS

	MPL NO.
1. CONTAINMENT ATMOSPHERIC MONITORING SYS IED	D23-1010
2. RESIDUAL HEAT REMOVAL SYS IBD	E11-1030

MPL NO. D23-1030

Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 1 of 10)

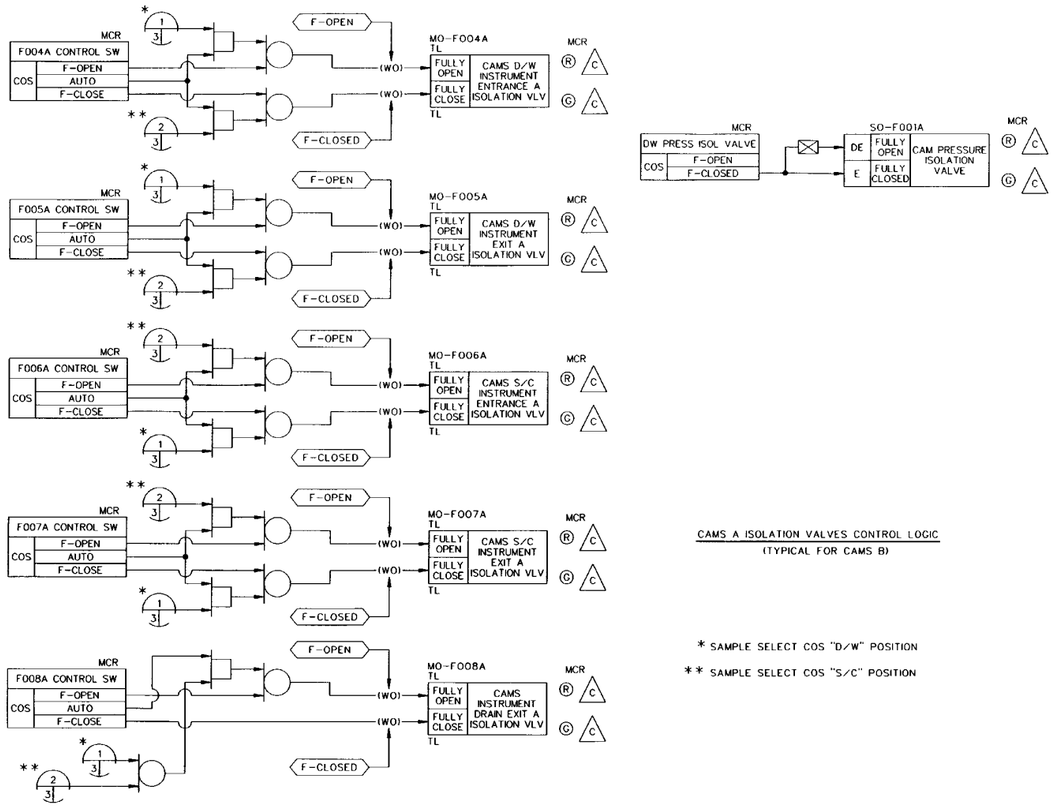
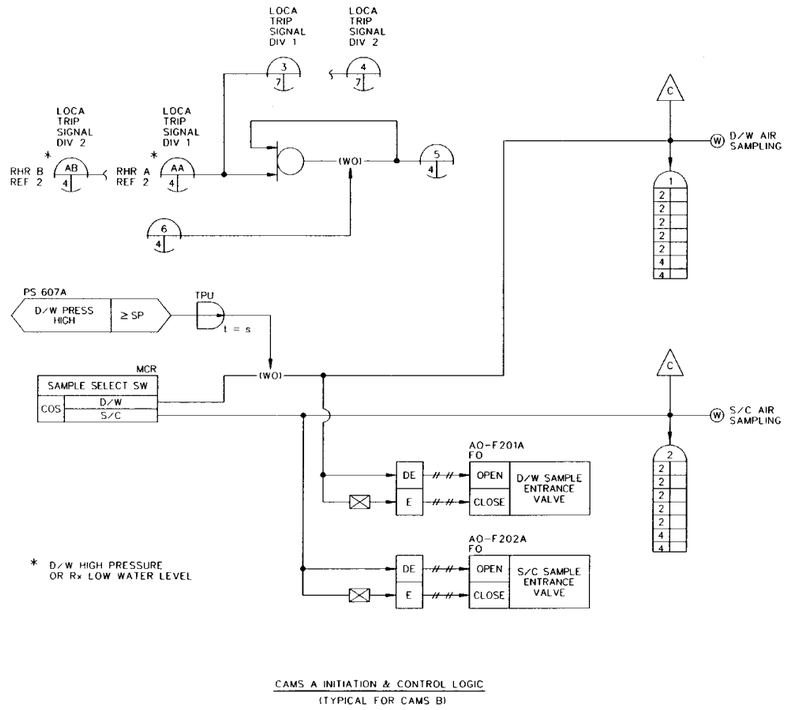


Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 2 of 10)



CONTROL SWITCH

OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION

OTHERS

Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 3 of 10)

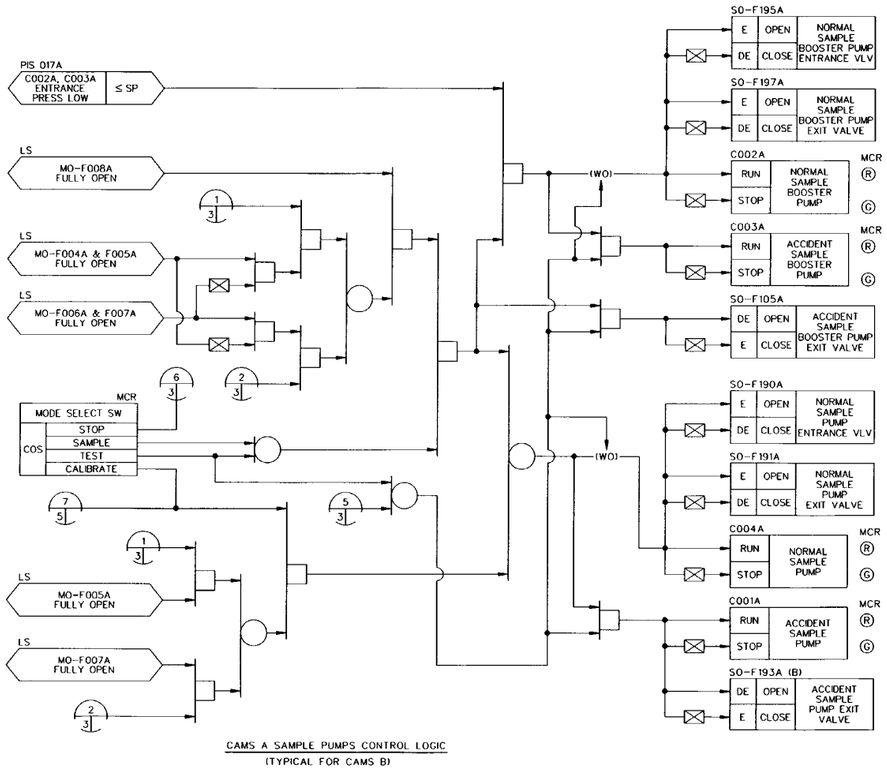


Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 4 of 10)

