ENVIRONMENTAL QUALIFICATION
OF
MECHANICAL EQUIPMENT
FOR
THE COMMONWEALTH EDISON COMPANY
BYRON STATION UNITS 1 AND 2
BRAIDWOOD STATION UNITS 1 AND 2
COMPONENT:
PACIFIC SAFETY INJECTION PUMP
MODEL 3" 10 STAGE JHF
REV. 0
5/23/83

M J Zegar 6/20/83

PREPARED BY: M.J. ZEGAR

APPROVED BY: L.I. WALKER 6/20/83

TABLE OF CONTENTS

Introduction

This report documents the Environmental Qualification of the Pacific Safety Injection Pump Model 3" 10 Stage JHF for Commonwealth Edison Byron Station Units 1 and 2 and Braidwood Station Units 1 and 2. The evaluation documented herein verifies that the component, as originally designed, is adequate to meet the plant environmental conditions as specified in the Equipment Specification.

1.0 Equipment/Document Identification

1.1 Specification No.: 677474 Rev. 0 (motor), 678815 Rev. 2 (pump)

1.2 Vendor: Pacific Pumps

1.3 Model/Type: 3 inch 10 stage JHF Safety Injection Pump

1.4 Spin No/Serial No.
SIAPSI - CAE/CBE/CCE/CDE
CAE - 49758/59, CBE - 49760/61
CCE - 49762/63, CDE - 49764/65

1.5 Reference Drawings: AXS-49754 Rev. 7, MB-7187 Rev. E, H-SP-1786-5 Rev. E, JLF-49754 Rev. 2, 5-162-06-018-003 Rev. 2, FC-49758 Rev. 6, VBC-49754 Rev. 4, PLO-49758 Rev. 2.

1.6 Equipment Function(s): To provide emergency core cooling in the event of a break in either the reactor coolant or steam system. Injects water from the refueling water storage tank (RWST) and recirculates water from the containment sump after the RWST supply is exhausted.

1.7 Seismic Qualification Report:
K363, K386 Rev. 3 (pump)
S.O. 75F32374 (motor)

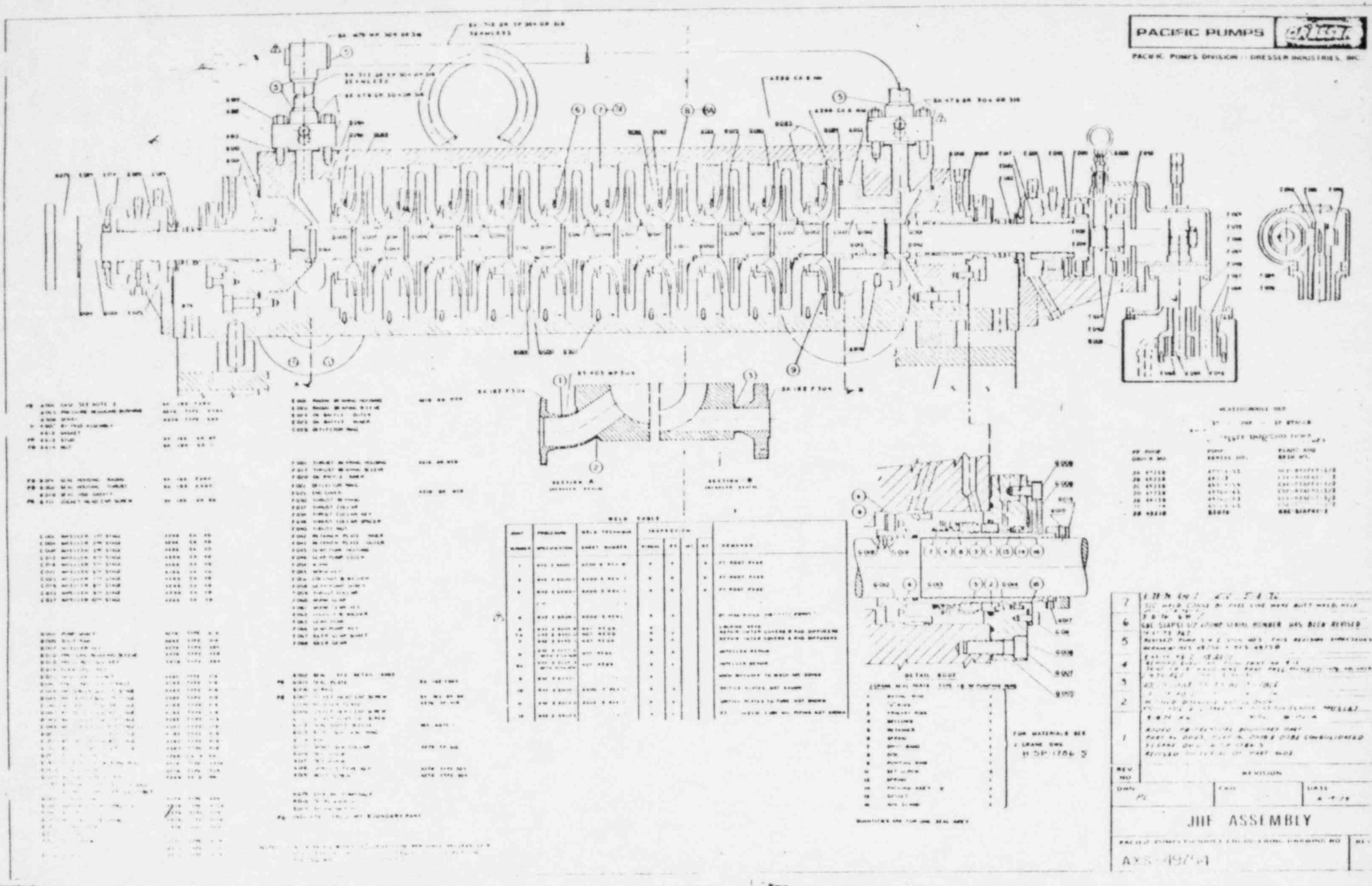
2.0 ENVIRONMENTAL SUMMARY

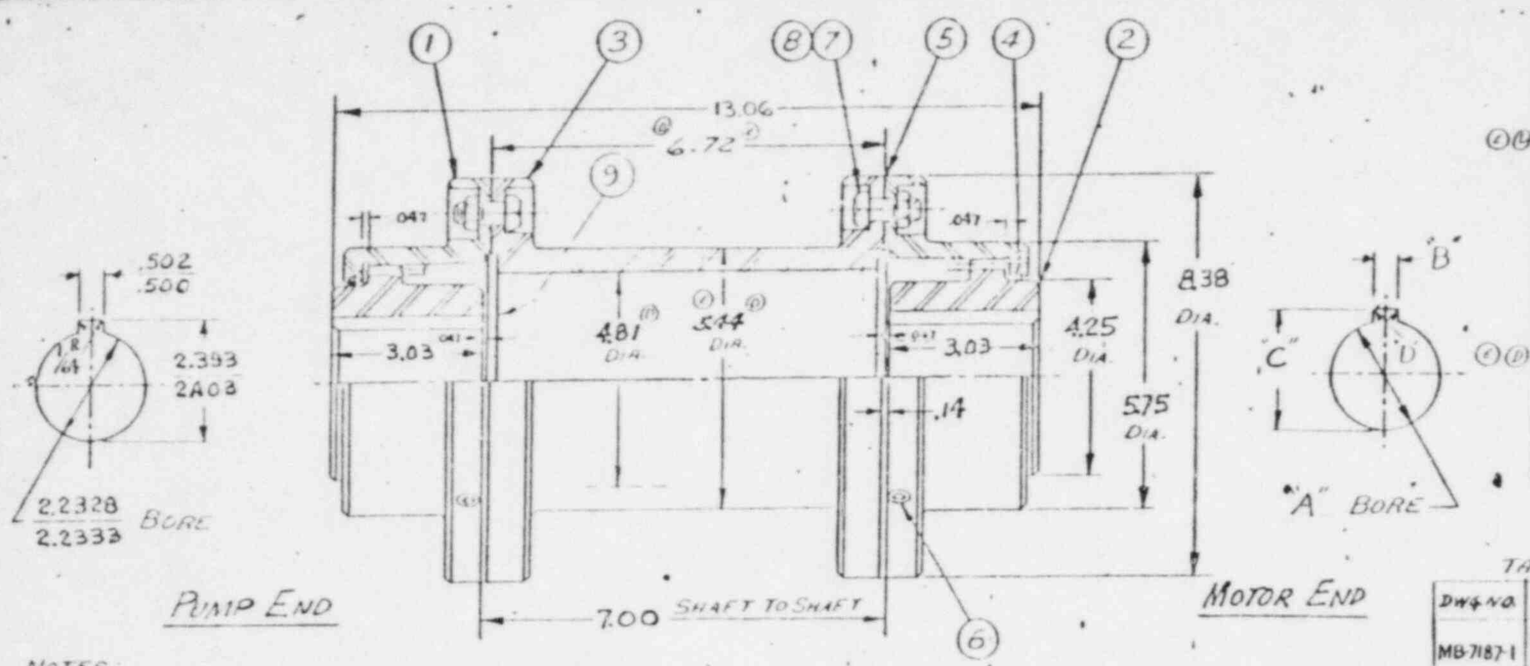
ENVIRONMENTAL PARAMETER	POSTULATED	SPECIFICATION
MAXIMUM TEMPERATURE (°F)	120	130
MAXIMUM PRESSURE	ATM	ATM
MAXIMUM RELATIVE HUMIDITY	95%	NOT SPECIFIED
CONTAINMENT SPRAY	NOT APPLICABLE	NOT APPLICABLE
40 YEAR NORMAL RADIATION DOSE (RADS)	1.2×10^7	1×10^7
ACCIDENT RADIATION DOSE RADS	INCLUDED IN NORMAL DOSE	INCLUDED IN NORMAL DOSE
TOTAL RADIATION DOSE (RADS)	1.2×10^7	1×10^7
SUBMERGENCE (YES/NO)	NO	NO

FLUID CONDITONS: DILUTED BORATED WATER: 40° TO 100°F, 0 - 35 FT.

ACCIDENT SUMP WATER: 40 TO 300°F, 0 TO 350 FT.

3.0 PUMP OUTLINE DRAWINGS


PACIFIC PUMPS
PACIFIC PUMPS DIVISION — DRESSER INDUSTRIES, INC.
WELD TABLE
SECTION A
SECTION B
DETAIL
REVISION
JHF ASSEMBLY



LIST OF MATERIAL

ITEM NO.	NAME	PART NO.	NO. REQD
1	SLEEVE	40072-2	2
2	HUB	40070-0	2
3	SPACER	61610-30	1
4 *	"O" RING	23750-41	2
5 *	GASKET	40257-25	2
6 *	LUBE PLUG	23752-3	4
7 *	BOLT, HEX HD	40254-2	20
8 *	NUT, HEX.	26149-5	20
9	BAFFLE PLATE	40267-3	2

* RECOMMENDED SPARE PARTS.

TABULATED HUB BORES

DWG NO.	A	B	C	D
MB-7187-1	2.3730 2.3735	.627 .625	2.646 2.661	1/64 R
MB-7187-2	2.8730 2.8735	.752 .750	3.200 3.215	1/64 R
MB-7187-3	7/8	—	—	—

SEP 25 1975

NOTES:

1. COUPLING RATING: 85 H.P. PER 100 R.P.M. MAX. R.P.M. - 3600
2. COUPLING TO TRANSMIT 400 H.P. AT 3600 R.P.M.
3. MISALIGNMENT CAPACITY:
   ANGULAR ± 1½° PER GEAR MESH.
   EQUIVALENT PARALLEL OFFSET = .292 IN.
4. MATERIAL: GEAR ELEMENTS - AISI-1045 STEEL.
5. COUPLING WILL MEET AGMA BALANCE CLASS 7
6. FOR INSTALLATION AND LUBRICATION INSTRUCTIONS SEE FORM 104-SH.
   MISALIGNMENT SHOULD NOT EXCEED 20% OF ANGULAR NOR 10% OF PARALLEL CAPACITIES.
7. RECOMMENDED QUANTITY OF LUBE (MIN.) .25 QUARTS EACH END.
8. RECOMMENDED BOLT TIGHTENING TORQUE = 69 FT. LBS.
9. COUPLING WEIGHT: MB-7187-1: [illegible] MB-7187-2: [illegible] FINISHED BORE)
10. WR^2 = 479 LBS. IN^2 (SOLID HUBS)
11. TORSIONAL STIFFNESS = 8.208×10^6 IN.-LBS. PER RADIAN (MB-7187-1)
    = 9.322×10^6 IN.-LBS. PER RADIAN (MB-7187-2) (INCLUDES 1/3 SHAFT PENETRATION)
12. COUPLING WILL BE MATCHMARKED END A-A, & END B-B.

