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PROJECT NO.	81CC-001
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POWER OPERATED RELIEF VALVE

JUSTIFICATION REPORT

PER

EPRI LETTER, JUNE 4, 1981

TARGET ROCK CORPORATION

EAST FARMINGDALE, LONG ISLAND, N. Y.

PREPARED BY [signature]
CHECKED BY [signature]
APPROVED BY [signature]

TARGET ROCK CORPORATION
EAST FARMINGDALE, LONG ISLAND, N. Y.

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REPORT 3070
PROJECT 81CC

REVISIONS

LETTER	DESCRIPTION	DATE	BY	APP	X = PAGE CHANGED THIS REV. O = NO CHANGES THIS REV.									
					PG. NO.	-	A	B	C	D	E	F	G	
---	First Issue	6/29/81	MSMCC	[signature] 6/29/81	TITLE	x								
					1	x								
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					4	x								
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					7	x								
					8	x								
					9	x								
					10	x								

1.0 INTRODUCTION

a. The Target Rock Corporation Power Operated Relief Valve is a 2 1/2"x 4" Solenoid Operated Globe Valve, TRC Model 81CC-001. The Assembly Drawing Parts List for this valve model is TRC Drawing Number 81CC-201.

b. At this writing the TRC 2 1/2" x 4" PORV is intended to be installed at the following plants.

UTILITY	PLANTS	VALVE MODEL
Consumers Power Co.	Midland Plants 1 & 2	81CC-001

DRAWING NUMBERS	QUANTITIES OF VALVES
Project Control Drawing: 81CC-001	1 each plant
Assembly Drawing & Parts List: 81CC-201	

2.0 DESCRIPTION OF THE BASIC VALVE MODEL

The Target Rock Corporation 2 1/2" x 4" Power Operated Relief Valve is a Solenoid Operated, internally piloted, globe valve design. Refer to Assembly Drawing No. 81CC-201.

This valve contains a main disc which is pressure seated by the fluid on the upstream (butt-weld end) side of the valve. A pilot disc is contained within the main disc. Energization of the solenoid coil lifts the pilot disc off its seat in the main disc and drops pressure from the volume above the main disc. When the pressure in this volume has dropped to approximately half the upstream pressure, the main disc will be hydraulically lifted from its seat.

When the solenoid is de-energized, the pilot disc is reseated in the main disc. This allows the upstream pressure to enter, the volume above the main disc. This build-up of pressure in this volume recloses the main disc hydraulically.

A push rod and magnet is attached via several connecting members to the main disc. When the main disc moves, the magnet is positively moved a distance equal to the main disc lift. This magnet motion is picked up by reed switches to provide a positive indication of main disc position. For systems checkout the main disc with the attached magnet can be magnetically opened and closed, since (as described above) for the absence of a pressure differential across the valve, the solenoid force is sufficient to lift the main disc against the force of its return spring.

This hydraulic force lifting the main disc is aided by a solenoid force which, acting on the moveable core, contributes force sufficient to lift the main disc against the force of its return spring.

All pilot disc and main disc seating surfaces in this valve are hardsurfaced to provide tight seating and resistance to wire drawing at high differential pressures. The magnetic circuit parts internal to the bonnet pressure boundary are made from annealed 410 Stainless Steel and are chrome plated. Pressure boundary parts (body, bonnet tube, indicator tube, and main disc) are made of 300 series stainless steel. All other trim parts are also made of corrosion resistant materials. The valve bonnet is screwed into the body. This joint is then seal welded to provide zero leakage to the

surroundings.

3.0 SELECTED TEST VALVE

The valve selected for the EPRI test, TRC Model 80X-006, is the prototype of the Model 81CC-001 production valve. The assembly drawing for this test valve is TRC Drawing Number 1052020-1.

4.0 DESIGN VARIATIONS BETWEEN PWR PLANT VALVES AND SELECTED TEST VALVE

As a result of testing of the Target Rock Corporation 2 1/2" x 4" Power Operated Relief Valve, Test Model 80X-006, both in-house and at EPRI test sites, a number of minor changes have been incorporated into the production model PORV 81CC-001. These are described below:

1. Magnetic Circuit: Enlargement of the diameter of the bonnet tube at its upper end, shortening of the moveable core, and increasing the ampere turns of the solenoid coil, all contribute to increasing the force margin for solenoid actuation under normal and accident conditions.