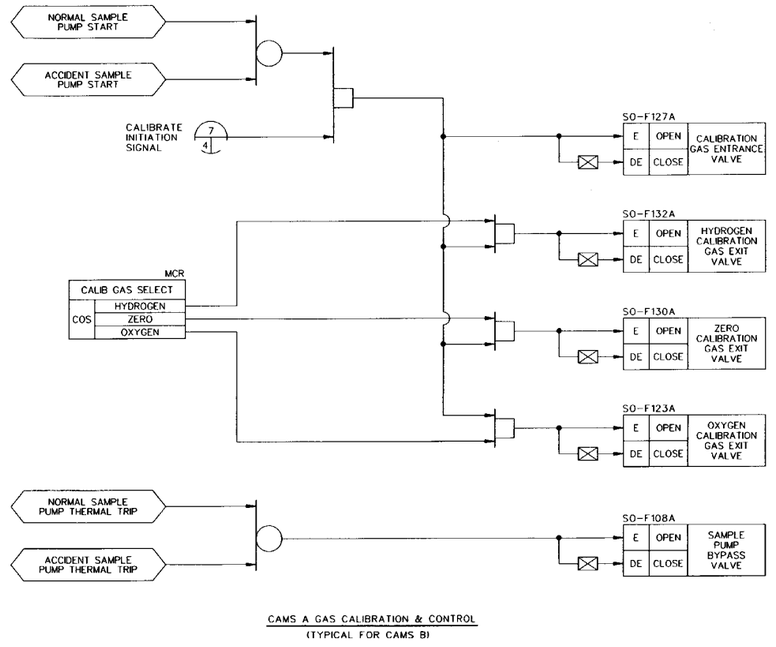


Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 5 of 10)

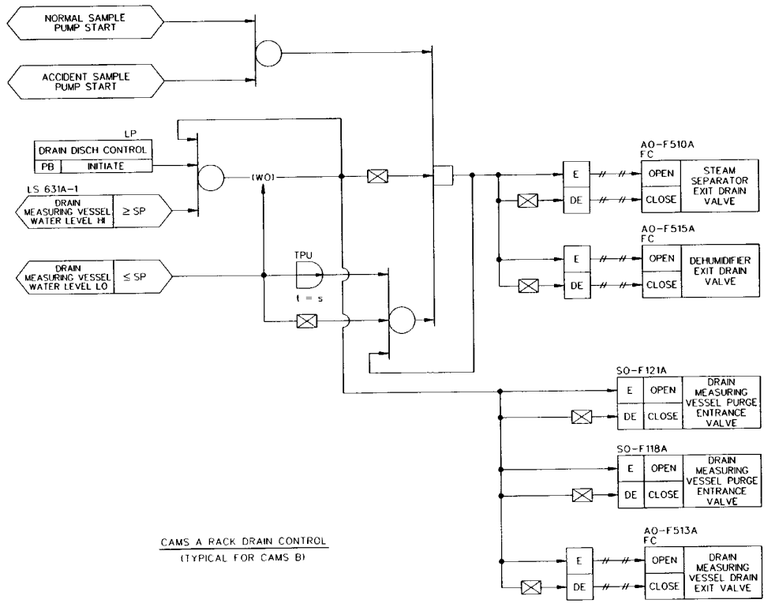


Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 6 of 10)

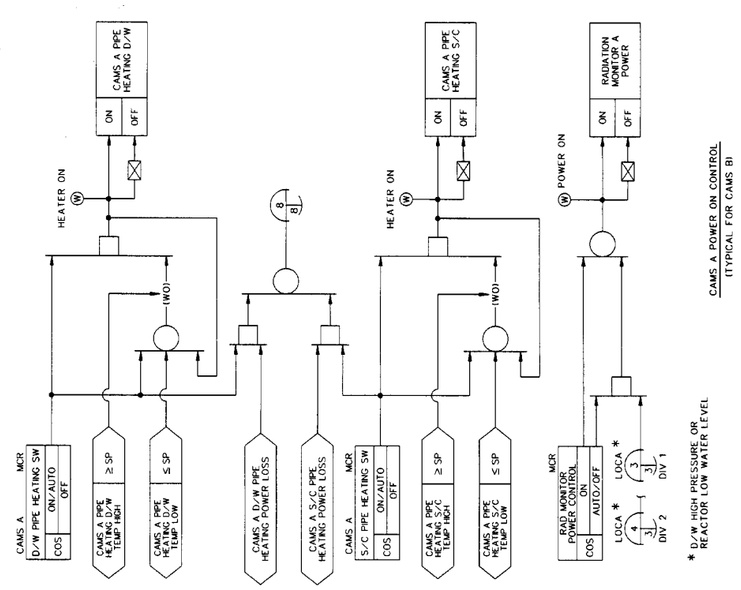
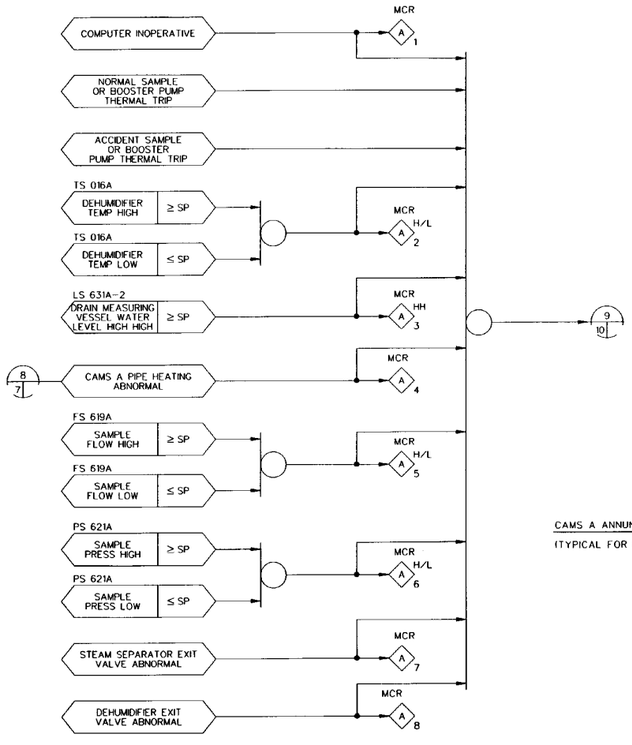


Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 7 of 10)

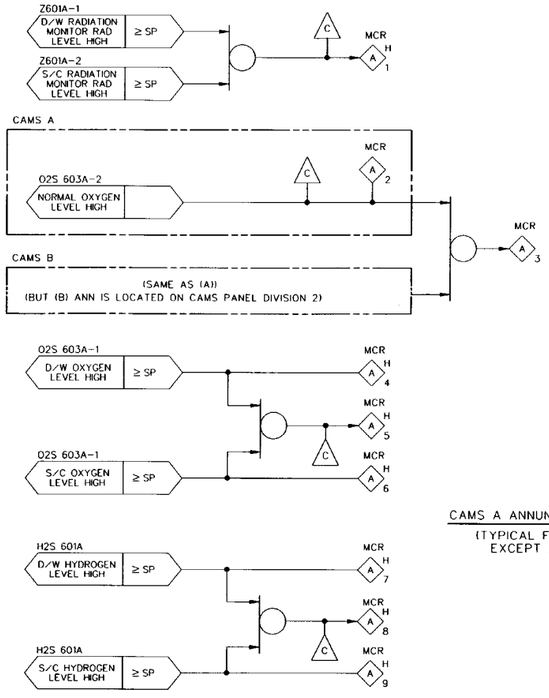


CAMS A ANNUNCIATORS

(TYPICAL FOR CAMS B)

CONTROL SWITCH		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
1	COMPUTER INOPERATIVE	MCR
2	DEHUMIDIFIER TEMP HIGH/LOW	MCR
3	DRAIN LEVEL HIGH HIGH	MCR
4	CAMS A PIPE HEATING ABNORMAL	MCR
5	SAMPLE FLOW HIGH/LOW	MCR
6	SAMPLE PRESSURE HIGH/LOW	MCR
7	STEAM SEPARATOR EXIT VLV ABNORMAL	MCR
8	DEHUMIDIFIER EXIT VALVE ABNORMAL	MCR
OTHERS		

Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 8 of 10)