JOB NO.	PUMP S/N	PLANT/SPIN NO'S
JC49218	49758/59	CAE-SIAPSI-1/2
JD49218	49760/61	CBE-SIAPSI-1/2
JE49218	49762/63	CCE-SIAPSI-1/2
JF49218	49764/65	CDE-SIAPSI-1/2

LETTER	REVISION - WAS	C.N. NO.	BY	CK	APPD	DATE
E	[illegible]	—				9-22-75
D	REVISED TO ORIGINAL DESIGN	—	CM			8-15-75
C	6.72 WAS 6.69	—				7-1-75
B	REDESIGNED SPACER	—				1-20-75
A	GEN. REV. PER CUSTOMER REQUEST	—				12-10-74

REF. SUPERSEDES	DR. BY	CK. BY	APPROVED	DATE	SCALE	FILE
				5-17-74	~	A18

SPECIAL-FE-102½ BALANCED W/ 3/16 L.E.F.
AMERIGEAR FULLY-CROWNED TOOTH FLEX CPLG

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Z.I. ORDER NO. 75-63361

CERTIFIED CORRECT

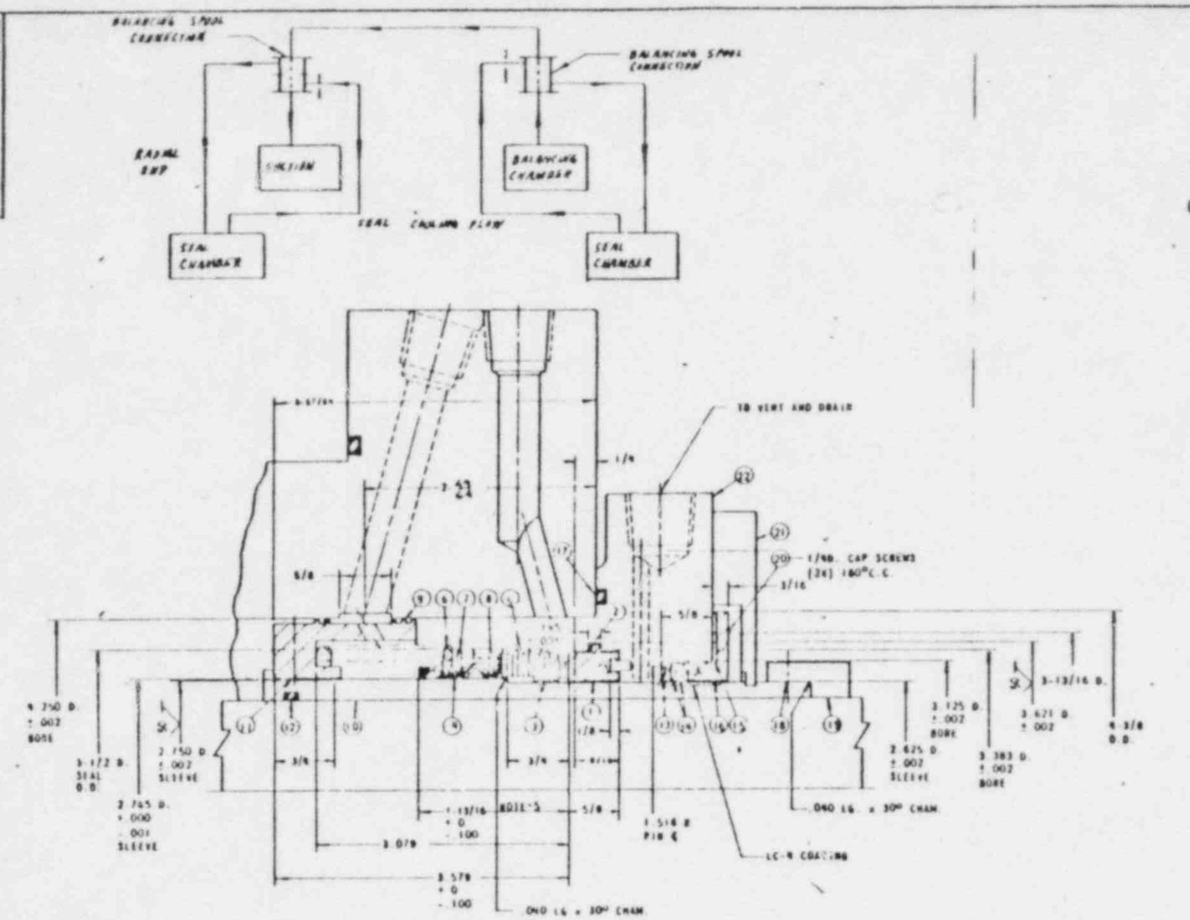
CUSTOMER: PACIFIC PUMPS

CUSTOMER ORDER NUMBER: 71435

ZURN INDUSTRIES, INC
ERIE PA 16512 U.S.A.

DRAWING NO. MB-7187

9



ITEM	*	PART NUMBER			MTL CODE	PART NAME		REQ'D	MATERIAL	
1		D	2625	656	9200	[illegible] RING		1	T.C. AMQ200	A
2			1866	15	8807	"O" RING		1	CRANELAST **	A
3	*	D	2750	332	9003	PRIMARY RING		1	CARBON AMQ2003	A
4	*	E	2750	50	8804	BELLOWS		1	CRANELAST **	*
5	*	D	2750	229	4502	RETAINER		1	304SS ASTM-A-276	
6	*	BJ	4261		4530	SPRING		1	304SS QQ-W-423B	
7	*	D	2750	92	4502	DRIVE BAND		1	304SS ASTM-A-276	
8	*	D	1382		4502	DISC		1	304SS ASTM-A-276	
9	*	D	2750	758	4502	PUMPING RG		1	304SS ASTM-A-276	
10		BY	CUST			SLEEVE				
11	*	5/16-24x5/8 LG 1131-2410-000			8539	SET SCREW		4	304 SS ASTM-A-493	
12		BY	CUST			"O" RING				
13			4267		4030	SPRING			AMS-5529 CM900 17-7 PH	*
14		D	2625	669	4033	PACKING ASS'Y		1	304 SS/1625 BF ASTM-A-276	*
15		D	2125	295	7350	GASKET		1	ASTM-D-1191-B	A
16		D	2625	666	4502	AUX. GLAND		1	304SS ASTM-A-276	
17		BY	CUST.			"O" RING				
18		BY	CUST.			SET SCREW				
19		BY	CUST.			COLLAR				
20		BY	CUST.			CAP SCREW				
21		BY	CUST.			SPACER				
22		BY	CUST.			GLAND FL.				

**
8807 MTL CODE ASTM-D-2000(2BA 810C 12:17)
8804 MTL CODE ASTM-D-2000(2BA 710C 12:17)

PLT	SPIN NO.	SERIAL NO.
NEG	SIAPSI 162	49/54/55
GN	SIAPSI 162	57029/49737
CAL	SIAPSI 162	49758/59
KAL	SIAPSI 162	49760/61
CCE	SIAPSI 162	49762/63
CDE	SIAPSI 162	49764/65

*** 220 PSIG MAX.
STUFF. / BOX
PRESS

**** 140° F NORMAL
300° F 4 HRS MAX

4. SEAL SUPPLIED WITH CRANELAST. KEEP OIL FROM CONTACTING ELASTOMERIC PARTS. FOR INSTALLATION USE PROPYLENE GLYCOL GLYCERINE OR DISTILLED WATER.
3. SEAL MUST BE INSTALLED IN AN UPEN POSITION TO ALLOW INTERNAL CLEARANCE FOR SHAFT MOVEMENT.
2. VENT GAS OUT OF SEAL BEFORE STARTUP.
1. [illegible] PRESSURE IN SEAL CAVITY [illegible] DURING OPERATION.
. CLEAN SEAL FACES BEFORE FINAL ASSEMBLY.
. BEFORE INSTALLING SEAL LUBRICATE ITEMS # 2 & 14

(5/3 A-3F-1786-6

CODE					* PART OF ASSEMBLY / • SPECIAL PART
θ_{40}	F_3	1	9	1	

REAL ASSY. NO. D-2750-757
NEXT ASSY. NO.
SPEC. NO.

OPERATING CONDITIONS
LIQUID BORATED WATER SP. GR. 1.0
2.2% BORIC ACID (8)
3570 R.P.M. TEMP. **** °F PRESS *** 30 MIN PSI SUCT 1750 MAX PSI DISCH
UNIT REF. PUMP [illegible] 10 SS PUMP BY PACIFIC PUMP CO.
(8) S/N [illegible]
M/P REF.
PACIFIC PUMP DWG NO NUMBER DT'D 12-7-73
P.O. # 60581 JOB # 5249-218

REV (4) REV. 10-28-74 02921
(8) REF. B.W. 14 23195
(6) REV. 12/23/75 01579
(5) REV. [illegible]
STD APP. [illegible]

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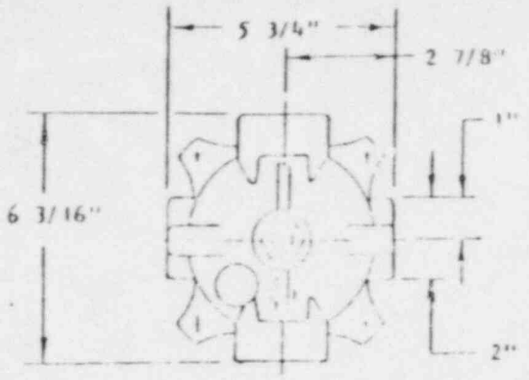
John Crane
CRANE PACKING COMPANY
6400 W. OAKTON ST. MORTON GROVE, ILL.

DR. R.S.
CK.
APP.
DATE
SCALE 1:1

TYPE - 1B
2-3/4 SHAFT SEAL
PACIFIC PUMP CO.

DWG. NO. A-3F-1786-5

(6) 278-J49218 5-4-76



MANUFACTURER - AMF CUNO DIVISION

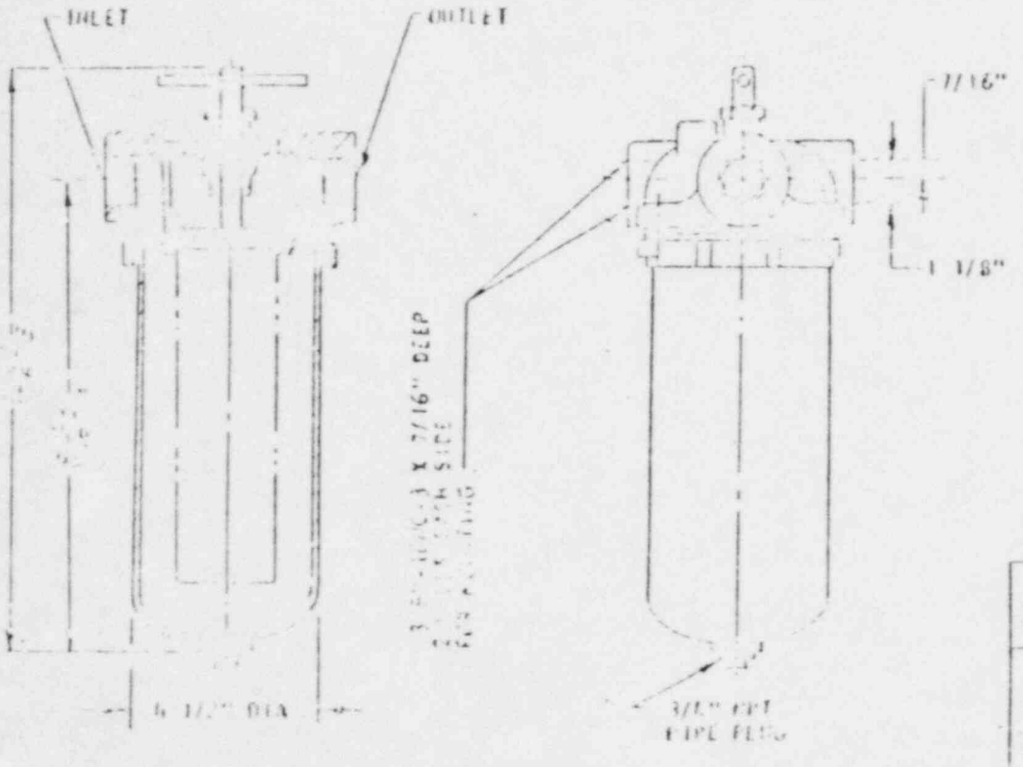
TYPE . EG . . AUTO-KLEAN . . . . . .
FURNISHED WITH BUILT-IN DIFFERENTIAL PRESSURE BY-PASS VALVE, SET AT 10 PSI DIFFERENTIAL.

INLET / OUTLET SIZE . 1" NPT . . . . . .

CARTRIDGE: SIZE . 5" . . . . MATERIAL . BRONZE . .

SPACING 0.005" . . . . . .

MATERIAL OF: HEAD CAST IRON . SUMP . STEEL . . . . .



WESTINGHOUSE NO.S

3" - JHF - 10 STAGES

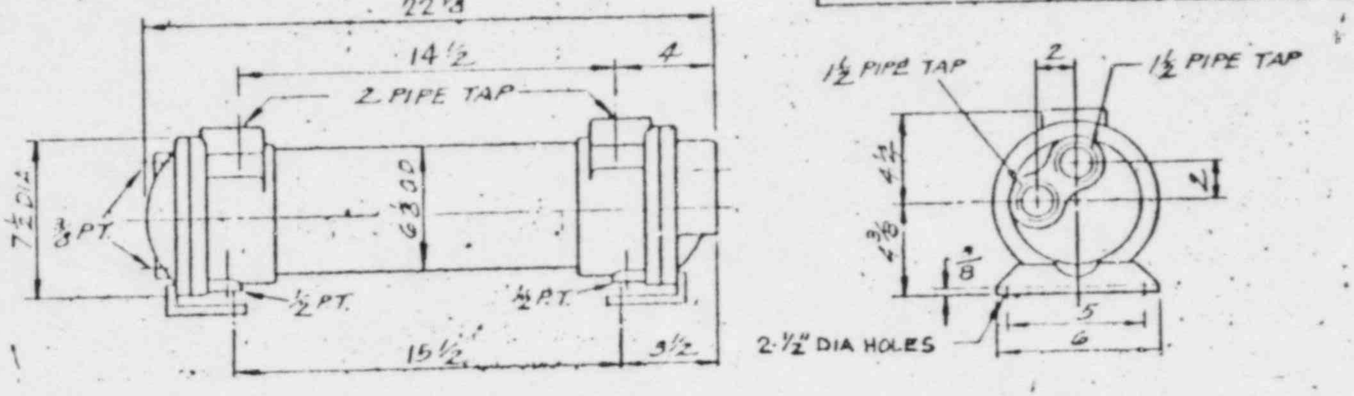
SAFETY INJECTION PUMPS

PP SHOP ORDER NO.	PUMP SERIAL NO.	PLANT AND SPIN NO.
JA 49218	49754/55	GBE-SIAPSI-1/2
JB 49218	49757	GBE-SIAPSI- 2
JC 49218	49758/59	GBE-SIAPSI-1/2
JD 49218	49760/61	GBE-SIAPSI-1/2
JE 49218	49762/63	GBE-SIAPSI-1/2
JF 49218	49764/65	GBE-SIAPSI-1/2
JG 49218	52079	GBE-SIAPSI-1

2	5-4-76 G.W. / 8-23-76 F.C. GBE SIAPSI-1/2 & PUMP SERIAL NUMBER HAS BEEN REVISED		
1	3-25-76 R.A. / 5-14-76 F.C. REVISED PLANT & SPIN NO'S DRAWING NO JLF 49758 SUPERSEDED BY THIS REV	WESTINGHOUSE (PACIFIC PUMPS)	
		DWG. NO. 49754	REV. C

CO

	DESIGN PRESS	TEST PRESS	TEMP
TUBE SIDE	150#	295#	200°F
SHELL	150#	235#	200°F



CERTIFIED FOR CONSTRUCTION BY
AMERICAN STD HEAT TRANSFER DIV.