2. Guidance between plunger and moveable core: The test model relief upon the bonnet wall to guide both the plunger and the moveable core. However, scratch marks found on both parts, and on the inside surface of the bonnet tube indicated a need for improving the guidance between these parts. Although these scratches are not regarded as a problem, the guidance between the plunger and the moveable core has been improved on the production model by tightening machining tolerances of plating parts.

3. Length of Valve Stroke: Since the desired flow through the production model is less than that exhibited by the test model, the valve stroke (main disc lift) has been reduced from 0.438" to .300".

4. Pilot Seat Material: The test valve pilot seat was made of "Haynes 25", Condition CA-7. Since ASME Code requirements do not permit welding this material to the stainless steel main disc, the pilot seat will be made of Stellite No. 6, directly applied to the pilot seat area of the main disc.

5. Piston Rings: Probable closure of the piston ring gaps during extremely rapid temperature transient tests (100°F to 650°F in less than one second) will be averted by increasing the installed ring gaps to 0.040". The piston ring grooves have been moved approximately 1/2" higher on the main disc, since it was observed after EPRI tests at Marshall Steam Plant that heavy contact between the main disc and the hardened sleeve in the body was causing localized scratches in the disc material. Although this scratching would not usually be considered as causing a problem, some metal was upset into the ring grooves, interfering with the rings' free expansion. Moving the piston ring grooves away from the scratched area will prevent this.

6. Sleeve Material: The hardened sleeve in the body, against which the piston rings bear, is made of AISI 440C material, in

accordance with TRC standard practice. A Stellite 6B sleeve was used in the test model because at the time the test valve was built, no AISI 440C sleeves for this size of valve were immediately available. The AISI 440C sleeves are presently being used in all Target Rock Corporation 1/2", 1" and 2" solenoid operated valves.

7. Pilot Exit Hole in the Main Disc: This has been enlarged in the region downstream of the pilot seat to reduce the possibility of this passage being blocked by crystals of dried boric acid.

Target Rock Corporation considers that the changes described above improve performance and operability.

5.0 CONCLUSION

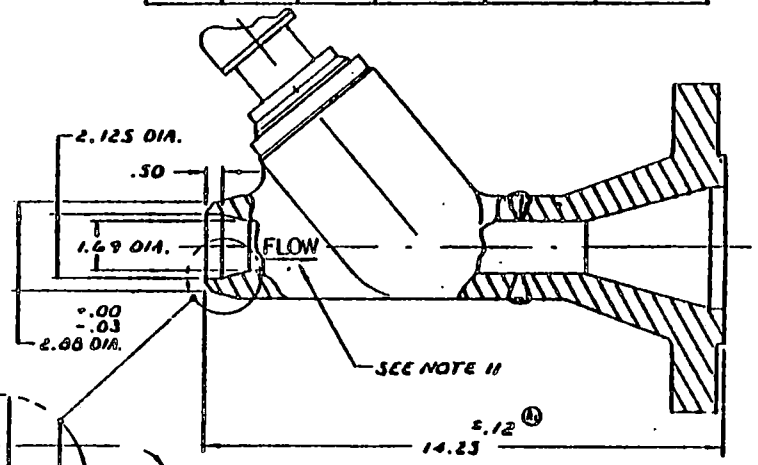
The Target Rock Corporation Model 80X-006 2 1/2" x 4" Power Operated Relief Valve tested by EPRI is representative of the Model 81CC valves to be installed at Consumers Power Company, Midland Plants 1 and 2. The minor variations which exist between these two models have primarily been made in response to the test results generated by the EPRI tests at Marshall Steam Facility at Wyle Laboratories. They are fully described in Section 4 above.

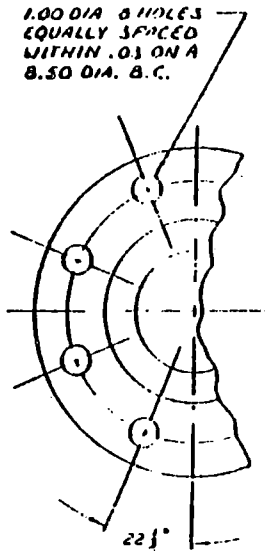
NOTES:

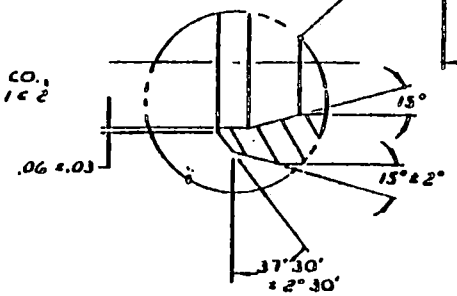
1. DESIGNED AND MANUFACTURED PER SECTION III ASME BOILER AND PRESSURE VESSEL CODE, 1980 EDITION THRU SUMMER 1980 ADDENDA NUCLEAR CLASS 1.
2. PRIMARY PRESSURE CLASS 1700 LB INLET AND 600 LB OUTLET PER ANSI B16.34-1977.
3. HYDROSTATIC TEST PRESSURE 6150 PSIG INLET AND 2175 PSIG OUTLET AT 100°F MAX APPLIED FOR 10 MINUTES WITH SOLENOID AND POSITION INDICATOR PARTS REMOVED.
4. VALVE CLOSURE TEST PRESSURE (DISC HYDRO TEST PRESSURE) 4525 PSIG AT 100° MAX APPLIED FOR 1 MINUTE
5. POSITION SWITCH ASSEMBLY CONTAINS 4 SPST SWITCHES TWO SWITCHES CLOSE AT THE VALVE CLOSED POSITION THE OTHER TWO SWITCHES CLOSE AT THE VALVE OPEN POSITION. EACH SWITCH IS RATED AT 0.5 AMP INDUCTIVE LOAD AND 1.5 AMP RESISTIVE LOAD AT 125 VDC.
6. SOLENOID COIL SHALL OPERATE AT 125 VDC +10% -20%
7. C_v = 32 (CALCULATED) C_d = 0.838 in^2 (CALCULATED)
8. VALVE IS SEISMIC CATEGORY I.
9. REQ'D STROKE TIMES FOR OPENING AND CLOSING ARE PER BABCOCK & WILCOX MDS 34-1121B7S (LATEST REV.)
10. PIPE TO BE ATTACHED TO 4" ANSI 600 LB FLANGE IS LIMITED TO 4" SCHED. 40 REFERENCE ASME CODE, PARAGRAPH NB-3545.2
11. VIBROTOOL "FLOW" .38 HIGH AND ARROW .75 LONG IN APPROX. POSITION SHOWN.
12. ALL DOCUMENTS LISTED ON BABCOCK & WILCOX APPLICABLE DOCUMENTS LIST ADL NO. 21-1122781 (LATEST REV) APPLY TO THIS VALVE ORDER
13. ALL ACCESSIBLE FINAL PRESSURE RETAINING SURFACES SHALL BE EXAMINED BY LIQUID PENETRANT INSPECTION PRIOR TO FINAL ASSY. LPI PROCEDURE TRP 1689; ACCEPTANCE STANDARDS TRP 2297.
14. VISUAL INSPECTION OF PRESS BOUNDARY PARTS IS REQ'D PRIOR TO FINAL ASSY. VISUAL INSPECTION OF ACCESSIBLE SURFACES OF PRESSURE BOUNDARY PARTS IS REQ'D AFTER HYDRO TEST. VISUAL INSPECTION PROCEDURE NO. TRP 3014
15. PRODUCTION TEST PROCEDURE: TRP 3015
16. VALVE MOUNTING IS IN HORIZONTAL PIPE RUN. AS VIEWED FROM PIPING AXIS, SOL. COIL AXIS IS TILTED 10° BELOW HORIZONTAL
17. WALL THICKNESS MEASURE PROCEDURE: TRP. 3013
18. CLEANLINESS STANDARD TRP 890.
19. JWP 11.263 WITH TRP 11.200 IS AN ALTERNATE FOR W-2.
20. JWP 11.210 & WITH TRP 11.200 IS AN ALTERNATE FOR W-3.
21. JWP 11.212 WITH TRP 11.200 IS AN ALTERNATE FOR W-8.

JOINT WELD PROCEDURES APPLICABLE TO THIS VALVE
(SEE TRC ASSY DRAWING, BICC-201 FOR LOCATION)