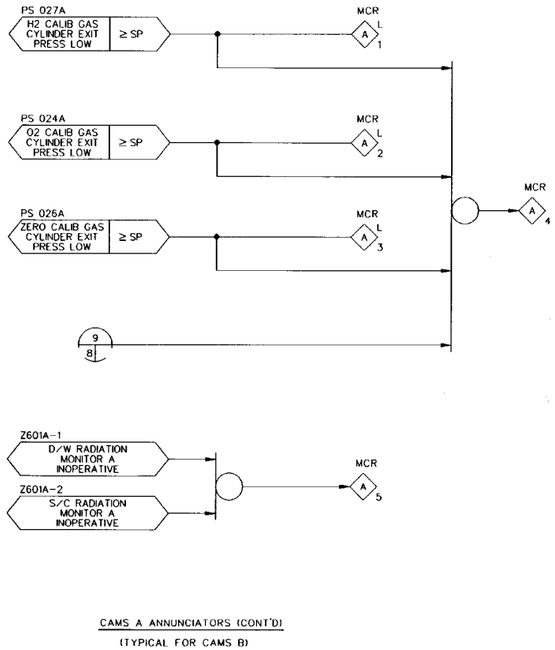


CAMS A ANNUNCIATORS (CONT'D)

(TYPICAL FOR CAMS B)
EXCEPT AS NOTED

CONTROL SWITCH		
OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION
ANNUNCIATOR		
NO.	INDICATOR	LOCATION
1	CAMS (A) RADIATION LEVEL HIGH	MCR
2	NORMAL O2 LEVEL HIGH – CAMS A	MCR
3	NORMAL O2 LEVEL HIGH	MCR
4	D/W O2 LEVEL HIGH – CAMS A	MCR
5	CAMS (A) O2 LEVEL HIGH	MCR
6	S/C O2 LEVEL HIGH – CAMS A	MCR
7	D/W H2 LEVEL HIGH – CAMS A	MCR
8	CAMS (A) H2 LEVEL HIGH	MCR
9	S/C H2 LEVEL HIGH – CAMS A	MCR
OTHERS		

Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 9 of 10)



CAMS A ANNUNCIATORS (CONT'D)

(TYPICAL FOR CAMS B)

CONTROL SWITCH

OBSERVATIONAL MEASURES		
USE	SPECIFICATION	LOCATION

ANNUNCIATOR		
NO.	INDICATOR	LOCATION
1	H2 CALIBRATION GAS LOW PRESSURE	MCR
2	O2 CALIBRATION GAS LOW PRESSURE	MCR
3	ZERO CALIBRATION GAS LOW PRESSURE	MCR
4	CAMS (A) SYSTEM ABNORMAL	MCR
5	CAMS (A) RADIATION MONITOR INOPERATIVE	MCR

OTHERS

Figure 7.6-8 Containment Atmospheric Monitoring System IBD (Sheet 10 of 10)

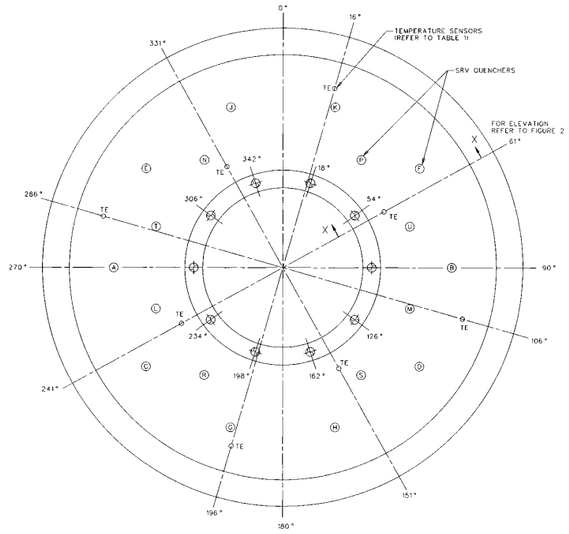
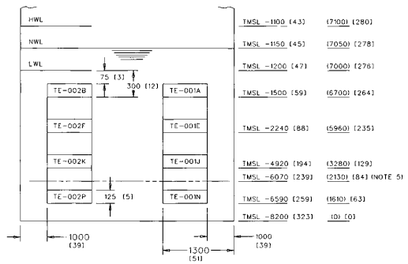


FIGURE 1: INSTRUMENTATION LOCATION DEFINITION



VIEW X–X FROM FIGURE 1
NOTES 2,6,7

FIGURE 2: SENSOR AND ENVELOPE DEFINITION

NOTES:

1. DIVISION I AND DIVISION III AND DIVISION II AND DIVISION IV TEMPERATURE SENSORS AT EACH LOCATION SHALL BE SEPARATED BY 150–300 MM (6–12 INCHES).
2. TYPICAL OF DIVISION I AND DIVISION II SENSORS AT AZIMUTHAL LOCATIONS 16° AND 61°. DIVISION III AND DIVISION IV SENSORS ARE NOT SHOWN.
3. BULK AVERAGE TEMPERATURE ALARM.
4. SIGNALS FROM TE WHICH ARE LOCATED AT THE SAME LEVEL SHALL BE OMITTED FROM AVERAGE TEMPERATURE CALCULATION, WHEN S/P WATER LEVEL DECREASE BELOW SENSOR LEVEL.
5. MIDDLE QUENCHER LEVEL.
6. TMSL = TYPICAL MEAN SEA LEVEL.
7. NUMBER ARE IN MILIMETER EXCEPT [] WHICH ARE IN INCHES.

TABLE 1: SENSOR DIVISION ASSIGNMENT

	DIVISION I	DIVISION II	DIVISION III	DIVISION IV
16°	TE-001A,E,J,N		TE-001C,G,L,R	
61°		TE-002B,F,K,P		TE-002D,H,M,S
106°		TE-003B,F,K,P		TE-003D,H,M,S
151°	TE-004A,E,J,N		TE-004C,G,L,R	
196°	TE-005A,E,J,N		TE-005C,G,L,R	
241°		TE-006B,F,K,P		TE-006D,H,M,S
286°		TE-007B,F,K,P		TE-007D,H,M,S
331°	TE-008A,E,J,N		TE-008C,G,L,R	

SUPPLEMENTAL DOCUMENTS UNDER THE FOLLOWING IDENTITIES SHALL BE USED IN CONJUNCTION WITH THIS DRAWING.

		REFERENCE DESIGNATOR
1.	ATMOSPHERIC CONTROL SYSTEM P&ID	T31-1010
2.	REMOTE SHUTDOWN SYSTEM IED	C61-1010
3.	RESIDUAL HEAT REMOVAL SYS P&ID	E11-1010
4.	PIPING AND INSTRUMENT SYMBOLS DIAGRAM	A10-3030
5.	REACTOR PROTECTION SYSTEM IED	C71-1010
6.	REACTOR BUILDING COOLING WATER SYS P&ID	P21-1010

MFL NO 153 1010

Figure 7.6-11 Suppression Pool Temperature Monitoring System IED (Sheet 1 of 3)