A.S.M.E. SECT. III CL.3

NO.		QTY	DESCRIPTION	MAT'L	SPEC	PATTERN NO OR SIZE	PART NUMBER	CHG	REMARKS
10	HEAT NO.	4	STUD 2 1/4 LG	ALLOY STL	SA193 B7	3/8 DIA - 16 TPI TFL	2-012-5-06-901-09	A	
9	-	2	SUPPORT FOOT	STL			3-425-5-06-201-01	B	
8	HEAT NO.	12	STUD	ALLOY		3/8 DIA -16 TPI - TFL	2-012-5-06-901-08	A	
7	HEAT NO.	16	HEX NUT		SA194 2H	3/8 DIA -16 TPI	2-122-5-00-902-03	A	
6		2	PROTECTOR RODS	ZINC		3/8 P.T.	3-386-9-03-101-16	A	
5		1	GASKET	A-S	MIL A		3-298-8-06-110-03	A	
4		1	GASKET	A-S	MIL A		3-298-8-06-110-01	A	
3	HEAT NO.	1	BONNET				3-112-6-06-815-01	B	
2	HEAT NO.	1	BONNET				3-093-6-06-115-01	B	
1		1	CORE ASSEMBLY				4-446-06-018-001	A	

MATERIAL	ASTM	ASME	CORR
[illegible]			

TOLERANCE UNLESS OTHERWISE SPECIFIED

AMERICAN STANDARD
HEAT TRANSFER PRODUCTS DEPT.

TITLE 06018 SSC EXCHANGER

5-162-06-018-003

2

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

DRAWING NOT TO SCALE

S	SUCTION FLG 4" 600 ASA STD R.F. FLG 8 O.D. 7/8 THICK RAISED PORTION 6 3/16 DIA 1/16 THICK 8-3/4" DIA HOLES ON 7-1/2 DIA B.C. SEE NOTE 10
P-D1	DISCH FLG 3" 1500 ASA STD R.F. FLG 10 1/2 O.D. 1-7/8 THICK RAISED PORTION 5" DIA 1/4 THICK 8-1-1/8" DIA HOLES ON 8 DIA B.C. SEE NOTE 10
P-D4	DRAIN, DRIP POCKET 1" NPT
P-V1	VENT, PUMP CASE - SEE NOTE 9
S-F1	SEAL FLUSH INLET 1/2 NPT (NOTE 3)
S-F2	SEAL FLUSH OUTLET 1/2 NPT (NOTE 3)
S-F3	SEAL FLUSH LINE CONN - TO SEAL 1/2 NPT (NOTE 3)
S-F4	SEAL FLUSH LINE CONN - FROM SEAL 1/2 NPT (NOTE 3)
B-E1	3/4 NPT THERMOCOUPLE CONDUIT & CONN - SEE NOTE 18
B-E2	3/4 NPT THERMOCOUPLE CONDUIT & CONN - SEE NOTE 18
B-E3	3/4 NPT THERMOCOUPLE CONDUIT & CONN - SEE NOTE 18
L-RR	LUBE OIL RESERVOIR CAPACITY 5 GAL
L-D1	LUBE OIL RESERVOIR DRAIN - 3/4 NPT - PLUGGED
L-C1	LUBE OIL INLET TO COOLER 1" NPT - SEE NOTE 2
L-C2	LUBE OIL OUTLET FROM COOLER 1" NPT - SEE NOTE 2
H-D1	BASE DRAIN 2" S.W.
H-R1	10-1" DIA HOLES FOR FOUNDATION ANCHOR BOLTS
H-R2	18 - GROUT HOLES 4" DIA
V-T1	TERMINAL BOX
J-W1	LUBE OIL COOLER COOL WATER INLET 1" NPT - PLUGGED FOR SHIPMENT - SEE NOTE 4 & 10
J-W2	LUBE OIL COOLER COOL WATER OUTLET 1" NPT - PLUGGED FOR SHIPMENT - SEE NOTE 14

WEIGHTS

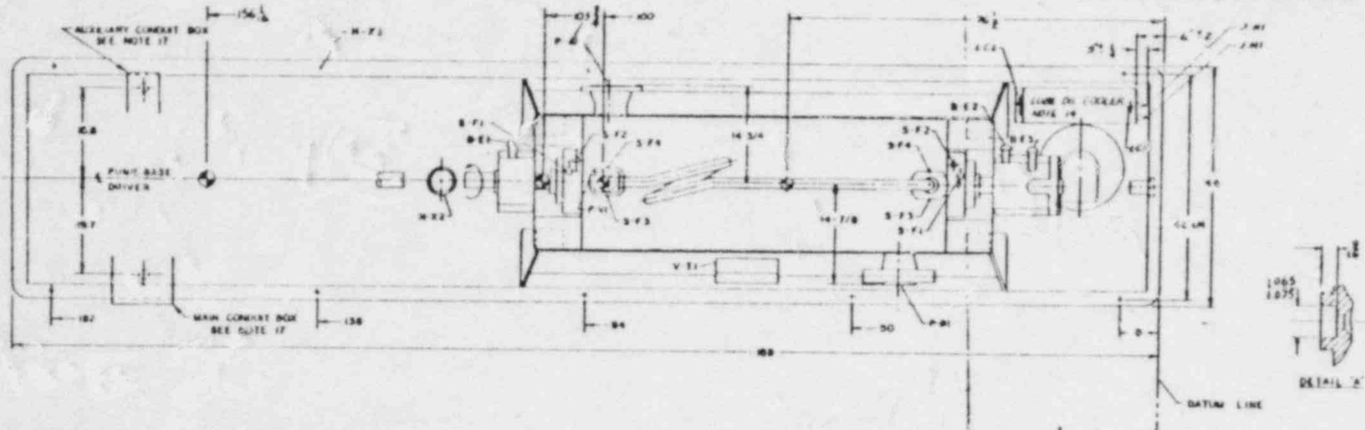
PUMP 5,260
BASE 4,070
DRIVER 3,045
TOTAL 12,375

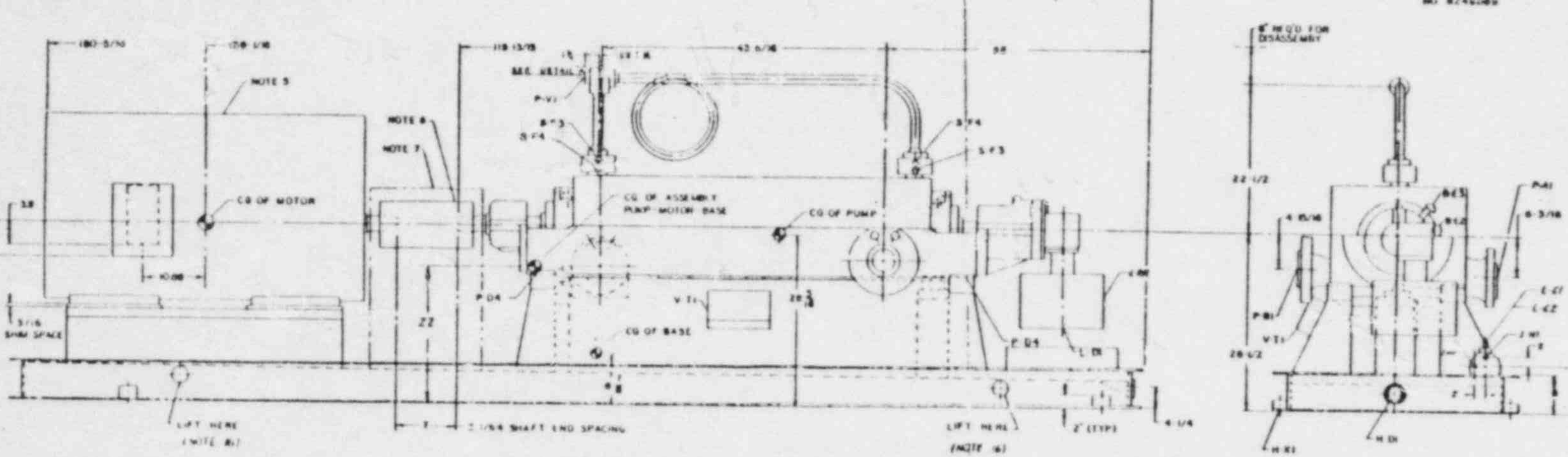
GENERAL INFORMATION NOTES

1. ASSEMBLY DWGS
   PUMP ASSEMBLY AX2-49704
2. BEARING LUBE - FORCED OIL
   LUBE OIL PIPING BY PP PER DWG PLO-49738
3. SEAL FLUSH PIPING BY PP PER DWG PSF-49754
4. COOLING REQUIREMENTS
   TO LUBE OIL COOLER
   33 GPM AT 100°F 150 PSI(MAX)
   MINIMUM ALLOWABLE COOLING WATER TEMPERATURE 15 ±3° F.
5. DRIVER BY PP
   MOTOR MANUFACTURER WESTINGHOUSE
   HP 400 RPM 3600 FRAME/TYPE 5010TH
   VOLTS 4000 PHASE 3 HERTZ 60
   DWG 8248089
6. COUPLING BY PP
   MAKE ZURN SIZE 102 1/2
   TYPE EE
   L.E.F. SEE NOTE 11
   DYNAMICALLY BALANCED
7. COUPLING GUARD BY PP
   HINGED TYPE
8. PIPING AND EQUIPMENT MAY OVERHANG BASE
9. FURNISHED WITH CONNECTION 3/4" SCH 160 PIPE SEE DETAIL "A"
   TAPE SEALED FOR SHIPMENT
10. FLANGES COVERED WITH WOODEN DISCS
11. THIS COUPLING HAS LIMITED END FLOAT (LEF) TO PREVENT MOTOR SHAFT THRUST COLLAR FROM CONTACTING AND DAMAGING MOTOR SLEEVE BEARING IT IS NECESSARY TO POSITION THE MOTOR SO THAT WHEN THE MOTOR SHAFT IS PULLED ALL THE WAY TOWARD DRIVEN EQUIPMENT, THE DISTANCE BETWEEN BOTH SHAFT ENDS IS 1/8" LESS THAN SPACING INDICATED
12. MAXIMUM ALLOWABLE DESIGN PUMP NOZZLE LOADS
    REFERENCES
    SPECIFICATION E 678815 REV 2
    TABLE 3.1.21.4.2

LOAD DESCRIPTION	PUMP NOZZLE SUCTION	PUMP NOZZLE DISCHARGE
AXIAL	2105 LBS	2005 LBS
SHEAR	2105 LBS	2005 LBS
BENDING	1778 FT-LBS	1252 FT-LBS
TORSIONAL	1778 FT-LBS	1252 FT-LBS

13. MAXIMUM ALLOWABLE DESIGN COOLER NOZZLE LOADS PIPING LOADS SHALL BE LIMITED TO LOADS IMPOSED BY A 1 INCH SCHEDULE 40 SA 106 GRADE "A" PIPE ON THE COOLING WATER SIDE AND SCHEDULE 40 SA 106 GRADE "B" ON THE LUBE OIL SIDE
14. LUBE OIL COOLER BY PP MAKE AMERICAN STANDARD, TYPE SSCF-C, SIZE 06048 DWG NO 5-162-06-015-003 COOL WATER INLET AND OUTLET CONNECTIONS REDUCED FROM 1-1/2 NPT 1" NPT REDUCERS OF SA-479 OR 304 OR 316 MATERIAL
15. RECOMMENDED FOUNDATION ANCHOR BOLTS 3/4 SIZE, A 307 GR A OR EQUIVALENT MATERIAL.
16. 2-1/2 PIPE WITH 2.469 (NOM) I.D. ACROSS FULL BASE WIDTH
17. FOR HOLES AND DRILLING AREAS IN CONDUIT BOXES SEE MOTOR DRAWING NO 8248089
18. THERMOCOUPLE WILL BE WIRED TO COMMON TERMINAL BOX
    SEE DWG 570 JC49218 TEMP DETECTOR
    SEE DWG 383 JC49218 WIRING DIAGRAM & TERMINAL BOX
    SEE DWG 576 JC49218 DRILL FOR TEMP DETECTOR
    THE SIDES OF THE TERMINAL BOX MAY BE DRILLED 1/2" DIA MAX FOR CONDUIT OUTLET





WESTINGHOUSE NES

3" JHF 10 STAGES

PO# 546 CAL 197083	CAE	5J49 218	S/N	49758/59
546 CAL 197084	CBE	5J49 218		49760/61
546 CAL 197087	CCE	5J49 218		49762/63
546 CAL 197088	CDE	5J49 218		49764/65