JOINT	JWP	TRP	PARTS	LPI PER TRP 1689	ACCEPT PER TRP 2297 PARA AS NOTED
W-1	12.134	12.100	BODY / FLANGE	YES	YES NB-5350
W-2	11.106 SS	11.100	PILOT DISC H/F	NOT REQ'D	NOT REQ'D
W-3	11.116 SS	11.100	SEAT INSERT H/F	YES	YES NB-2546-3
W-4	11.112 SS	11.100	MAIN DISC H/F	YES	YES NB-2546-3
W-5	12.161 SS	12.100	BONNET / INDICATOR TUBE	YES	YES NB-5350
W-6	12.111 SS	12.100	BODY / SEAT INSERT	YES	YES NB-5350
W-7	12.157 SS	12.100	BODY / BONNET	YES	YES NB-5350
W-8	11.128 SS	11.100	PILOT DISC H/F	NOT REQ'D	NOT REQ'D
W-9	11.132 SS	11.100	PILOT SEAT H/F	YES	YES NB-2546-3
W-10	11.106 SS	11.100	MAIN DISC H/F	NOT REQ'D	NOT REQ'D







CUSTOMER: BABCOCK & WILCOX
INSTALLATION: CONSUMERS POWER CO., MIDLAND PLANT, UNITS 1 & 2

APPLICABLE TRC VALVE ASSY AND INSTALLATION DWG: BICC-201

POWER OPERATED RELIEF VALVE 2½" x 4" PROJ CONT. DWG

81CC-0011B

NOTES:
1. FRONT VIEW LOCATION OF C.G. IS ON ℄.
2. SEE PROJECT CONTROL DRAWING FOR APPLICABLE NOTES, WELDING PROCEDURES, DESIGN DATA & BODY END PREPS.

10	9	8	7	6	5	4	3	2	1						
										65					
										64					
										63					
										62					
										61					
										60					
										59					
										58					
										57					
										56					
										55					
										54					
										53					
							1			52	300761-1	BODY R/M	S.S. 316	ASME-SA 182	M/F 300171-1
										51					
									1	50	102860-1	PLATE	SS 300 SER		
									1	49	202822-1	SLEEVE	S.S 440c		CHROME PLATED
									1	48	100900-1	IDENT. TAG	S.S. 300 SER.		
									1	47	202535-1	NAME PLATE	S.S. 300 SER.		
									2	46	200605-1	CLAMP ASSY.	S.S. 300 SER.		
									4	45	100967-1	REED SWITCH ASSY.			
									A/R	44	858-0003	SHRINK TUBING	BLACK		
									A/R	43	858-0004	SHRINK TUBING	RED		
							1			42	202901-1	FLANGE END	S.S 316	ASME-SA 182	
							1			41	200783-1	SEAT INSERT	S.S. 316 L	ASME-SA 479	STELLITE HARD FACE
									A/R	40	858-0002	SHRINK TUBING	GREEN		
									A/R	39	858-0001	SHRINK TUBING	WHITE		
									8	38	115-0002	NUT, HEX SELF LKG.	S.S 300 SER.		10-32
									8	37	056-0004	SCREW, HEX HEAD	S.S 300 SER.		10-32 x .625 LG