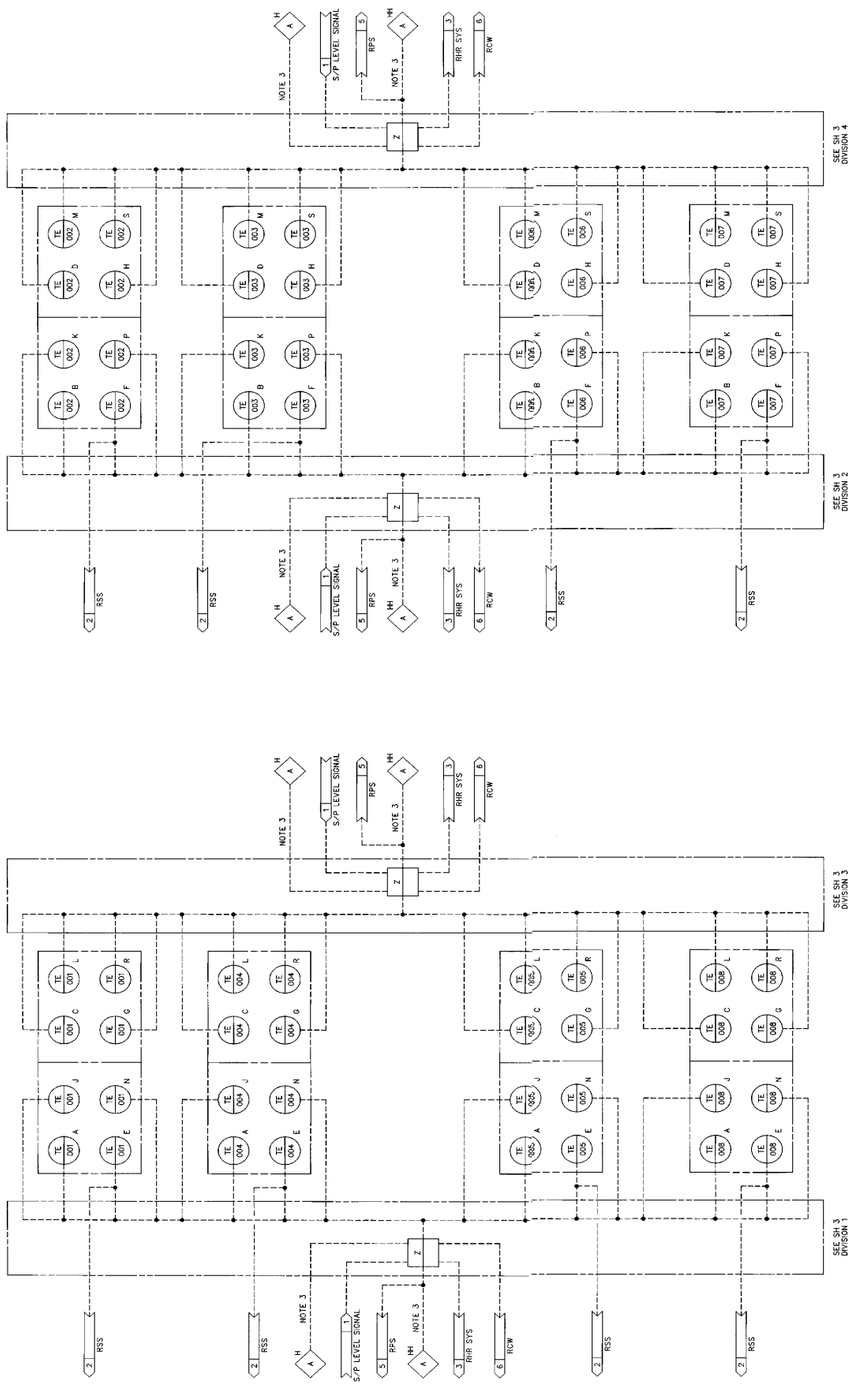


Figure 7.6-11 Suppression Pool Temperature Monitoring System IED (Sheet 2 of 3)

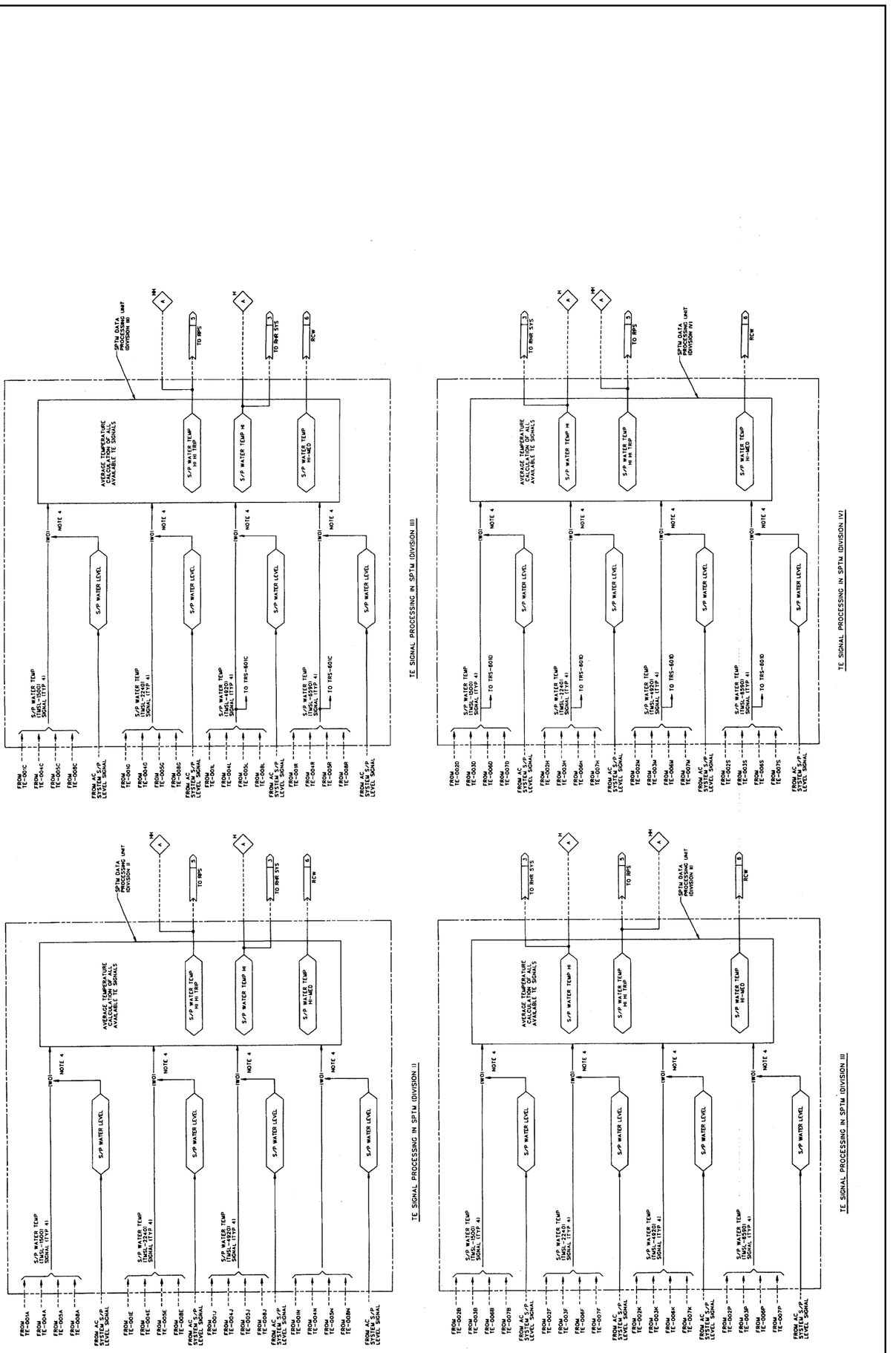


Figure 7.6-11 Suppression Pool Temperature Monitoring System IED (Sheet 3 of 3)

TABLE 1: ANNUNCIATORS

NUMBER	INDICATION	FUNCTION	SOURCE OF THE SIGNAL	LOCATION
1	ALARM	SUPPRESSION POOL WATER (A) TEMP HIGH	LOGIC OUTPUT	
2	ALARM	SUPPRESSION POOL WATER (B) TEMP HIGH	LOGIC OUTPUT	
3	ALARM	SUPPRESSION POOL WATER (C) TEMP HIGH	LOGIC OUTPUT	
4	ALARM	SUPPRESSION POOL WATER (D) TEMP HIGH	LOGIC OUTPUT	
5	ALARM	SUPPRESSION POOL WATER (A) TEMP HI-HI	LOGIC OUTPUT	
6	ALARM	SUPPRESSION POOL WATER (B) TEMP HI-HI	LOGIC OUTPUT	
7	ALARM	SUPPRESSION POOL WATER (C) TEMP HI-HI	LOGIC OUTPUT	
8	ALARM	SUPPRESSION POOL WATER (D) TEMP HI-HI	LOGIC OUTPUT	

NOTES:

1. SUPPRESSION POOL TEMPERATURE SIGNALS ARE PROCESSED BY POOL WATER LEVEL SIGNALS. SEE REFERENCE DOC 1.
2. SETPOINTS ARE REFERENCE VALUES.
3. SUM TO DETERMINE NUMBER OF INPUTS (1-4).
4. SUM OF UP TO 4 TEMPERATURES.
5. AVERAGE OF 12 TO 16 TEMPERATURE INPUTS.