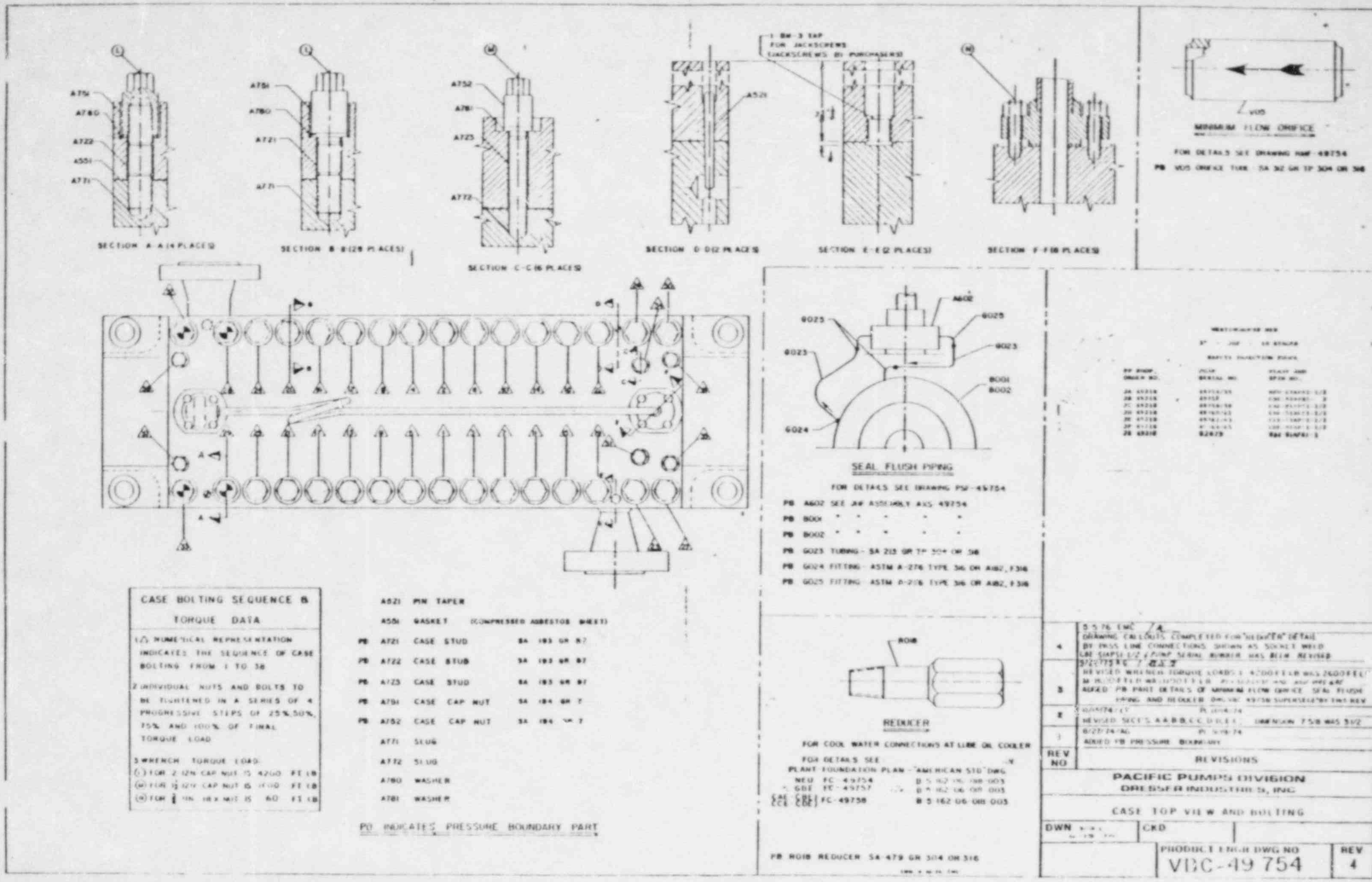
PACIFIC PUMPS DIVISION
DRESSER INDUSTRIES INC

TITLE: FOUNDATION PLAN

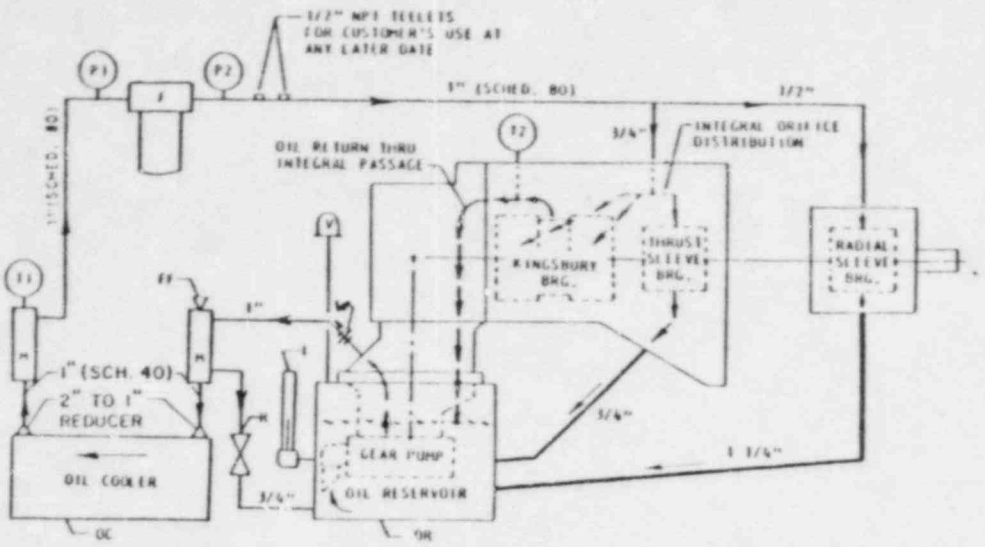
FC-49758

REV	DESCRIPTION	ZONE
REV 6	REVISED NOTE ...	
REV 5 DATE 8-12-76	REVISED NOTES 3, 5, 12 WEIGHTS ADDED ... NOTE 18 ... OF ASSY PUMP MOTOR BASE	A-1
REV 4	SOC WELD CONNS WERE BUTT WELD	
REV 3 DATE 1-21-75	REDRAWN TO MICROFILM QUALITY ...	ALL
REV 2 DATE 11-21-74	DWG UPDATED CONN P-D2 (NOZZLE DRAIN) REMOVED, DWG CERTIFIED	ALL
REV 1 DATE 5-15-74	REVISED MOTOR INFO PP S/O No	A1

10



SECTION A-A (4 PLACES)
SECTION B-B (28 PLACES)
SECTION C-C (6 PLACES)
SECTION D-D (2 PLACES)
SECTION E-E (2 PLACES)
SECTION F-F (8 PLACES)
MINIMUM FLOW ORIFICE
FOR DETAILS SEE DRAWING
SEAL FLUSH PIPING
FOR DETAILS SEE DRAWING PSI-49754
PB G023 TUBING - SA 213 GR TP 304 OR 316
PB G024 FITTING - ASTM A-276 TYPE 316 OR A182, F316
PB G025 FITTING - ASTM A-276 TYPE 316 OR A182, F316
CASE BOLTING SEQUENCE & TORQUE DATA
1. NUMERICAL REPRESENTATION INDICATES THE SEQUENCE OF CASE BOLTING FROM 1 TO 38
2. INDIVIDUAL NUTS AND BOLTS TO BE TIGHTENED IN A SERIES OF 4 PROGRESSIVE STEPS OF 25%, 50%, 75% AND 100% OF FINAL TORQUE LOAD
3. WRENCH TORQUE LOAD
A521 PIN TAPER
A551 GASKET (COMPRESSED ASBESTOS SHEET)
PB A721 CASE STUD
PB A722 CASE STUD
PB A723 CASE STUD
PB A751 CASE CAP NUT
PB A752 CASE CAP NUT
A771 SLUG
A772 SLUG
A780 WASHER
A781 WASHER
PB INDICATES PRESSURE BOUNDARY PART
REDUCER
FOR COOL WATER CONNECTIONS AT LUBE OIL COOLER
FOR DETAILS SEE
PLANT FOUNDATION PLAN - AMERICAN STD DWG
PB R018 REDUCER SA 479 GR 304 OR 316
REVISIONS
REV NO
PACIFIC PUMPS DIVISION
DRESSER INDUSTRIES, INC.
CASE TOP VIEW AND BOLTING
DWN
CKD
PRODUCT ENGR DWG NO
VBC-49 754
REV
4



NOTES:
1. ALL PIPE, SCHED. 80 EXCEPT AS NOTED - MATERIAL ASTM A-106, GR. B.
2. ALL PIPE FITTINGS, 2000# MAT'L ASTM A-105 GR. 2 SCREWED AND SEAL WELDED EXCEPT AT INSTRUMENTS, BEARING HOUSINGS, OIL COOLER, OIL RESERVOIR, GEAR PUMP, FILTER AND UNION COLLARS.
3. REDUCERS, WHERE REQUIRED, ARE SWAGE NIPPLES OR REDUCER COUPLINGS. 2"TO1" REDUCERS AT OIL COOLER ARE HEX HEAD REDUCER BUSHINGS.

ITEM	SIZE/NPT	DESCRIPTION
F	1"	FILTER - [illegible]ND, CAT. NO 12318-01, 5" CARTRIDGE - BRZ. - 0.005 SPACING
FF	3/4"	PLUG - COOLER FILLER CONNECTION
L	1/4"	OIL LEVEL GAUGE - LUNKENHEIMER, CAT. NO 528
M		BARSTOCK MANIFOLD - BY PP, MATERIAL ASTM A-576 GR 1020
OC		OIL COOLER - AMERICAN STANDARD TYPE-SSCF-C; SIZE-0618
OR		OIL RESERVOIR - BY PP, MATERIAL, CARBON STEEL WITH #4 SOC-CO 0.006" THICK PLASTIC COATING.
P1	1/4"	PRESSURE GAUGE - ASHCROFT, CAT. NO 1122KE, 0-60 PSI, 2-1/2" DIAL.
P2	1/4"	PRESSURE GAUGE - ASHCROFT, CAT. NO 1122KE, 0-30 PSI, 2-1/2" DIAL
R	3/4"	RELIEF VALVE - FARFLO, CAT. NO VS-4 WITH SS PISTON AND 7-35 SPRING. ADJUST VALVE SO THAT PRESSURE GAUGE P2 INDICATES 8 - 10 PSIG
T1	1/2"	THERMOMETER - ASHCROFT, CAT. NO 30L160L-4-50/300 F AND 3/4" NPT 316-SS WELL
T2	1/2"	THERMOMETER - ASHCROFT, CAT. NO 30E160L-4-50/300 F AND 3/4" NPT 316-SS WELL WITH 1/2" NPT CARBON STEEL ADAPTER (PART #5015, MOUNTED ON BEARING HOUSING)
V	3/8"	AIR VENT - RENDER SKINNER, MODEL NO 569022
W	1"	UNION WITH CHECK VALVE - "CHECK ALL" STYLE UNV

WESTINGHOUSE NCS

3" - JHF - 10 STAGES

SAFETY INJECTION PUMPS

PP SHOP ORDER NO.	PUMP SERIAL NO.	PLANT AND SPIM NO.
JB 49218	49757	GBE-SIAPSI-1/2
JC 49218	49758/59	CAE-SIAPSI-1/2
JD 49218	49760/61	CBE-SIAPSI-1/2
JE 49218	49762/63	CCE-SIAPSI-1/2
JF 49218	49764/65	CDE-SIAPSI-1/2
JG 49218	SE073	GBE-SIAPSI-1

NO	REVISION	DRN	AG	CHKD	DATE
2	ADDED ITEM "W" REVISED NOTE 3, SPIM NOS	EEJ	7-23-75		
1	ADDED 2" TO 1" REDUCER TO OIL COOLER	EEJ	7-23-75		

(DRESSER) PACIFIC PUMPS DIVISION

LUBE OIL PIPING | PLO-49758 | REV 2

TABLE 1

PACIFIC PUMPS, INC.