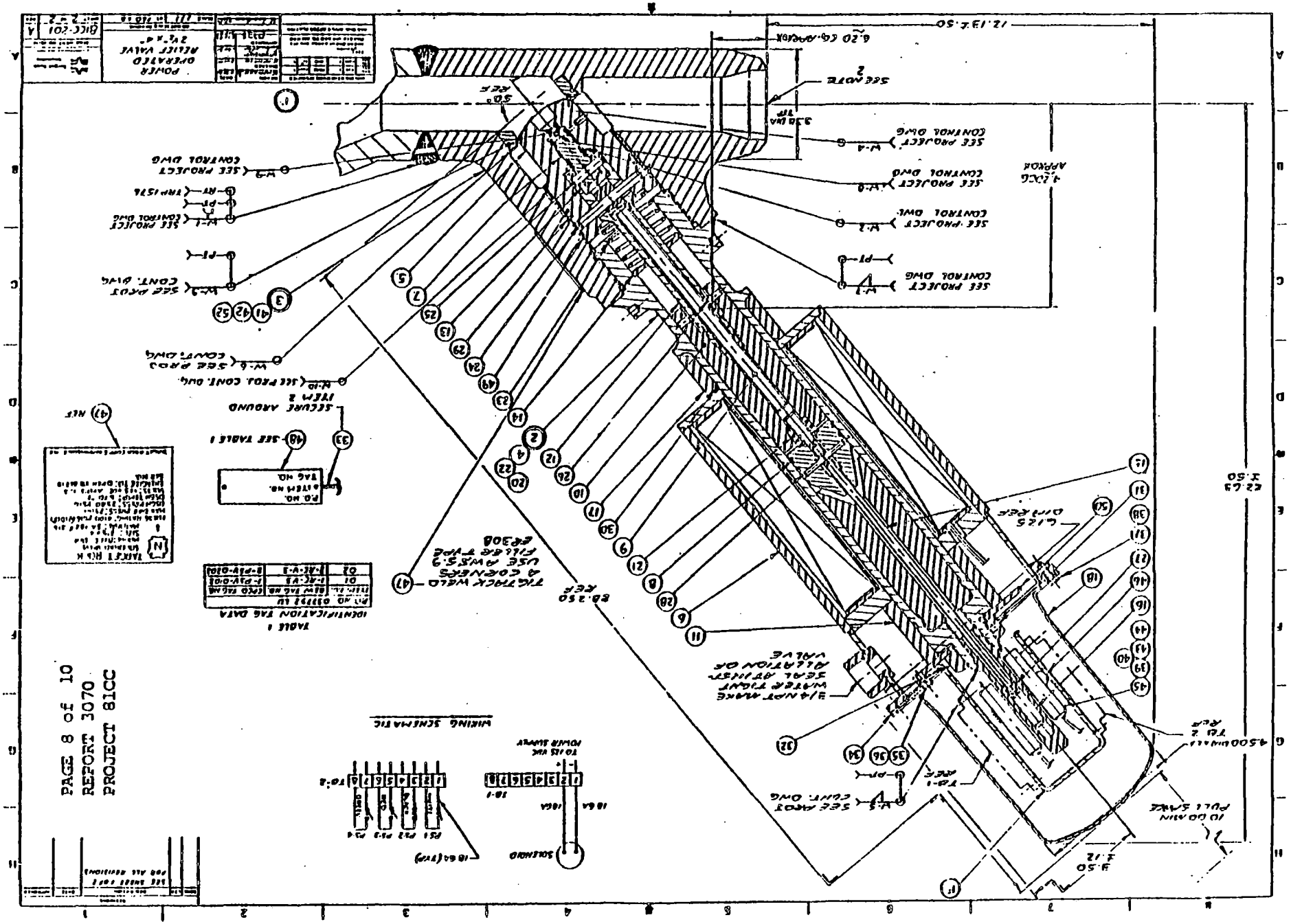
QUANTITY REQUIRED

10	9	8	7	6	5	4	3	2	1						
									4	36	211-0006	LOCKWASHER, SPLIT	S.S. 300 SER.		# 10
									4	35	064-0017	SCREW, SOCKET HEAD	S.S. 300 SER.		10-32 x .750 LG
									1	34	200989-2	GASKET	SILICONE RUBBER		
									A/R	33	834-0001	LOCKWIRE	S.S 300 SER.		
									1	32	102768-1	NUT, HEX JAM	S.S 300 SER.		
									1	31	080-0007	SET SCREW	S.S. 300 SER.		1/4-20 x .375 LG
									1	30	300-2034	O-RING	SILICONE RUBBER		
									2	29	100948-1	PISTON RING	S.S. 17-7 pH	AMS 5644	R_c 38-50
									1	28	440-0013	SPIROL PIN	S.S 300 SER.	AISI OR EQUAL	.125 x 1.500 LG
									1	27	438-0001	PIN, SPRING	S.S.		.125 x .375 LG
									1	26	440-0015	SPIROL PIN	S.S 300 SER.	AISI OR EQUAL	.187 x .500 LG
									1	25	102865-2	PIN	S.S. A-286		
									1	24	102865-1	PIN	S.S. A-286		
									1	23	102763-2	SPRING	S.S. A-286		
								1		22	202551-2	FIXED CORE	S.S 410		ANNEALED & CHROME PLATED
									1	21	102866-1	SPRING	S.S A-286		
								1		20	102687-1	INDICATOR TUBE	S.S. 316	ASME SA479	
									1	19	300109-5	ELECT. ASSY DC.			
									1	18	202097-2	COVER	S.S. 300 SER.		
									1	17	100950-2	RING	C.S. 1010 TO 1020	AISI OR EQUAL	NICKEL PLATED
									1	16	102664-1	MAGNET ASSY.	S.S, ALNICO 8		CHROME PLATED
									1	15	102670-17	ROD	S.S 316		
									1	14	102863-1	RETAINER, SPRING	S.S. 300 SER		
									1	13	102862-1	PLUG	S.S. 17-4 pH		R_c 32-38
									1	12	300715-1	ROD, PILOT DISC.	S.S 316		
									1	11	102735-1	SLEEVE MAG.	C.S.		NICKEL PLATED
									1	10	202821-1	PLUNGER	S.S. 410		ANNEALED & CHROME PLATED
									1	9	202819-1	ROD, DISC	S.S. 316	AISI OR EQUAL	
									1	8	202818-1	MOVABLE CORE	S.S 410		ANNEALED & CHROME PLATED
									1	7	202918-1	PILOT DISC. F/M	S.S. 347/348	ASME SA479	M/F 202917-1
									1	6	300360-2	SOLENOID ASSY		COIL: CL H INSULATION	
									1	5	300764-1	MAIN DISC F/M	SS 347/348	ASME SA-479	M/F 202902-1
								1		4	300553-1	BONNET	S.S 316	ASME SA 479	
							X		1	3	300763-1	BODY F/M (ASSY.)	SEE DETAILS		M/F 300762-1
								X	1	2	300571-2	BONNET ASSY.	SEE DETAILS		
									X	1	81CC-201	DC-4 SWITCH VALVE			