SUPPLEMENTAL DOCUMENTS UNDER THE FOLLOWING IDENTITIES ARE TO BE USED IN CONJUNCTION WITH THIS DRAWING.

	REFERENCE DESIGNATOR
1. SUPPRESSION POOL TEMP MONITORING SYS IED	T53-1010
2. INTERLOCK BLOCK DIAGRAM STANDARD	A10-3070
3. RESIDUAL HEAT REMOVAL SYSTEM IBD	E11-1030
4. REACTOR COOLING WATER/ REACTOR SERVICE WATER SYSTEM IBD	P21/P41-1030
5. REACTOR PROTECTION SYSTEM IBD	C71-1030

ABREVIATIONS

STPT = SETPOINT
NR = NARROW RANGE
WR = WIDE RANGE

MPL NO. T53-1030

Figure 7.6-12 Suppression Pool Temperature Monitoring System IBD (Sheet 1 of 6)

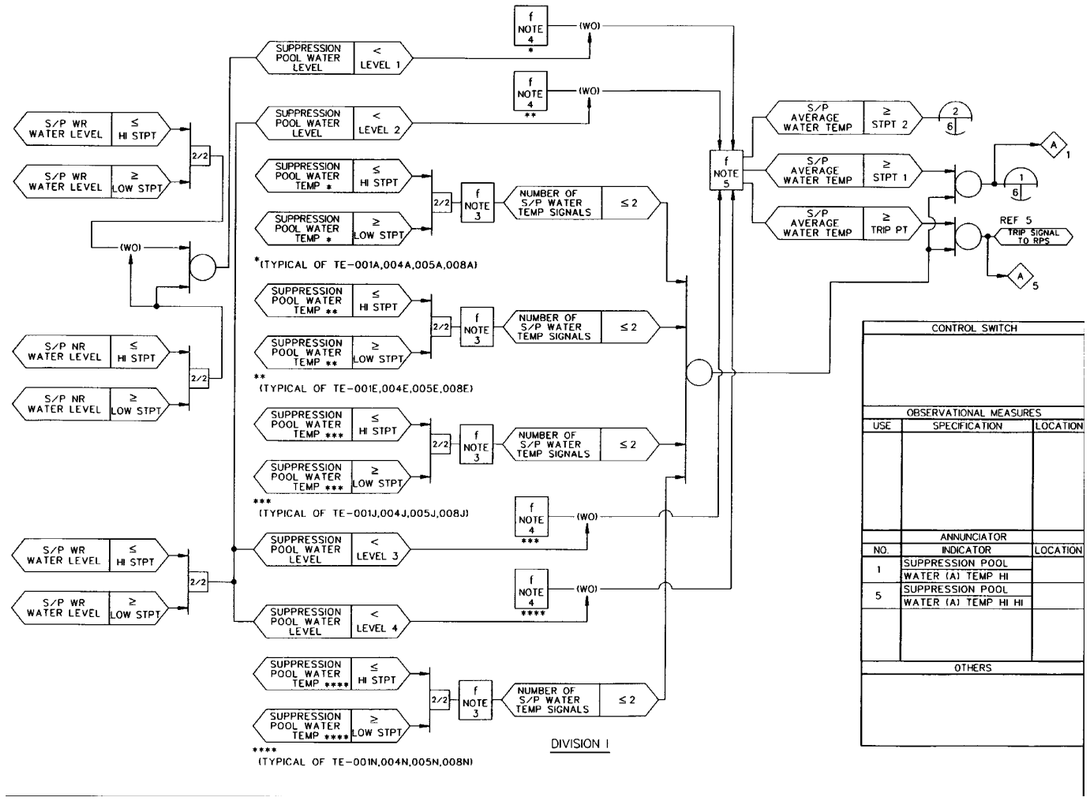


Figure 7.6-12 Suppression Pool Temperature Monitoring System IBD (Sheet 2 of 6)

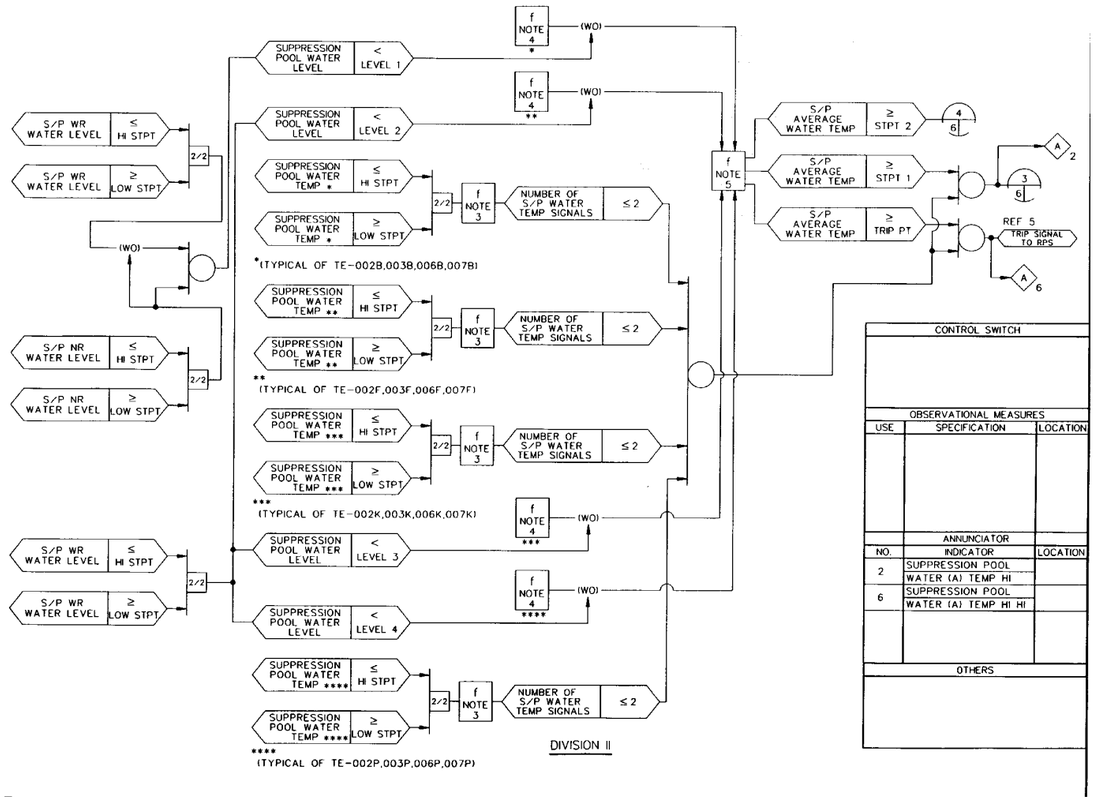


Figure 7.6-12 Suppression Pool Temperature Monitoring System IBD (Sheet 3 of 6)