PARTS LIST

OUR ORDER NO. J49218 — P.O.N. WESTINGHOUSE ELECTRIC CORP

PCS PER UNIT	TOTAL REQ'D	PART NO	DESCRIPTION	PATTERN NO	DRAWING NO	LINE NO	COLUMN NO	MATERIAL NO	HEAT TREAT	PRICING
1	12	A001	FLEV 10 STG FINAL 3 JHF CASE		D15145			393		
1	12	A053	BUSH FINAL SP 13 PRESS REDUCING		C17677	1		132	25	SP
1	12	A538	DOWEL PR SP 20 1/2X1/8LG					23		SP
2	24	A521	PIN TAPER P/F 10X6LG		JT1000	6		14		
1	12	A551	GASKET 1/64THK					347		
1	1	A551	CASE PARTING FLG GASKET 57X22X1/64THKB					347		
1	2	A602	SP4 BY PASS ASSY C		D16468			192		SP
2	24	A612	FLEXITALLIC CG 6E GSKT					266		
8	96	A613	SP20 5/8 11NCX4 3/4LG STUD TFL					259		SP
8	96	A614	SP20 5/8 11NC NUT HEX					383		SP
32	384	A751	CASE CAP NUT SP 6 2		B20277			383		SP
6	72	A752	CASE CAP NUT SP 6 1 1/2		B20279			383		SP
32	128	A771	SLUG P/F 2		A62221	9		14		
6	24	A772	SLUG P/F 1 1/2		A62221	5		14		
1	12	B001	FINAL RAD SP 8 3 SEAL HSG CCW		D15269					SP
1	12	B002	FINAL THR SP 8 3 SEAL HSG CCW		D15270					SP
2	24	B010	GASKET SEAL HSG ARP 568 369					376		
2	2	B010	SEAL HOUSING GASKET ARP 568 369 B					376		
12	144	B211	SCR SOC CAP SP20 3/4 10NCX3 1/4LG					552		SP
10	120	B005	SP 20 3 SHAFT SPLIT RING		A61893			42	21	SP
10	120	B037	BOTH END RD SP 20 KEY IMP		A20207	12	1	23		SP
1	12	B010	FINAL CLR.010.012 SP12 3 SLEEVE PR		B20198	2		22	60	SP
1	12	B013	BOTH ENDS RD SP20 KEY SLV PR		A20207	12	1	23		SP
1	12	B014	KEY FLEX CPLG ONE END RD ONE END SQ		A20236	6	1	14		
1	12	B040	SP 13 LOCKNUT IMP SUCT END		A61892			42	21	SP
1	12	B042	SP 13 LOCKNUT SLV PR		A61891			42	21	SP
1	12	B044	SP 13 SLV IMP SPACER 1ST STG		A61897	9		42	21	SP
1	12	B045	SP 13 SLV IMP SPACER 2ND STG		A61897	8		42	21	SP
1	12	B046	SP 13 SLV IMP SPACER 3RD STG		A61897	7		42	21	SP
1	12	B047	SP 13 SLV IMP SPACER 4TH STG		A61897	6		42	21	SP
1	12	B048	SP 13 SLV IMP SPACER 5TH STG		A61897	5		42	21	SP
1	12	B049	SP 13 SLV IMP SPACER 6TH STG		A61897	4		42	21	SP
1	12	B050	SP 13 SLV IMP SPACER 7TH STG		A61897	3		42	21	SP
1	12	B051	SP 13 SLV IMP SPACER 8TH STG		A61897	2		42	21	SP
1	12	B052	SP 13 SLV IMP SPACER 9TH STG		A61897	1		42	21	SP
1	12	B068	SP 13 WRG RING SUCT SPACER		A61894			132	25	SP
3	36	B069	INTERM CVR WRG SP 20 LOCKING KEY		A22985	2		23		SP
1	12	B084	SP20 3 DISCH DIFF SPCR RG CLR.010.020		A61898	1		23		SP
9	108	B086	SP 13 WRG RING CVR INTERM		A61895			132	25	SP
27	324	B087	SP 20 LOCKING KEY WRG RING		A22985	2		23		SP
9	108	B089	SP 13 BUSH CVR INTERM		A61896			132	25	SP
27	324	B090	SP 20 LOCKING KEY BUSH CVR INT		A60504	6		23		SP
10	120	B095	INTERM&SUCT SPACER O RING CVR		B12574	23		374		
10	10	B095	COVER O RING ITERM & SUCT SPACER B		B12574	23		374		
2	24	B501	SCR SOC CUP PT SP 20 1/4 20NCX3/8LG					23		SP
10	120	B537	DOWEL CIESUCT SPACER SP20 1/4X3/4LG					23		SP
9	108	B511	DOWEL SLV SPACER SP20 3/32X3/8LG					23		SP
1	12	E001	HSG RAD BRG U/H & KBURY	M5739	D15148	1		2		
1	12	E001	HOUSING RAD BRG L/H	M5758	D15148	1		2		
1	12	E020	BEARING RAD SLV		C10602	3		277		

Table 1 (Continued)

PACIFIC PUMPS, INC.

PARTS LIST

OUR ORDER NO. J49218 FOR WESTINGHOUSE ELECTRIC CORP.

PCS UNIT	TOTAL REQD	PART NO	DESCRIPTION	PATTERN NO	DRAWING NO	LINE NO	COLUMN NO	MATERIAL NO	HEAT TREAT	PROCESS
1	1	F020	RADIAL BRG SLEEVE B		E10602	3		277		
1	12	F024	BAFFLE STAT OIL 2 HLVS OUTER		B12426	1	3	11		
1	12	F025	BAFFLE STAT OIL 2 HLVS INNER		B12426	1	3	11		
1	12	F029	DEFLECTOR RING		A17097	3		11		
1	12	F001	HOUSING THR BRG L/H	M6283	B15149	1		2		
1	12	F001	HOUSING THR BRG 6 KBURY U/H	M6282	B15149	1		2		
1	12	F017	BEARING THR SLV		E10519	3		277		
1	1	F017	THRUST BRG SLEEVE A		E10519	3		277		
1	12	F020	BAFFLE STA OIL 2 HLVS INNER		B12426	1	3	11		
1	12	F022	DEFLECTOR RING		A17097	3		11		
1	12	F025	COVER END CCW	M6284	B07637			2		
1	12	F030	BEARING THR LESS COLLAR 6 JHJ KBURY		LE0100	6				
12	12	F030	THRUST BRG SHOE 6JHJ KBURY B							
1	12	F037	COLLAR THR 6 KBURY		B11343	19		15		
1	1	F037	COLLAR THR 6 KBURY B		B11343	19		15		
1	12	F038	KEY THR COLLAR BOTH ENDS ROUND		A20210	2	1	14		
1	12	F039	SPACER THR COLLAR		B18100	6	16	165		
1	12	F040	NUT THR CCW POT LH THREAD		A25041			68	16	
1	12	F042	PLATE RETAINER INNER		A23355			14		
1	12	F043	PLATE RETAINER OUTER		A23398			11		
1	12	F045	HOUSING GEAR PUMP	M5747	D06151	2		11		
1	12	F046	COVER GEAR PUMP		A19302			11		
1	12	F054	WORM PUMP SFT		A19630	1		89		
1	12	F055	KEY WORM		A20207	23	1	14		
1	12	F056	EA LOCKNUT & WASHER SKF N W 06		LH0100		6			
1	12	F058	SHAFT GEAR PUMP		A19316			185		
1	12	F059	COLLAR THR WORM G		A19315	1		185		
1	12	F060	GEAR WORM		A19631			106		
1	12	F061	KEY GEAR WORM		A20207	17	2	14		
1	12	F062	EA LOCKNUT & WASHER SKF N W 04		LH0100		4			
1	12	F065	GEAR PUMP		B10744	2		89		
1	12	F066	KEY GEAR PUMP		A20207	21	1	14		
1	12	F067	SHAFT IDLER GEAR		A19317			185		
1	12	F068	GEAR IDLER		B10744	1		89		
2	24	G002	J CR IB W/PR AUX PACK BS 1 SEAL							
2	2	G002	MECH SEAL ITEMS 1 THRU 16 BSI B							
2	24	G003	SP 7 PLATE SEAL FINAL		E17814					SP
2	24	G006	GASKET O RING ARP 568 246					374		
2	2	G006	SEAL PLATE O RING ARP 568 246 B					374		
8	96	G007	SCR CAP SOCK HD SP20 1/2 13NCX1 3/4LG					452		SP
2	4	G008	PLATE RETAINER B		A61970	1		21		
2	24	G009	SCR CAP SOCK HD 3/8 16NCX3/4LG		MR0061	60	12	23		
8	96	G011	SCR SOC HD CAP 1/4 20NCX1/2LG		MR0042		8	23		
2	24	G012	SP 14 SLEEVE SEAL SHAFT		A20274			364	21	SP
2	24	G013	SL RG SFT SLV ARP 568 228					374		
2	24	G014	PIN DRIVE 1/8X5/16LG		JR0004		10	23		
2	24	G015	SEAL COLLAR SHAFT SLV		A61969			21		
12	144	G016	SCR SOC SET CUP PT 3/8 16NCX3/8LG		ME0061	60	6	23		
6	12	G017	SCR SOC SET HF DOG PT1/4 20NCX1/4LG		MD0042		4	23		
2	24	G018	SP 20 KEY SFT SLV		A22822	1		23		SP

TABLE 1 (CONTINUED)

PACIFIC PUMPS, INC.

PARTS LIST

OUR ORDER NO. J59218 FOR WESTINGHOUSE ELECTRIC CORP

PCS UNIT	TOTAL REQ'D	PART NO	DESCRIPTION		PATTERN NO	DRAWING NO	LINE NO	COLUMN NO	MATERIAL NO	HEAT TREAT	PROGRAM
2	24	G019	SCR FLAT HD MACH SP 20 4 40NCX3/8LG						23		SP
	1	2	BS5 W/REV D CPLG ZURN 102 1/2	B							
	1	2	BS4 CPLG ZURN 102 1/2 BALANCED	B							
1	2	2	BS 3 CPLG ZURN 102 1/2 BALANCED	D							
	1	47	BASE	B		150J84	92	38	78		
		366	HOLDER UNION	A		B18856	99	1			
3	6	695	NIPPLE TBE 1/2X2LG SCH80	A					308		
3	6	B06	WSHR STOP COLL GRIZZLY 3/16X1/2XL/4	A		EXX007	10		229		
3	6	981	SPRING CENTURY STOCK 384	A		A31528	1		342		
3	6	992	FERRULE 3/16 IMPERIAL NO 60 F B	A		EXX007	14		210		
6	12	993	FLAT WSHR 10 32 BOLT SIZE	A		EXX007	12		210		
	6	1070	O RG ARP568008	A		L05680		8	211		
3	6	1214	HD4 TERMINAL 5 C15666 F3G2	A							
1	2	1248	ELEMENT SHEATH 5LG	A							
2	4	1248	ELEMENT SHEATH 8 LG	A							

4.0 Methodology

4.1 The evaluation/verification was performed by first reviewing the complete pump assembly inclusive of the bill of materials (Reference 1). Each part was then evaluated as to its specific function with respect to the function of the overall assembly. The parts were then categorized as critical or noncritical.

4.2 Critical parts are defined as those parts whose integrity, when exposed to the postulated environments, are critical to the overall component operation and whose failure would preclude the equipment from performing its intended safety function. The critical parts are identified in Table 2.

4.3 Subsequent to the above, the critical parts were then individually evaluated with respect to their ability to withstand the postulated environmental/operating conditions.

5.0 Acceptance Criteria

5.1 The acceptance criteria is defined as follows:

The critical parts shall be technically shown to be able to withstand the postulated environmental conditions without exhibiting common mode failure effects.

TABLE 2

CRITICAL PARTS LIST

Part No.	Quantity	Description	Material
A551	13	Gaskets/Parting Flange Gasket	Compressed Asbestos Sheet
A612	24	Flexitallic Gasket	Stainless Steel and Asbestos
B010	26	Seal Housing Gaskets	EPDM
D095	130	Suction Spacer O-Ring and Suction Cover O-Ring	EPDM
G006	26	Gasket O-Ring and Seal Plate O-Ring	EPDM
G013	24	Seal Ring-Shaft Sleeve	EPDM
G002	26	Mechanical Seal	EPR Graphite
F060	12	Worm Gear	Canvas Micarta
(Heat Exchanger Items 4 & 5)	2	Gaskets	Compressed Asbestos

6.0 Critical Parts Material Discussion

6.1 Ethylene Propylene Rubber (EPR) (Cranelast) and graphite safety bushings

6.1.1 EPR and graphite are specifically used for the bellows and bushings respectively in the pump seals Part G002. While previous industry tests were performed on these materials under static conditions. Additional tests were required under dynamic conditions. Tests were performed on the complete seal assembly (Reference 2) which simulated the seal environment and operating conditions. The testing encompassed the following conditions inclusive of exposure to boric acid moderator solutions:

Pressure - 0.2 - 400 psig
Temperature - 140 - 300°F
Test Duration - 50 - 500 hrs.
Shaft Speeds - 1800 and 3600 RPM
Radiation - 1.1×10^{8} rads gamma

6.1.2 The tests concluded that the seal assembly which included the organic parts successfully performed their function under both normal and adverse conditions.

6.1.3 Graphite is considered not to be effected by thermal aging. It's radiation threshold, however, is 1×10^{10} rads gamma.

6.2 Asbestos/Compressed Asbestos

6.2.1 This material is used in parts A551 and A612 for gasketing applications. Based on common industry data, asbestos is acceptable for use in elevated temperature applications up to 150°C. This material is not considered as organic and, therefore, not subject to heat aging. Asbestos retains its properties and is usable for radiation doses in excess of 10^{10} Rads. When this material is used in contact with coolant fluid and/or stainless steels, the chloride/flouride content is controlled to not exceed 200 PPM. This eliminates any possible stress corrosion effects.

6.3 Ethylene Propylene Diene Momer Rubber (EPDM)

6.3.1 EPDM is used in various parts of the pump assembly in gasketing and/or seal applications. (Parts B010, D095, G006, G013). This material has excellent thermal aging and radiation restance at temperature in excess of 300°F and 2×10^{8} rads gamma respectively.

6.3.2 Additional full sequence test data has been made recently available through the W Environmental Qualification of ASCO Solenoid Valves (Ref. 3). This additional data further reinforces the adequacy of EPDM for the above listed parts.

6.4 Canvas Micarta

6.4.1 This material is specifically used for the gear pump worm gear Part F060. The property of importance is flexural strength. Using standard acceptance criteria of 50% retention, the data indicates acceptable performance up to 230°F.

6.4.2 The most radiation sensitive properties are elongation and impact strength which are not considered to be primary properties for this application. However, these properties, used for comparison purposes, are only reduced by 25% in the dose range of 8×10^6 Rads.

7.0 Pump Motor

7.1 The W motor used on this pump application has been qualified by separate W testing. The test specifics are reported in Reference 4.

8.0 Lubricants

8.1 Various lubricants are acceptable for use under the operating conditions specified in the Pump Instruction and Maintenance Manual. It is the responsibility of the user to provide documentation for the lubricant used and maintain the equipment as recommended in the Instruction and Maintenance Manual. (Reference 1)

9.0 Maintenance

9.1 Maintenance shall be considered to be the responsibility of the user. The user shall establish a maintenance program to maintain the equipment as described in Reference 1. Periodic maintenance to maintain qualification is required on critical parts per the qualified life as stated in Table 3.

10.0 Conclusion

10.1 As stated in Section 5.0, the environments postulated for the critical parts were compared with the specific material capabilities. Table 3 summarized this comparison. Based on this evaluation and comparison, the Pacific Model 3" 10 stage JHF safety injection pump is considered environmentally qualified to perform its intended safety function of Para. 1.6 without common mode failure effects.

10.2 The qualified life of this equipment is 40 years provided the recommended maintenance is performed per Reference 1 and the critical parts identified on Table 3 are replaced at the end of their individual qualified lives.