QUANTITY REQUIRED

POWER OPERATED RELIEF VALVE 2 1/2" x 4"

81CC-201 A



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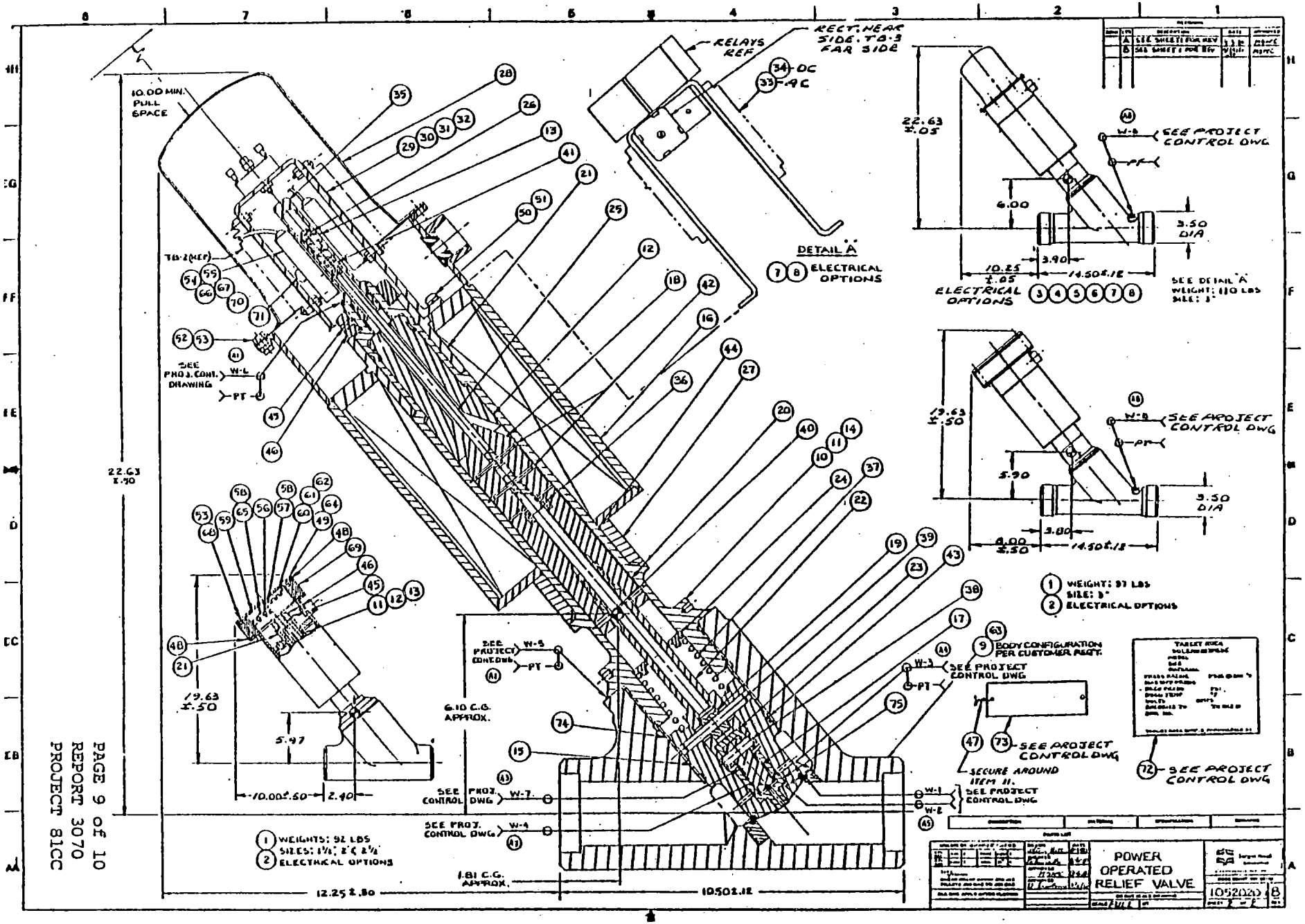