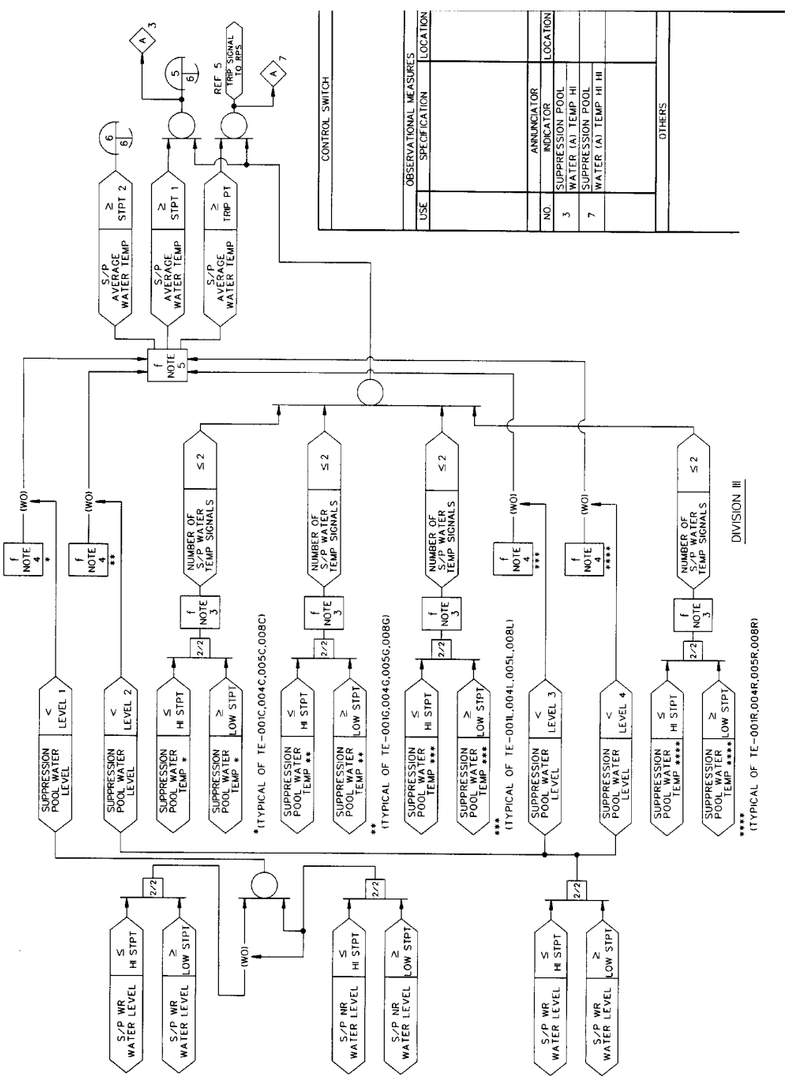


Figure 7.6-12 Suppression Pool Temperature Monitoring System IBD (Sheet 4 of 6)

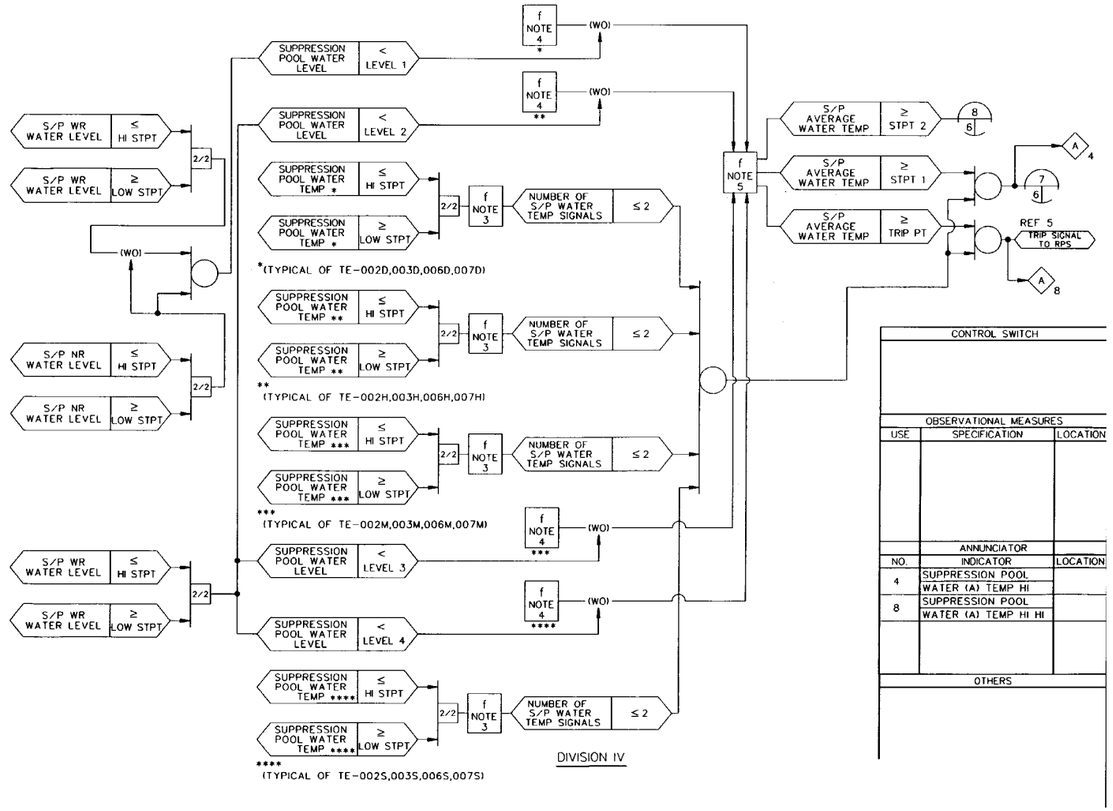


Figure 7.6-12 Suppression Pool Temperature Monitoring System IBD (Sheet 5 of 6)

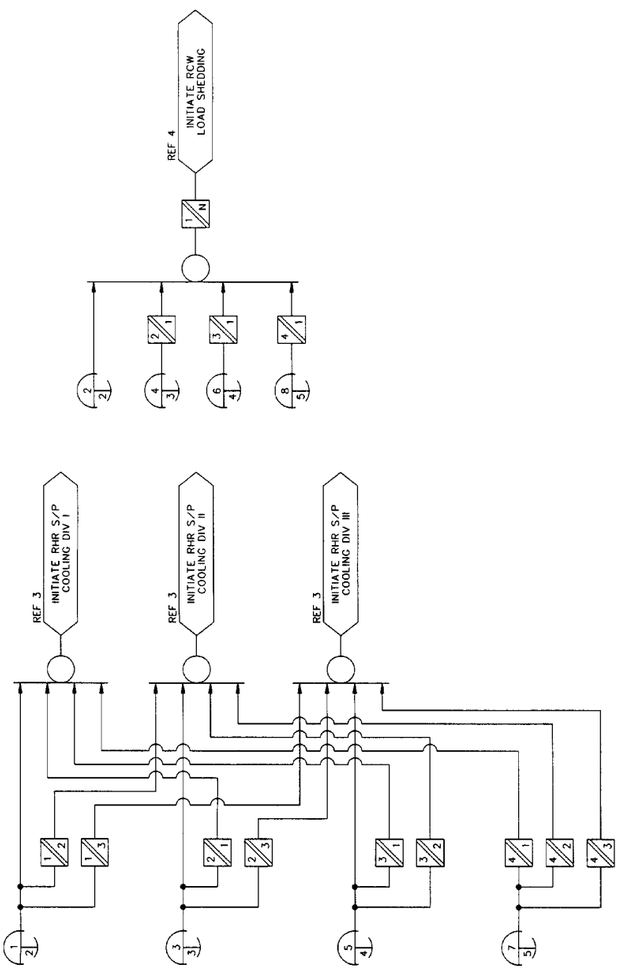


Figure 7.6-12 Suppression Pool Temperature Monitoring System IBD (Sheet 6 of 6)