TABLE 3

CRITICAL PARTS - ENVIRONMENTAL QUALIFICATION SUMMARY

Material	Postulated Environmental Conditions (Worst Case)	Material Capabilities	Property Evaluated	Activation Energy (eV)	Qualified Life (Yrs)
Asbestos	120°F Normal 300°F Accident 1.2×10^7 Rads Gamma(1)	300°F 10^{10} Rads Gamma	(2)	N/A	> 40
EPR (Seal)	120°F Normal 300°F Accident 1.2×10^7 Rads Gamma (1)	300°F 1.1×10^8 Rads Gamma	60% Elongation Retention	0.93	1(4)
Graphite	120°F Normal 300°F Accident 1.2×10^7 Rads Gamma(1)	> 300°F 1×10^{10} Rads	Wear(2)	N/A	1(4)
Canvas Micarta	140°F(3) 4×10^6 Rads Gamma(1)	230°F $> 8 \times 10^6$ Rads Gamma	50% Retention of Flexural Strength	2.10	> 8
EPDM(5)	120°F Normal 300°F Accident 1.2×10^7 Rads Gamma(1)	> 300°F 2×10^8 Rads Gamma	Retention of Initial Elongation	0.94	8

Notes:
1. Includes normal plus accident dose (accident duration is one (1) year).
2. Considered to be uneffected by thermal aging.
3. Environment is governed by maximum allowable lubricant temperature.
4. Based on continuous operation with maintenance.
5. Can also be used as an alternative seal material in place of EPR.

REFERENCES

1. Pacific Pump Instruction and Maintenance Manual for Commonwealth Edison 3" 10 Stage JHF Safety Model Injection Pumps.

2. "Seal Performance Testing for Nuclear Power Plant Safety Injection Systems," by Crane Packing Company. Bulletin #3472 (W Proprietary).

3. Cesarski, W.V. "Equipment Qualification Test Report ASCO Solenoid Valves" WCAP 8687, Supplement 2 - H02A (Proprietary) June 1981.

4. Anderson, A.A., "Equipment Qualification Test Report for the Westinghouse Large Pump Motor," WCAP-8687, Supplement 2-AE-2A (Proprietary).

5. W Corporate Thermal-Radiation Materials Application Data Manual.

ATTACHMENT B2

AIR OPERATED VALVE 8028
(PVORT/NSSS)

Responses to the audit findings are as follows:

Open Item 1 - During the audit the final static deflection test report prepared by the vendor for this valve had not been approved by Westinghouse. As noted in Attachment A20. Item 3, this report has been reviewed.

Open Item 2 - As discussed in the FSAR, operability testing is done on a representative number of valves. Each valve tested covers a series of valves and is selected based on size, type, weight, vendor and other pertinent valve characteristics. The valve selected represents the worst set of parameters for the particular series of valves being grouped together. As noted in the approval of the test report for this valve (see Attachment A20, Item 1), a number of valves were covered by the one report. Additionally, the enclosed letter from the vendor (ITT Grinnell) documents the applicability of the test report to this valve.

Open Item 3 - This item refers to the air supply used to actuate valve 8028. During operability testing a pressure of 72 psig was applied to the air operator. The specified pressure range of the valve is 63 to 85 psig. The 72 psig used during the testing is adequate to demonstrate operability of the valve for the following reasons:

- The valve is designed to fail closed (safe position) in the event of low or a complete loss of air pressure. Hence, if the valve did not remain open at the lower end of the actuator design pressure, no safety problem would be encountered.

- The air pressure applied to the operator is used to hold the valve in the open position. Thus, if the valve functioned at 72 psig, it would also remain open at higher pressures in its design range.

- The air line to the valve is equipped with regulators to limit the actuator pressure to 85 psig.

- The valve functional specifications require closure within 10 seconds. During the operability tests the valve closed in the 2-3 second range at 72 psig. An increase in the actuator air pressure by 20% (i.e., to 85 psig) would have very little effect on the closing time and the closing forces on the valve.

Based on the above discussion, operability testing with the valve actuator at 72 psig adequately demonstrates the functional capability of this valve and testing at the maximum and minimum actuator air pressure limits is not considered necessary.

Open Item 4 - A static analysis using a finite element model was performed by the valve vendor (ITT Grinnell) to calculate the natural frequency of the valve and extended structure. In performing tests on similar valves for other organizations, Grinnell determined that the horizontal natural frequencies of this valve were below 33 Hz. Hence, the natural frequency analysis reviewed by the audit team has been invalidated. Grinnell has performed additional static fragility testing on this valve and determined that the valve's operability is not impaired for accelerations as high as 10g's. In light of this information Westinghouse has reanalyzed piping systems containing similar valves in the Byron plant using flexible valve models. The results of this reanalysis indicate that both the valve and piping system loads are acceptable. The information described above is currently in draft form with final reports in the process of being completed. Upon issuance of these reports and the finalization of piping analyses SQRT and PVORT Forms will be revised and submitted to the NRC.

Open Item 5 - The impact of dynamic fluid loads on operability testing is described in Attachment 3B Item 6. For the valve in question fluid dynamic effects are negligible.

Open Item 6 - The approach implemented by Commonwealth Edison to address the environmental qualification of mechanical equipment is discussed in response to draft SER Item 3. In order to demonstrate the acceptability of this approach Westinghouse has prepared information on the critical soft parts of the safety injection pump as agreed to with the Staff at a May 13, 1983 meeting. Please refer to Attachment B1, Item 4, and Attachment B8 Item 3.

ITT Grinnell Corporation
DIA-FLO Division
33 Centerville Road
Lancaster, Pennsylvania 17603
(717) 291-1901
Telex: 84-8420

June 8, 1983

Westinghouse Purchase Order 191000
Valve Operability Test Certification

This is to certify that ITT Grinnell Operability Test Report W-210 qualifies valve I.D.'s as listed below:

3/8DA42R, 3/8DA92R,3/4DA32R, 3/4DA42R, 3/4DA62R, 3/4DA92R, 1DA32R, 1DA42R, 1DA42RZ, 1DA92R, 2DA42D, 2DA92D, 2DA32R, 2DA42R, 2DA62RZ, 2DA92R, 3DA42D, 3DA32R, 3DA42R, 3DA62RZ, 3DA92R, 4DA42D, 4DA32R, 4DA42R, 4DA92R, 3/4X32D, 3/4X42D, 3/4X92D, 1X32D, 1X42D, 1X92D, 2X32D, 2X42D, 2X92D, 3X32D, 3X42D, 3X62D, 3X92D, 4X32D, 4X42D, 4X92D.

Michael J. Panciera
Sen. Prod. Eng.

MJP/twa

Attachment B3
Gate Valve - Main Steam Isolation
(PVORT-BOP)

Response to the audit findings are as follows:

a) The maximum pressure in the accumulators will be 5000 psi under accident conditions. As a result the design pressure used was 5000 psi rather than the 3750 psi normal pressure. The accumulator was supplied as part of the MSIV operator and as such, was not subject to a separate test program by Anchor/Darling or Commonwealth Edison. However, the accumulator was purchased as an ASME Section VIII component. As a result, the vendor (Parker-Hannafin, holder of ASME "U" Stamp) certifies that the accumulator met or exceeded code testing requirements. This requirement is a test pressure of 1.5 x design pressure or, in this case, a minimum of 7500 psi. Documentation of subcomponent design and testing is retained by the valve supplier, Anchor/Darling.

REFERENCE: F/L 2756L MS-Isolation Valve Specification

b) The original external environmental temperatures and pressures specified were overly conservative. FSAR Section C3.6 summarizes the calculation of the valve room and steam tunnel pressurization. The calculated peak pressure is less than 20 psig. A calculation to extend the transient shows that the pressure in the valve rooms is very close to ambient within five seconds. The transient is very rapid with the peak occuring less than 1.0 second after the break. The sharp pressure rise will force open doors and ventilation areas in the valve house and rapidly vent the steam to the environment. This ventilation also serves to rapidly reduce the temperature in the valve house and steam tunnel. The temperatures used in the environmental condition specification were very conservatively calculated. A more recent calculation shows that the temperature will drop to below 150°F in less than 15 minutes after an exterior door opens.

The concern about valve operability under elevated pressures results from a design limitation of the actuator. The air supply must be 59 psig above the environmental pressure. The supplied pressure at Byron will be in a range of 80-100 psig. Since the calculated maximum pressure is actually less than 20 psig, the required minimum supply pressure would be less than 79 psig. Therefore, a small margin is available even if a design basis double ended break occurs while the supplied air pressure is at its minimum value, and the closure signal is received at the valve during the short (1-2 seconds) time that the environmental pressure is elevated.

Gate Valve - Main Steam Isolation
(PVORT-BOP)

c) Assurance of the ability of the valve to function under full flow conditions is achieved by a combination of analysis and test. The vendor provides assurance that the closure time requirements are met by calculating the force necessary to close the valve against a full flow load and then testing the actuator to insure that adequate closing force was available. Documentation of this testing is retained by the valve manufacturer. Because it is not practical to fully stroke these valves during normal operation, the valves will be part stroke exercised every three months and fully stroked during shutdown. This is documented on Page 21 of the Byron Inservice Testing Program Plan for Valves. A description of this program was submitted to the NRC in the November 4, 1982 letter from T.R. Tramm to H.R. Denton.

d) The actuator used for seismic qualification was identical to the actuators installed at Byron. The actuator, Model 64324-C, was qualified by analysis. Wyle Lab report number 43847-2 lists this model number which is identical to the model number of the installed actuator.

e) The actuator was vibrationally tested (Wyle Lab report 43847-2) and this report is available. The valve itself was qualified by analysis and, as a result no vibration testing data is available. The analysis establishes that the valve is not sensitive to vibration predicted in seismic events. The Byron vibration monitoring program detects any unusually high amplitude vibration during pre-operational testing.

Aging of the Class 1E electrical equipment is considered in the qualification program for 1E equipment in a harsh environment. For tested equipment, the sequential test requirements of IEEE 323-1974 have been complied with. Aging of mechanical components is addressed by a program of maintenance and surveillance which will detect age related degradation of mechanical components. This program is further discussed in SQRT Draft SER Generic Item #6.

f) A loss of air in the accumulators would lead to inability to close the valve. However, the loss of air would have to occur in both accumulators to actually cause the valve to fail to close. The accumulators are independent, and are subject to surveillance. As noted previously, th accumulators are ASME code designed and inspected components. Failure because of accumulator leakage would require an initiating event plus two independent failures in a safety grade system. This scenario is beyond the required plant design basis.

Attachment B4
Main Steam Safety Valve (1MS013A)
(PVORT-BOP)

Responses to the open audit items are as follows:

a) The leakage rate of the Main Steam Relief Valves, while an important consideration for plant operating efficiency, is not a safety concern. The secondary side of the steam supply system is not normally radioactive. Leakage will cause an offsite release only if the primary to secondary side boundary is breached. The analysis in FSAR Section 15.6.3 for steam generator tube rupture assumes a loss of offsite power and control of steam generator pressure by opening of steam generator relief valves. This clearly conservatively bounds the effect of a leaking valve.

b) The Byron Preservice and Inservice Testing Program Plan for Valves includes valve 1MS013A (page 21 of the Program Plan). Prior to startup and at each refueling outage, the valve setpoint will be verified in accordance with IWV-3510 of ASME Section XI.

c) The test report for the Main Steam Safety Valve 1MS013A (EMD 003901) is divided into three parts. Phase 1 is a determination of the resonant frequency. Phase 2 is a determination of the effects of vibration and resonance on the valve operation. Phase 3 is the actual test of valve operability under vibrational loading. Phases 1 and 2 can be characterized as developmental testing.

The valve has a lowest horizontal natural frequency of 37 Hz. When tested with a high amplitude 30 Hz input some operability problems were noted in the Phase 2 testing. Some modifications were made to the valve but the object was not to completely eliminate the resonance problems associated with the 30 Hz input.

Phase 3 is the actual qualification testing of the valve. The prototype as tested in Phase 3 is the same as the production valve installed by Byron with the exception of the differences noted in Section 4.2.1 of the report.

The results of the testing indicate that the valve will perform as required.

d) Establishment of a qualified life as a result of aging is not required for these valves. These valves are all metal and do not have any critical non-metallic parts subject to aging. A maintenance and surveillance program has been established to schedule repair or replacement of the valve or valve parts based on manufacturers recommendations and operating experience. The surveillance program for these valves is described in the response to finding (b).

Attachment B5
Essential Service Water Pump (1SX01PA)
(PVORT-BOP)

Responses to the open audit items are as follows:

a) The minimum critical speed has been determined by the pump manufacturer to be 2611 rpm. This is approximately three times the normal operating speed of 880 rpm. Therefore, the critical speed has no effect on the operation of the pump.

b) A revised PVORT from has been prepared and is attached.

c) Attached is a section of the preoperational test procedure for the subject pump. Section 9.20 is the procedure for the Essential Service Water Pump 1A Performance Test. In addition, this pump is included in the Byron Preservice Inspection Testing Program Plan for Pumps. (Page 2 of Program Plan for Pumps, T.R. Tramm letter to H.R. Denton dated November 4, 1982) This program has been developed in accordance with ASME Sec. XI requirements and includes provisions for monitoring pump vibration, flowrate, discharge pressure, and bearing temperature. Although final preoperational test results are not available, these test plans show that adequate pump performance will be demonstrated prior to plant operation.

d) The essential service water pumps are normally operating components located in a mild environment. As a result, the aging is only due to normal operation. This is addressed by the maintenance and surveillance programs which have been established at Byron. The maintenance program is described in the response to SQRT draft SER generic item 6. The surveillance program is described in the response to item (c) above.

e) The pump is qualified by analysis (EMD-013374). In the dynamic model, the bed plate is assumed to be supported only at the foundation bolts. This is true for upward forces but for downward forces the bed plate channel flanges are continuously supported. This conservative assumption was made so that the idealized model would be more flexible than the actual assembly, thus leading to conservative stress and deflection calculations.