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PROJECT 81CC

NOTES
1. SEE PROJECT CONTROL DWG. FOR APPLICABLE NOTES, WELD PROCEDURES & DESIGN DATA.

QUANTITY REQUIRED															
10	9	8	7	6	5	4	3	2	1	ITEM NO.	PART NO.	DESCRIPTION	MATERIAL	SPECIFICATION	REMARKS
		1	1	1	1	1	1	1	1	75	202600-1	PILOT SEAT	HAYNES 25 (L-605)		
		1	1	1	1	1	1	1	0	74	102909-1	SLEEVE	STELLITE 6B		
		1	1	1	1	1	1	0	0	73	100900-1	IDENT TAG	SS 300 SER		
		1	1	1	1	1	1	0	0	72	202333-1	NAME PLATE	SS 300 SER		
		1	1	2	2	1	1			71	200805-1	CLAMP ASSY	SS 300 SER		
		3	2	4	4	2	2			70	100967-1	REED SWITCH ASSY			
								1	1	69	102406-3	SPACER	SS 300 SER		
								B	B	68	045-70332-2250-01-01	SCREW, HEX. HD.	SS 300 SER		
				A/R	A/R					67	615B-01BB	SHRINK TUBING	BLACK		
				A/R	A/R					66	062-01MB	SHRINK TUBING	RED		
								1		65	045-70332-2250-01-01	SCREW, RD. HEAD	SS 300 SER.		
									1	64	102522-4	COVER PLATE	SS 300 SER		
		1	1	1	1	1	1	1	1	63	200783-1	SEAT INSERT	SS 316L	ASME 479	
								2	2	62	540-53407-1	TERMINAL LUG	SOLDERLESS INSULATED		
								A/R		61	587-11GA	WIRE	SILICONE FIBERGLASS INS		
								1	1	60	439-06600-0002	TERMINAL BOARD			
		1 REF		1 REF		1 REF		1		59	913-5041-027	RECTIFIER			
								A/R	A/R	58	840-RTV01	SEALANT	SILICONE		
								4	4	57	845-0632-0506-01-01	SCREW, ROUND HD	SS 300		
								4		56	575-0250-BLK	TERM. QUICK DISC.	NOT SOLDERLESS INSULATED		
		A/R	A/R	A/R	A/R	A/R	A/R			55	863-01GD	SHRINK TUBING	GREEN		
		A/R	A/R	A/R	A/R	A/R	A/R			54	863-01BB	SHRINK TUBING	WHITE		
		B	B	B	B	B	B	B	B	53	045-70334-2500-01-01	NUT, HEX SLOTTED	SS 300 SER		
		B	B	B	B	B	B			52	045-70332-2500-01-01	SCREW, HEX. HD.	SS 300 SER		
		4	4	4	4	4	4			51	510-0600-0000-01-01	LOCKWASHER, SPLIT	SS 300 SER		
		4	4	4	4	4	4			50	045-70332-2500-01-01	SCREW, SOC. HD.	SS 300 SER		
								1		49	102522-2	COVER PLATE	SS 300 SER		
		1	1	1	1	1	1	2	2	48	200989-2	GASKET	SILICONE RUBBER		
		A/R	A/R	A/R	A/R	A/R	A/R	A/R	A/R	47	634-0632-0000-01-01	LOCKWIRE	SS 300 SER		
		1	1	1	1	1	1	1	1	46	102768-1	NUT, HEX JAM	SS 300 SER		
		1	1	1	1	1	1	1	1	45	045-70328-0250-01-01	SET SCREW	SS 300 SER		
		1	1	1	1	1	1	1	1	44	2-014	O-RING	SYNTHETIC RUBBER		
		2	2	2	2	2	2	2	2	43	100948-1	PISTON RING	17-7PH	AMS 5644	R_c 38-40
		1	1	1	1	1	1	1	1	42	129-015 MDM	SPIROL PIN	300 SS	AISI OR EQUIV	CEM CO.
		1	1	1	1	1	1	1	1	41	486-0015-0134-01-08	ROLL PIN	SS		