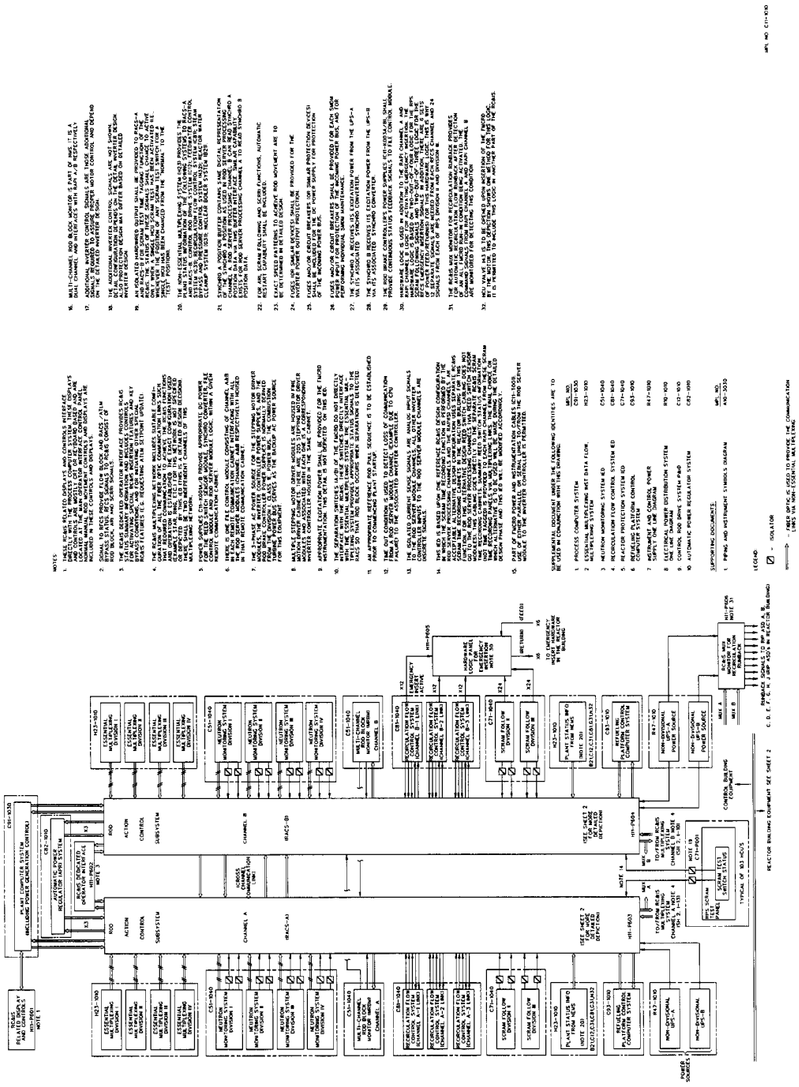
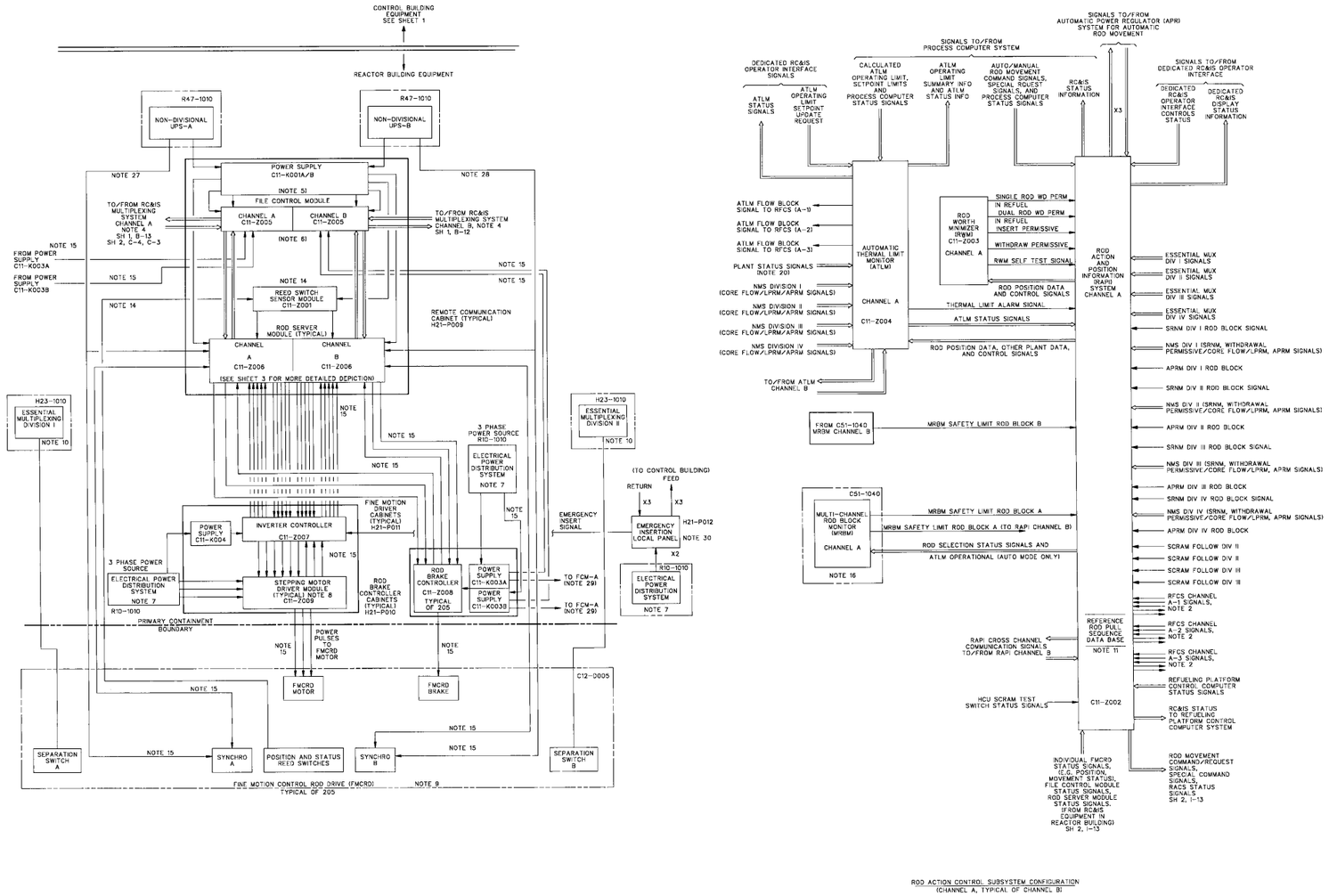
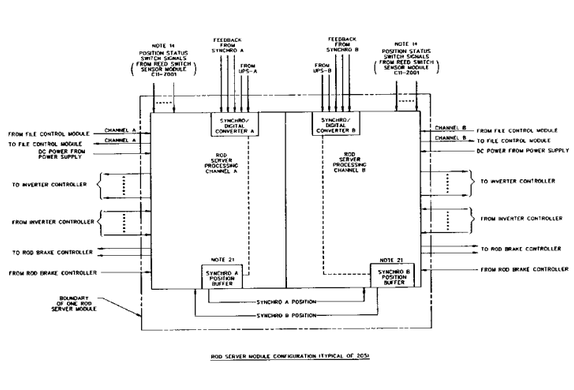


Figure 7.7-2 Rod Control and Information System IED (Sheet 1 of 5)

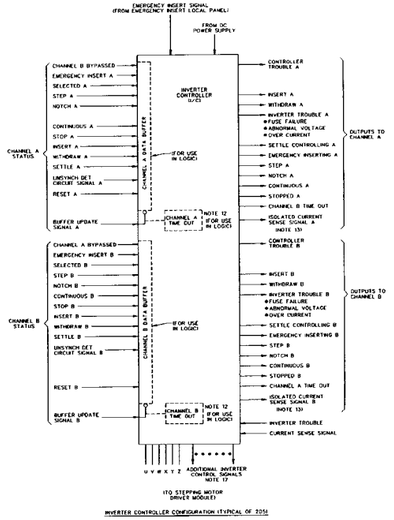


ROD ACTION CONTROL SUBSYSTEM CONFIGURATION (CHANNEL A, TYPICAL OF CHANNEL B)

Figure 7.7-2 Rod Control and Information System IED (Sheet 2 of 5)



ROD SERVER MODULE CONFIGURATION (TYPICAL OF 205)



INVERTER CONTROLLER CONFIGURATION (TYPICAL OF 205)

Figure 7.7-2 Rod Control and Information System IED (Sheet 3 of 5)