In the qualification document, a seismic analysis for the coupling (see 6.2 of McDonald Engineering Analysis Company Report No. ME-523) is presented for functional capability of the pump.

Attachment 3
Rev. 0
Rev. 1 09-17-82
Rev. 2 06-22-83

PUMP AND VALVE OPERABILITY ASSURANCE REVIEW

I. PLANT INFORMATION

1. Name: Byron/Braidwood Unit No. 1&2 2. Docket No.: 50-454, 50-455 50-456, 50-457

3. Utility: Commonwealth Edison Company

4. NSSS: Westinghouse Electric [X] PWR [ ] BWR

5. A/E: Sargent & Lundy

II. GENERAL COMPONENT* INFORMATION

1. Supplier: [ ] NSSS [X] BOP

2. Location: a. Building/Room Auxiliary

   b. Elevation 330' (15-N)

   c. System Essential Service Water

3. Component number on in-house drawings: 1SX01PA

4. If component is a [X] Pump complete II.5.

   If component is a [ ] Valve complete II.6.

5. General Pump Data

	a. Pump	b. Prime-mover
	Name 1SX01PA	Name 1SX01-PA-M
	Mfg. Bingham-Willamette	Mfg. Westinghouse
R	Model Suction Double Volute	Model HHS-DPO
	S/N 16210001	S/N 1013BA-01
	Type HSA	Type Frame 8009S55

* The component, whether pump or valve, is considered to be an assembly composed of the body, internals, prime-mover (or actuator) and functional accessories.

a. Pump (continued)

Size 24 x 30 x 30

Weight 14,200 lbs.

Mounting Method Bolted

Required B.H.P. 1247

Parameter	Design	Operating
Press	125	100
Temp	100	100
Flow	24,000	24,000
Head	180	180

Required NPSH at maximum flow 46'

Available NPSH 40'

Operating Speed 800 rpm

R Critical Speed 2611 rpm

b Prime-mover (continued)

Size 1250 HP

Weight 12,000 lbs.

Mounting Method Bolted

H.P. 1250

Power requirements: (include normal, maximum and minimum).

Electrical 4000 VAC
60 Hz, 3 phase
1250 Hp

Other 80% Minimum starting voltage

If MOTOR list:

Duty cycle Continuous

Stall current 520% full load

Class of insulation B

List functional accessories:* Contol switch @ 1PM06J and 1PL04J.
Lube oil pump and motor space heater.

List control signal inputs: Interlocks with 1SX027A, 1PS-SX139, lube oil pressure, 1SX016A, 1SX001A, 1PSL-SX023 ESW pump low suction pressure.

* Functional accessories are those sub-components not supplied by the manufacturer that are required to make the pump assembly operational, (e.g., coupling, lubricating oil system, etc.)

6. General Valve Data

a. Valve

Name _____

Mfg. _____

Model _____

S/N _____

Type _____

Size _____

Weight _____

Mounting Method _____

Required Torque _____

Parameter	Design	Operating
Press	_____	_____
Temp	_____	_____
Flow	_____	_____

Max ΔP across valve _____

Closing time @ max ΔP _____

Opening time @ max ΔP _____

Power requirements for functional accessories, (if any) _____

_____

b. Actuator (if not an integral unit)

Name _____

Mfg. _____

Model _____

S/N _____

Type _____

Size _____

Weight _____

Mounting Method _____

Torque _____

Power requirements: (include normal, maximum and minimum).

Electrical _____

_____

_____

_____

Other: [] Pneumatic [] Hydraulic

_____

_____

_____

_____

List control signal inputs: _____

_____

_____

List functional accessories:* _____

_____

III. FUNCTION

1. Briefly describe components normal and safety functions: _____

Transfers heat loads generated by safety-related equipment, or equipment essential to safe shutdown of the reactor to the ultimate heat sink.

2. The components normal state is: [X] Operating [ ] Standby

3. Safety function:

a. [X] Emergency reactor shutdown

b. [X] Containment heat removal

c. [ ] Containment isolation

d. [ ] Reactor heat removal

e. [ ] Reactor core cooling

f. [ ] Prevent significant release of radioactive material to environment

g. [ ] Does the component function to mitigate the consequences of one or more of the following events? [X] Yes [ ] No
If "Yes", identify.

[X] LOCA [X] HELB [X] MSLB

[ ] Other _____

4. Safety requirements:

[ ] Intermittent Operation [ ] During postulated event

[X] Continuous Operation [ ] Following postulated event

If component operation is required following an event, give approximate length of time component must remain operational.

K throughout duration of accident (e.g., hours, days, etc.)

* Functional accessories are those sub-components not supplied by the manufacturer that are required to make the valve assembly operational, (e.g., limit switches).

5. For VALVES:

does the component [] Fail open [] Fail closed [] Fail as is

Is this the fail safe position? [] Yes [] No

Is the valve used for throttling purposes? [] Yes [] No

Is the valve part of the reactor coolant pressure boundary?
[] Yes [] No

Does the valve have a specific limit for leakage? [] Yes [] No

If "Yes" give limit: _____

IV. QUALIFICATION

1. Reference by specific number those applicable sections of the design codes and standards applicable to the component: _____

ASME Section III 1974 Ed. through S '76 ADD.

2. Reference those qualification standards, used as a guide to qualify the component: IEEE 323 - 1974 (Motor only) R

IEEE 344 - 1975

3. Identify those parts of the above qualification standards deleted or modified in the qualification program.

Deleted:	Modified:

4. Have acceptance criterias been established and documented in the test plan(s) for the component? [X] Yes [] No

5. What is the expected failure mode that would keep the pump or valve assembly from performing its safety function? Pump trip, R
loss of power to motor, loss of pump suction.

6. Are the margins* identified in the qualification documentation?
[X] Yes [] No

d. Margin is the difference between design basis parameters and the test parameters used for equipment qualification.

If component is a PUMP, complete IV.7.

If component is a VALVE, complete IV.8.

7. Pump operability has been demonstrated by: [] Analysis
[x] Test [] Combination

Identify PUMP tests performed:

a. [x] Shell hydrostatic (ASME Section III)

b. [] Bearing temperature evaluations

c. [x] Seismic loading

d. [] Vibration levels

e. [x] Exploratory vibration (Fundamental freq.____)

f. [] Seal leakage @ hydro press

R | g. [x] Aging: [x] Thermal (Motor only) [] Mechanical

h. [x] Flow performance
Are curves provided [x] Yes [] No

i. [x] Pipe reaction end loads (nozzle loads)

j. [] Others _____

R | k. [x] Extreme environment:
Motor only [x] Humidity
[] Chemical
[x] Radiation

8. Valve operability has been demonstrated by: [] Analysis
[] Test [] Combination

Identify VALVE tests performed:

a. [] Shell hydrostatic (ASME Section III)

b. [] Cold cyclic List times:
Open _____
Closed _____

c. [] Seismic loading

d. [] Hot cyclic List times:
Open _____
Closed _____

e. [] Exploratory vibration (Fundamental freq.____)

f. [] Main seat leakage

h. [] Aging: [] Thermal
[] Mechanical

i. [] Pipe reaction end loading

j. [] Back seat leakage

j. [] Disc hydrostatic

k. [] Extreme environment
[] Humidity
[] Chemical
[] Radiation

l. [] Flow interruption capability

m. [] Flow characteristics
Are curves provided?
[] Yes [] No

n. [] Others _____

9. As a result of any of the tests (or analysis), were any deviations from design requirements identified? [] Yes [X] No
If "Yes", briefly describe any changes made in tests (or analysis) or to the component to correct the deviation.

R

10. Was the test component precisely identical (as to model, size, etc.) to the in-plant component? [X] Yes* [] No If "No", is installed component [] oversized or [] undersized?
*for pump tests only, motor qualified by generic test

11. If type test was used to qualify the component, does the type test meet the requirements of IEEE 323-1974, Section 5.?
[X] Yes [] No Motor only

12. Is component orientation sensitive? [] Yes [] No [X] Unknown
If "Yes", does installed orientation coincide with test orientation? [] Yes [] No However, installed orientation concides with test orientation

13. Is the component mounted in the same manner in-plant as it was during testing (i.e., welded, same number and size bolts, etc.)
[X] Yes [] No [] Unknown
Motor only.

R 14. Were the qualification tests performed in sequence and on only one component? [X] Yes [ ] No Motor only

If "Yes" identify sequence, (e.g., radiation, seismic, cyclic, thermal, etc.): thermal, mechanical cycling, seismic

15. If "aging"* was performed, identify the significant aging mechanisms: _____

R 16. Identify loads imposed (assumed) on the component for the qualification tests (analysis) performed:

a. [ ] Plants (shutdown loads) b. [ ] Extreme environment

c. [X] Seismic load d. [ ] Others _____

R 17. Have component design specifications been reviewed in-house to assure they envelope all expected operating, transient, and accident conditions? [X] Yes [ ] No

R 18. Does the component utilize any unique or special materials? (Examples are special gaskets or packing, limitations on nonferrous materials, or special coatings or surfaces.)
[ ] Yes [X] No

If "Yes", identify: _____

R 19. Does component require any special maintenance procedures or practices, (including shorter periods between maintenance).
[ ] Yes [ ] No

If "Yes", identify: The standard plant maintenance program will address all required maintenance considerations for this component.

R 20. Is the qualified life for the component less than 40 years?
[ ] Yes [X] No If "Yes", what is the qualified life? _____

* As outlined in Section 4.4.1 of IEEE-627 1980.

21. Information Concerning Qualification Documents for the Component 1SX01PA

Report Number	Report Title	Date	Company/Organization Preparing Report	Company/Organization Reviewing Report
FL-2758A	Miscellaneous Pumps (Safety Category I)	5-4-77	S&L	S&L/CECo
FD-16210001/2 &5/6	Essential Service Water Pump	4-12-78	Bingham Pump Co	S&L/CECo
NPV-1	Manufacturer's Data Report	8-31-78	Bingham - Willamette	S&L/CECo
16210001	Performance Test	4-13-78	Bingham - Willamette	S&L/CECo
1013EA	Seismic Analysis for SX Pump Motors	7-31-78	Westinghouse	S&L/CECo
ME-523	Seismic - Stress Analysis of Horizontal Pumps	3-23-78	Bingham - Willamette	S&L/CECo
2.7.6.10	Essential Service Water Pre-Operational Test		CECo	S&L/CECo

4.0 - ACCEPTANCE CRITERIA

4.1 Each Essential Service Water pump shall have a minimum capacity of 24,000 gal./min. at a discharge head of 180±10% feet.

4.2 Each Essential Service Water Diesel Make-up Pump shall have a minimum capacity of 1500 gal./min. at a discharge head of 360 ± 10% feet.

4.3 Each Essential Service Water pump shall provide a minimum supply of 5320 gal./min. to the RCFC units.

4.4 Each Essential Service Water Pump shall provide a minimum supply of 16,000 gal./min. to either the Unit 1 or Unit 0 Component Cooling Heat Exchanger.

4.5 Each Essential Service Water Pump shall provide a minimum supply of 105 gal./min. to each ESW cubicle cooler (1A and 1B).

9.0 TEST PROCEDURE (Continued)

9.20 Essential Service Water Pump 1A Performance Test

NOTE The following section will test the performance of the 1A SX Pump. The OA SX cooling tower basin must be filled to a normal level. The strainer must be clean.

9.20.1 Verify OPEN suction valve 1SX001A using handswitch 1HS-SX017 on 1PM06J. ____/____

9.20.2 Verify OPEN RCFC inlet valve 1SX016A using handswitch 1HS-SX106 on 1PM06J. ____/____

9.20.3 Verify OPEN RCFC outlet valve 1SX027A using handswitch 1HS-SX107 on 1PM06J. ____/____

9.20.4 Verify alarm window 12D01 "ESS SW PUMP SUCTION PRESS LOW" is CLEAR Pump 1A. ____/____

9.20.5 Verify pump casing is filled and vented. ____/____

9.20.6 Verify normal oil levels in sight glasses. ____/____

9.20.7 Verify cooling water is lined up. ____/____

9.20.8 Position discharge valve 1SX143A to approximately 10% open. ____/____

9.20.9 Verify Racked In the breaker for SX Pump 1A. 4160 V Bus 141 CUB #2 (1SX01PA). ____/____

9.20.10 Verify the breaker for Aux. Lube Oil Pump 1A is CLOSED.

MCC 131 X1 Compt. J2 ____/____

9.20.11 START the Aux. Lube Oil Pump 1A from the local handswitch. ____/____

9.20.12 START SX Pump 1A by placing handswitch 1HS-SX001 to the CLOSE position until the main pump starts. As soon as the pump discharge pressure begins to rise, slowly throttle the discharge valve, 1SX143A, open approximately 40%. ____/____

9.20.13 STOP the Aux. Lube Oil Pump 1A. ____/____

NOTE: Allow the pump to reach normal operating temperatures.

9.20.14 Take pump data on Data Sheet 11.3. ____/____

9.20.15 Take vibration signatures on the pump and motor. ____/____

9.20.16 Using RCFC outlet valves 1SX021A, 1SX025A, 1SX021C and 1SX025C, balance the flow to the individual coils. Each individual flow must fall within ± 25 gpm of the average of the four flows. Record data at item 11.5.1. ____/____

9.20.17 Verify ESW Diesel Makeup Pump 0A is in PULL TO LOCK. ____/____

9.20.18 Using blowdown, bring the Tower 0A level down to the minimum operating level. Record tower level and record any vortexing observed near the suction duct. Monitor OLS-SX096. Record the level at which the switch closes.

Level _____

Observed vortexing _____

_____.

OLS-SX096 _____ (level) ____/____

9.20.19 Increase the tower level using available makeup. Establish a maximum operating level of approximately 874'2" or 6'5" from the Basin Bottom. Record tower level and any observed vortexing.

