



REFERENCE DRAWINGS:
 1. P&ID CONTROL ROD DRIVE HYDRAULIC SYS 3
 2. FUNCTIONAL CONTROL DIAG 3-7
 3. DESIGN SPEC 3-5

MPL ITEM NO.
 3
 3-7
 3-5

- PR IS DEFINED AS THE REACTOR PRESSURE IN THE SHROUD INNER ANNULUS IMMEDIATELY ABOVE THE CORE PLATE.
- MAX. OPERATING PR = 1055 PSIG
MIN. OPERATING PR = 0 PSIG
DESIGN PR = 1250 PSIG
- RESPONSE TIME OF FCV 3-19 IS SUCH THAT SCRAM IS COMPLETED BEFORE FCV STARTS TO CLOSE.
- PRESSURE DRCP FROM (25) TO (12) SHALL NOT EXCEED 195 PSI AT A FLOW OF 50 GPM. PRESSURE DROP IN HCU SHALL NOT EXCEED 60 PSI AT 50 GPM.
- FLOW CONDITIONS LISTED ARE BASED ON A ROD VELOCITY OF 100 IN. PER SEC. HOWEVER, THE ACTUAL MAX ROD VELOCITY IS APPROXIMATELY 85 IN. PER SEC.
- FLOW IS INTO DRIVE FROM REACTOR PRESSURE VESSEL.
- "—" IN TABLES I THRU VII INDICATES SAME AS LISTED UNDER CONDITION 1.
- PRESSURE DROP FROM (13) TO (29) SHALL NOT EXCEED 290 PSI AT 32 GPM. PRESSURE DROP IN HCU SHALL NOT EXCEED 118 PSI AT 32 GPM.
- VALVE 3-25-18A CLOSES ON DRIVE INSERT SIGNAL. VALVE 3-25-18B CLOSES ON DRIVE WITHDRAW SIGNAL, BUT DOES NOT STAY CLOSED DURING SETTLING.
- APPROXIMATE PUMP DISCHARGE PRESSURE AT SPECIFIED FLOW.
- MAXIMUM SYSTEM PRESSURE DROP ACROSS ELEMENTS:

FLOW ELEMENT	FLOW-GPM	PRESSURE DROP-PSI	OUTPUT SIGNAL AT FULL SCALE
3-203	59	0.4	200" H ₂ O AT 80 GPM
3-208	4	81	200" H ₂ O AT 8 GPM
3-235	6	3	200" H ₂ O AT 8 GPM
3-213	47	3.7	200" H ₂ O AT 60 GPM

- CONDITIONS LISTED REPRESENT THOSE CONDITIONS WHICH EXIST AFTER 10% INSERTION OF FULL STROKE.
- THE 546 °F LISTED IN CONDITIONS IV AND V SHALL BE USED ONLY IN DETERMINING THE MINIMUM PIPE WALL THICKNESS AND NOT IN DETERMINING STRESSES DUE TO THERMAL EXPANSION. IN DETERMINING MINIMUM WALL THICKNESS IT MAY BE ASSUMED THAT THIS TEMPERATURE OCCURS LESS THAN 1% OF THE OPERATING LIFE OF THE SYSTEM.
- THE DESIGN CONDITIONS ARE SHOWN FOR 137 CONTROL ROD DRIVERS, MPL NO. 02-1-10.
- MINIMUM PUMP SUCTION PRESSURE LISTED UNDER CONDITION 1, LOCATION 0 IS 9.8 PSIA.
- MAXIMUM FLOW VALUE OCCURS AT PR = 0 PSIG. MIN FLOW VALUE OCCURS AT PR = 1000 PSIG.
- WITH THE EXCEPTION OF LOCATIONS (28) AND (29) SYSTEM CONDITIONS LISTED ON THIS DWG ARE FOR SINGLE DRIVE OPERATION ONLY.
- PART NO'S. ARE DERIVED FROM REF 1.
- DRIVE SETTLING SPEED (CONDITION VII) IS APPROX 2" PER SEC.
- NORMAL DRIVE COOLING FLOW REQUIREMENTS ARE NOT LESS THAN 0.20 GPM PER DRIVE.
- EXHAUST WATER FLOW FROM ONE MOVING DRIVE IS DISPERSED VIA HYDRAULIC CONTROL UNITS OF OTHER NON-MOVING DRIVES TO THE REACTOR PRESSURE VESSEL.
- DURING SCRAM, FLOW WILL BE DIRECTED INTO THE SCRAM DISCHARGE VOLUME. FOLLOWING SCRAM, THIS FLOW WILL DECLINE AS VALVE FCV 3-19 CLOSES AND AS THE SCRAM DISCHARGE VOLUME PRESSURIZES TO EQUAL THE REACTOR PRESSURE. AFTER THE SCRAM DISCHARGE VOLUME AND THE REACTOR VESSEL PRESSURE HAVE EQUALIZED, FLOW WILL BE DIVERTED TO THE REACTOR VESSEL VIA THE CRD WITHDRAW LINES AT A FLOW RATE DEPENDENT ON THE REACTOR PRESSURE.
- RECIRC. PUMP AND RWCU PUMP SEAL PURGES ~5.3 TO 7.7 GPM