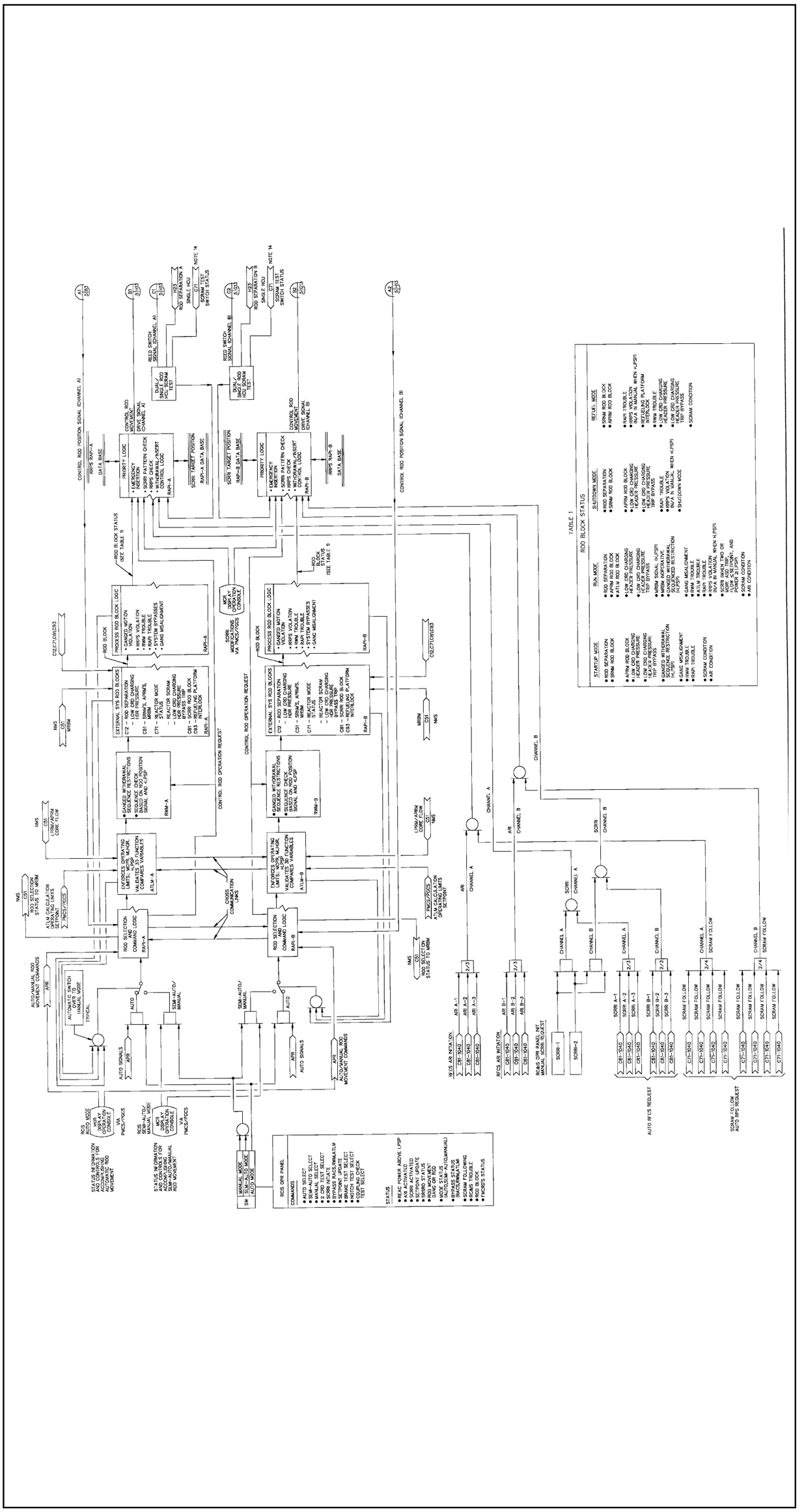


Figure 7.7-2 Rod Control and Information System IED (Sheet 4 of 5)

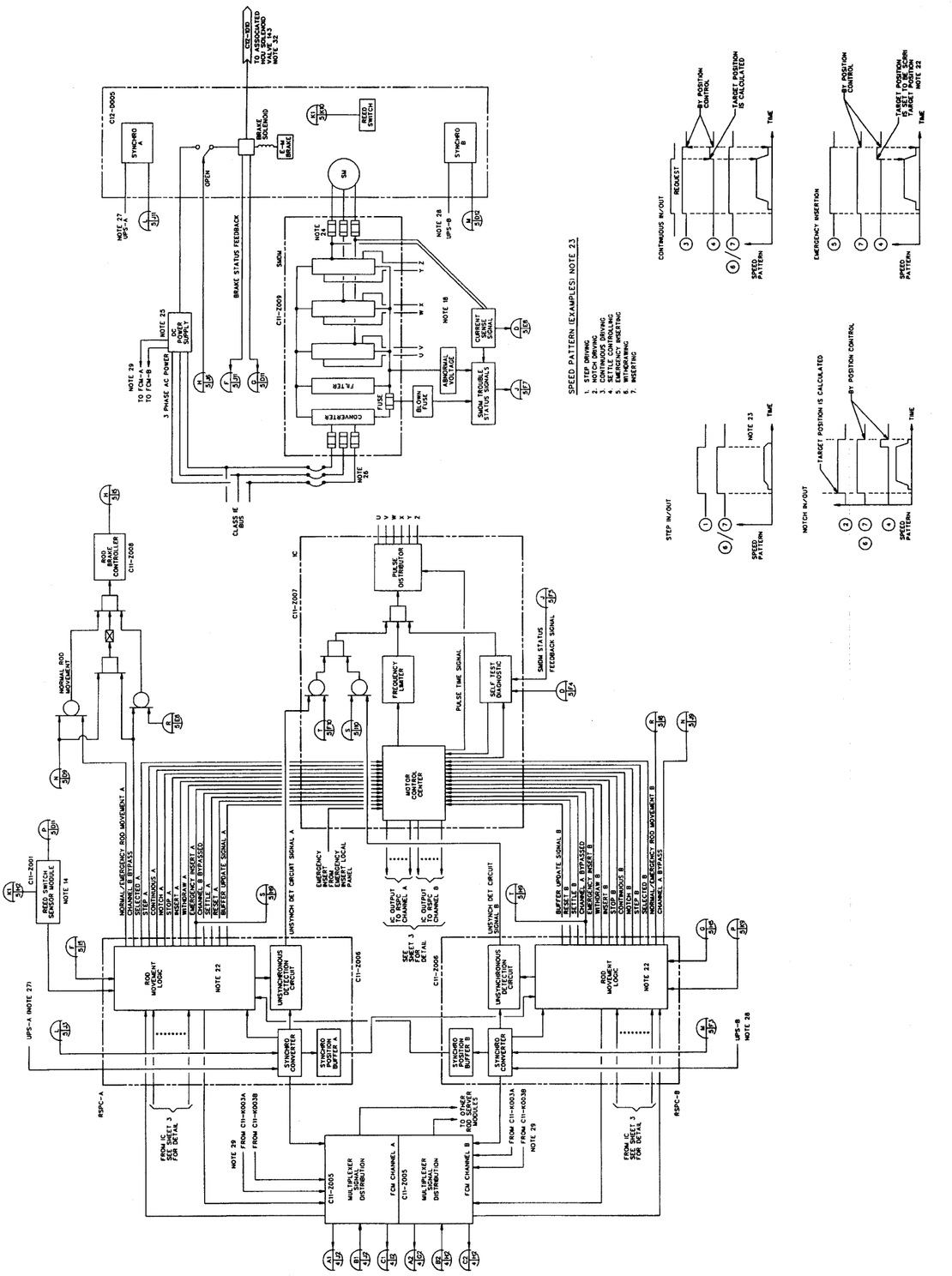


Figure 7.7-2 Rod Control and Information System IED (Sheet 5 of 5)