		1	1	1	1	1	1	1	1	40	129-0811-0500-01-01	SPIROL PIN	SS		
		1	1	1	1	1	1	1	1	39	102780-1	PIN	INCONEL 718		
		1	1	1	1	1	1	1	1	38	102780-2	PIN	INCONEL 718		
		1	1	1	1	1	1	1	1	37	102767-2	SPRING	35 N 286		
10	9	8	7	6	5	4	3	2	1	ITEM NO.	PART NO.	DESCRIPTION	MATERIAL	SPECIFICATION	REMARKS
		1	1	1	1	1	1	1	1	36	102908-1	SPRING	INCONEL X-750		
		1	1	1	1	1	1	1		35	102687-1	INDICATOR TUBE	SS 316	ASME SA479	
		1								34	300562-1	ELECTRICAL ASSY(AC)			
			1							33	300562-2	ELECTRICAL ASSY(DC)			
				1						32	300564-1	ELECTRICAL ASSY(AC)			
					1					31	300564-2	ELECTRICAL ASSY(DC)			
						1				30	300563-1	ELECTRICAL ASSY(AC)			
							1			29	300563-2	ELECTRICAL ASSY(DC)			
		1	1	1	1	1	1			28	202097-2	COVER	SS 300		
		1	1	1	1	1	1	1	1	27	100950-2	RING	C.S.		
		1	1	1	1	1	1			26	102664-1	MAGNET ASSY			
		1	1	1	1	1	1			25	102670-1	ROD	SS 316		
		1	1	1	1	1	1	1	1	24	102758-1	RETAINER, SPRING	SS 300		
		1	1	1	1	1	1	1	1	23	102794-1	PLUG	SS	17-4 PH	R_c 35-38
		1	1	1	1	1	1	1	1	22	300596-1	ROD PILOT DISC	SS 316		
		1	1	1	1	1	1	1	1	21	102735-1	MAGNETIC SLEEVE	C.S.		
		1	1	1	1	1	1	1	1	20	202545-1	PLUNGER	SS 410 ANNEALED		CHROME PLATE
		1	1	1	1	1	1	1	1	19	202548-1	ROD, DISC	SS 316		
		1	1	1	1	1	1	1	1	18	202546-1	MOVABLE CORE	SS 410 ANNEALED		CHROME PLATE
		1	1	1	1	1	1	1	1	17	202547-1	PILOT DISC	S.S. 347/348	ASME SA 479	MADE FROM 3" BAR STOCK
		1	1	1	1	1	1	1	1	16	300360-2	SOLENOID ASSY			
		1	1	1	1	1	1	1	1	15	300993-1	MAIN DISC	S.S. 347/348	ASME SA 479	MADE FROM 3" BAR STOCK
		1	1	1	1	1	1			14	300953-1	BONNET	SS 316	ASME SA479	
		1	1	1	1	1	1	1	1	13	300595-1	BONNET	SS 316	ASME SA479	
		1	1	1	1	1	1	1	1	12	202462-3	FIXED CORE	SS 316 ANNEALED		CHROME PLATE
								1	1	11	300573-1	BONNET ASSY			
		1	1	1	1	1	1			10	300571-1	BONNET ASSY			
		1	1	1	1	0	1	1	1	9	SEE BODY EQUIP. DWG.	BODY F/H	SS F316	ASME SA182	
	X									8	1052020-1-8	AC-2 SWITCH 1 RELAY VALVE			
		X								7	1052020-1-7	DC-2 SWITCH 1 RELAY VALVE			
			X							6	1052020-1-6	AC-4 SWITCH VALVE			
				X						5	1051020-1-5	DC-4 SWITCH VALVE			
					X					4	1052020-1-4	AC-2 SWITCH VALVE			
						X				3	1051020-1-3	DC-2 SWITCH VALVE			
							X			2	1052020-1-2	AC-NO SWITCH VALVE			
								X		1	1051020-1-1	DC-NO SWITCH VALVE			
10	9	8	7	6	5	4	3	2	1	ITEM NO.	PART NO.	DESCRIPTION	MATERIAL	SPECIFICATION	REMARKS

QUANTITY REQUIRED

POWER OPERATED RELIEF VALVE

1052020-10