CONDITION I																																
DRIVE LATCHED (VALVES 3-13: 120, 121, 122, 123, 126, 127 CLOSED; 3-25-18A & 18B OPEN)																																
LOCATION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FLOW, GPM	76.6	76.6	32.0	32.0	32.0	0	26.0	6.0	2.0	4.0	0	0	19	0	0	0	0	20.0	26.0	6.0	19	0	6.0	0	0	0	0	0	0	0	0	20
PRESS PSIG	(16)	(11)	1518	1512	1510	1510	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	PR+	1614	
TEMP F °	40	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	

CONDITION II																																
DRIVE INSERTING (VALVES 3-13: 121, 123; 3-25-18B OPEN; 3-13: 120, 122, 126, 127; 3-25-18A CLOSED)																																
LOCATION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FLOW, GPM	—	—	—	—	—	—	2.0	2.0	0	4.0	4.0	4.0	.72	.72	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
PRESS PSIG	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
TEMP F °	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

CONDITION III																																
DRIVE WITHDRAWING (VALVES 3-13: 120, 122, 3-25-18A OPEN; 3-13-121, 123, 126, 127; 3-25-18B CLOSED)																																
LOCATION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FLOW, GPM	—	—	—	—	—	—	4.0	0	—	2.0	0	1.63	2.0	0	2.0	1.63	2.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
PRESS PSIG	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
TEMP F °	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

CONDITION IV																																
DRIVE SCRAMMING (VALVES 3-13: 126, 127; 3-25-18A & 18B OPEN; 3-13: 120, 121, 122, 123 & 3-33 CLOSED)																																
LOCATION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FLOW, GPM	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
PRESS PSIG	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TEMP F °	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

CONDITION V SCRAM COMPLETED																																
(SCRAM VALVES 3-13: 126, 127 OPEN—SCRAM DISCHARGE VOLUME PRESSURE <65 PSIG)																																
LOCATION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FLOW, GPM	199	199	181	181	171	166	5	0	0	0	0	0	1.29	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
PRESS PSIG	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
TEMP F °	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

CONDITION VI SCRAM COMPLETED																																
(SCRAM VALVES 3-13: 126, 127 OPEN—SCRAM DISCHARGE VOLUME PRESSURE AT PR)																																
LOCATION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FLOW, GPM	200	200	182	182	172	167	5	0	0	0	0	0	1.29	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
PRESS PSIG	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
TEMP F °	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

CONDITION VII																																
DRIVE SETTLING (VALVES 3-13: 121, 122, 123 CLOSED; 3-25-18A: 3-13-120 OPEN)																																
LOCATION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FLOW, GPM	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
PRESS PSIG	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TEMP F °	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

- VIII SPECIAL CONDITIONS
- STALLED LEAKAGE FLOW "INSERT" ~ 1 GPM AT (12)
 - STALLED LEAKAGE FLOW "WITHDRAW" ~ 2 GPM AT (13)

AS BUILT
454005831

COOPER NUCLEAR STATION
FCF: 239X348B(3-6)

SAFETY RELATED
THIS ITEM IS OR CONTAINS A SAFETY RELATED ITEM

GENERAL ELECTRIC
PROCESS DIAGRAM
CONTROL ROD DRIVE
HYDRAULIC SYSTEM

DATE: 10-9-69
DRAWN: L.H. BIBBY
CHECKED: L.H. BIBBY
BY: GA. BAYLIS

719E580BB

1 CA-A6170R3