Level _____ _____

Observed Vortexing _____

_____. ____/____

DATA SHEET 11.3

PUMP DATA FOR SX PUMP 1A

DATA POINT	SUCTION PRESSURE (PSIG) 1PI-SX148	DISCHARGE PRESSURE (PSIG) 1PI-SX008	FLOW RATE (GPM) FLOW METER
1			
2			
3			
4			
5			
6*			

NAME _____ DATE _____

*Data Point 6 will prove the capacity of the SX Pump per the Acceptance Criteria.

Attachment B6
Containment Spray Pump (1CS01PA)
(PVORT-BOP)

The responses to the open audit items are as follows:

Open Item 1 - The qualification documentation has been corrected to be consistent with the serial number of the installed "A" pump. The documentation has been approved and signed off.

Open Item 2 - Attached is a section of the Containment Spray System preoperational test procedure results for the subject pump and the corresponding acceptance criteria. The test results meet the acceptance criteria and demonstrate that the pump performs adequately within the system. In addition, this pump is included in the Byron Preservice/Inservice Testing Program Plan for Pumps (page 1 of Program Plan for Pumps, T.R. Tramm letter to H.R. Denton dated November 4, 1982). This program has been developed in accordance with ASME Sec. XI requirements and includes provisions for monitoring pump vibration, flowrate, and discharge pressure. The preservice and periodic inservice testing described above will demonstrate the operability of the pump for the life of the plant.

Open Item 3 - The containment spray pump and pump motor are located in a cubicle. They are exposed to a harsh environment only because of the radiation levels associated with the location adjacent to the containment and the accident mode of operation (handling radioactive containment sump fluid). The containment spray pumps are operated only during system tests and following a LOCA or Main Steam Line Break inside containment.

The containment spray pump motor has been environmentally and seismically qualified (Westinghouse Report WCAP-8754 Rev. 1 and Shop Order 77F14089) and has a qualified life of 40 years under Byron specific conditions. The pump has been seismically qualified (Ingersoll-Rand Report EAS-TR-7801-IR). Although a specific program for environmental qualification of mechanical equipment is not required, a review of the design of this pump has been performed to insure that it has been properly designed to function in the specified high radiation environment. A summary of this review is attached.

Containment Spray Pump (1CS01PA)
(PVORT-BOP)

Open Item 4 - Seismic qualification of the containment spray pump was accomplished by analysis (S&L Report EMD-025038). The analysis was done using the faulted condition. The results of the analysis indicated that the lowest natural frequency was greater than 33 Hz (page 4, EMD-025038 attached) hence the equipment is considered rigid and qualified by static analysis. The containment spray pump is designated as seismic Cat. I, active equipment which means the pump must meet performance requirements during and following a safe shutdown earthquake. In the static analysis, the seismic forces on the pump assembly are obtained by concentrating the entire mass at the center of gravity of the assembly and multiplying it by the appropriate seismic accelerations. In this case the seismic accelerations for safe shutdown conditions are as follows:

Horizontal = 0.25g (in each of two orthogonal directions)

Vertical = 0.85g (page 3, EMD-025038 attached)

These acceleration values are used to produce the equivalent static forces for the analysis.

APPROVED
FOR TESTING

3.0 TEST OBJECTIVES

3.1 To demonstrate the ability of the Unit One components of the Containment Spray System to meet their design and operational requirements.

3.2 To insure proper operation of all equipment, controls, alarms and interlocks associated with the Containment Spray System.

3.3 To insure that the Containment Spray System will be capable of delivering a fluid solution at proper flows and pressures to the Containment Spray headers.

3.4 To verify the spray nozzles are unobstructed.

ACCEPTANCE CRITERIA

4.1 Verify that the capacity of containment spray pump 1CS01PA is a minimum of 3545 gpm at a head of 450 feet.

4.2 Verify that the capacity of containment spray pump 1CS01PB is a minimum of 4055 gpm at a head of 450 feet.

4.3 Verify the ability to educt a minimum of 55 gpm indicated of fluid from the spray addition tank into the spray discharge flow using the installed flow instrumentation.

4.4 Verify all spray nozzles are unobstructed.

APPROVED
FOR TESTING

9.0 TEST PROCEDURE (Continued)

9.19 Containment Spray Pump 1CS01PA Integrated Testing

9.19.1 Verify the Blank Flange is installed at 1CS04MA and the temporary jumper to the Fuel Handling Building rainwater header is installed. [signature] 12-15-82

9.19.2 Verify that CS pump 1A and all loop A piping has been filled and vented. [signature] 12-15-82

9.19.3 Vent the pump seal cavity by opening the seal vent valve 1CS049A. [signature] 12-15-82

9.19.4 Verify that the CS pump 1A motor oil reservoir has been filled to the proper level. [signature] 12-15-82

9.19.5 Verify a minimum level of greater than 20% for the RWST. [signature] 12-15-82

23

~~9.19.6 Install an ultrasonic flowmeter on line 1CS12AA-3".~~

9.19.7 Verify a normal operating line-up for Containment Spray Pump 1A and Containment Spray Loop 1A from the RWST as per M-46 and M-61-4. [signature] 12-15-82

9.19.8 Open test line discharge isolation valve 1SI001A. [signature] 12-15-82

9.19.9 Rack-in the breaker for CS pump 1A at Bus 141, Cub. 9. [signature] 12-15-82

9.19.10 Close valve 1CS040A. [signature] 12-15-82

9.19.11 "OPEN" 1CS010A by placing its handswitch at 1PM06J in the "Test" position. [signature] 12-15-82

9.19.12 Place the CS pump 1A Test Transfer Switch on MCB 1PM06J in the "Test" position. [signature] 12-15-82

9.19.13 Start CS pump 1A by going to close on MCB 1PM06J. [signature] 12-15-82

APPROVED
FOR TESTING

9.0 - TEST PROCEDURE (Continued)

9.19.14 Verify CS pump 1A operating parameters on Data Sheet 11-19, throttle valves 1CS007A and 1SI001A to obtain these flow rates.

MAR / 12-15-82

9.19.15 Verify the SAT is filled to nominally 55% with Grade "A" water. MAR / 12-15-82

9.19.16 Open valve 1CS040A. MAR / 12-15-82

9.19.17 Open valve 1MOV-CS019A at MCB 1PM06J. MAR / 12-15-82

9.19.18 With CS pump 1A in operation at a flow rate of nominally 3545 gpm, adjust valve 1CS021A to yield approximately 58 gpm as indicated on 1F1-CS015.

MAR / 12-15-82

9.19.19 Record the following:

CS pump 1A Disch Flow Rate (1F1-CS011) 3500 gpm
(minimum = 3105 gpm) MAR / 12-15-82

CS eductor 1A Flow Rate (1F1-CS013) 135 gpm
(10% of 1FI-CS011 reading ± 12 gpm) MAR / 12-15-82

TCR #2 MAR 6-20-82

Spray Additive Flow Rate (1F1-CS015) 58 gpm
(58 gpm, -0, +2.25 gpm) MAR / 12-15-82

~~Sonic Flowmeter Spray Additive Flow Rate _____ gpm~~

TCR #23 MAR 11-9-82

~~(58 gpm, -0, +2.25 gpm)~~

Spray Additive Tank level 47½ % MAR / 12-15-82
(20-55%)

9.19.20 Lock valve 1CS021A in its present position.

MAR / 12-15-82

9.19.21 Close valve 1CS019A. MAR / 12-15-82

9.19.22 Close valve 1CS007A. MAR / 12-15-82

APPROVED FOR TESTING

9.0 - TEST PROCEDURE (Continued)

9.19.23 Open valve 1CS019A and verify the CS pump 1A operating parameters on Data Sheet 11-19. 8-13-82

12-28-82

9.19.24 Close valve 1CS019A. 12-28-82

9.19.25 Verify CS pump 1A operating parameters on Data Sheet 11-19. 12-28-82

9.19.26 Trip CS pump 1A. 12-28-82

9.19.27 Close valve 1CS040A. 12-28-82

9.19.28 Close valve 1S1001A. 12-28-82

Item #	Noun Name or Equivalent		
11.19.14	Flow Rate 2000 gpm *	2000	mag 12-15-82
¢	Suction Pressure (1PI-CS003) ~~ft~~ psi mag 12-15-82	34½	mag 12-15-82
¢	Discharge Pressure (1PI-CS004) ~~ft~~ psi	266	mag 12-15-82
¢	CS Pump 1A Disch Flow Rate (1FI-CS011) gpm	2000	mag 12-15-82
¢	CS Eductor 1A Flow Rate (1FI-CS013) gpm	145	mag 12-15-82
	Running Current (amps)(maximum = 75 amps)	52	mag 12-15-82
	Flow Rate 2800 gpm *	2800	mag 12-15-82
¢	Suction Pressure (1PI-CS003) ~~ft~~ psi mag 12-15-82	34	mag 12-15-82
¢	Discharge Pressure (1PI-CS004) ~~ft~~ psi	257	mag 12-15-82
¢	CS Pump 1A Disch Flow Rate (1FI-CS011) gpm	2800	mag 12-15-82
¢	CS Eductor 1A Flow Rate (1FI-CS013) gpm	140	mag 12-15-82
	Running Current (amps)(maximum = 75 amps)	59	mag 12-15-82
	Flow Rate 3545 gpm *	3550	mag 12-15-82
¢	Suction Pressure (1PI-CS003) ~~ft~~ psi mag 12-15-82	33½	mag 12-15-82
¢	Discharge Prssure (1PI-CS004) ~~ft~~ psi	242	mag 12-15-82
¢	CS Pump 1A Disch Flow Rate (1FI-CS011) gpm	3550	mag 12-15-82
¢	CS Eductor 1A Flow Rate (1FI-CS013) gpm	135	mag 12-15-82
	Vibration Data Taken	yes	mag 12-15-82
	Running Current (amps)(maximum = 75 amps)	64	mag 12-15-82
	TO 900 VS CS 1A MOT INBD BRGT (maximum = 195°F)	152	mag 12-15-82
	TO 901 VS CS 1A MOT OUTBD BRGT (maximum = 195°F)	62	mag 12-15-82

TCR #4 mag 9-21-82

mag 12-15-82

APPROVED FOR TESTING

DATA SHEET 11-19

Item #	Nameplate/ Noun Name or Equivalent		
		~~retest~~ mab 12-21-82	
11.19.24	¢ Suction Press. (1PI-CS003) ~~ft.~~ psi mab 12-15-82	~~435~~	40.5 mab / 12-28-82
	¢ Discharge Press. (1PI-CS004) ~~ft.~~ psi	~~290~~	285 mab / 12-28-82
	¢ CS Pump 1A Disch Flow (1FI-CS011) gpm		400 mab / 12-28-82
TCR #29 mab 12-14-82	¢ Test Line Flow (1FI-SI006) gpm (or ultrasonic)		425 mab / 12-28-82
	¢ Spray Additive Flow (1FI-CS015) gpm		55 mab / 12-28-82
	¢ CS Eductor 1A Flow (1FI-CS013) gpm		143 mab / 12-28-82
TCR #23 mab 11-4-82	~~¢ Sonic Flowmeter gpm on Spray Additive line~~ mab 11-4-82		
11.19.26	¢ Suction Press. (1PI-CS003) ~~ft.~~ psi mab 12-15-82		40.5 mab / 12-28-82
	¢ Discharge Press. (1PI-CS004) ~~ft.~~ psi		285 mab / 12-28-82
	¢ CS Pump 1A Disch Flow (1FI-CS011) gpm		400 mab / 12-28-82
TCR #29 mab 12-14-82	¢ Test Line Flow (1FI-SI006) gpm (or ultrasonic)		425 mab / 12-28-82
	¢ CS Eductor 1A Flow (1FI-CS013) gpm		143 mab / 12-28-82
	Vibration Data Taken		yes mab / 12-28-82

mab / 12-28-82

APPROVED FOR TESTING

SARGENT LUNDY ENGINEERS CHICAGO

Calcs. For ENVIRONMENTAL QUALIFICATION OF CONTAINMENT SPRAY PUMPS	Calc. No. CQD- 006151	
X Safety-Related / Non-Safety-Related	Rev. 00	Date 2-25-83
	Page E5 of E15	

Client COMMONWEALTH EDISON COMPANY	Prepared by [illegible]	Date 2-25-83
Project BYRON / BRAIDWOOD	Reviewed by [illegible]	Date 2-25-83
Proj. No. 4391/92-00 4683/84-00 Equip. No. 1,2CS01PA,PB	Approved by [illegible] 006151	Date 2/25/83

Rev 00 2-25-83
Proj. No. 4391/92/4683/84-00
Page C5 of C15

Purpose:

To justify the environmental qualification of the containment spray pumps for Byron/Braidwood Nuclear Power Station by Analysis of the Pumps' materials.

Spec.: F/L 2758-B

Location: Aux. Building, elevation: -346' for PA
-343' for PB

Design: ASME Sec. III, class 2.

Seismic class: Category 1

Environmental zone: A13C

Size & Model: Ingersoll-Rand Co's 8x23 WDF, Vertical Centrifugal

Form GO-3.08.1 Rev. 2

Calc. No. CQD 006151
Rev: 00 Date 2-25-83
Proj. No. 4391/92/4683/84-00
Page C6 Of C15

REFERENCES: in Tab G

1 - Ingersoll-Rand Co.'s Drawings: C-8x23 WDF 86x7B; P.L. 8x23 WDF 500x6, pg. 1&2
C-8x23 WDF 500x6A; L.N. 8x23 WDF 86x7,
Sheet 1, 2, 3 of 5.

2 - Durametallic Co.'s Drawing: #2D-157002-RI dated 7-7-77.

3 - Telephone conversation of M. Khan (S&L) with Stan Samuelson (Ingersoll-Rand) dated 11-19-82.

4 - Telephone conversation of M. Khan (S&L) with F.B. Heakhcote and Henry Schelter of Ingersoll-Rand, dated 11-18-82.

5 - Lyon's "Valve Designer's Handbook".

6 - Wyle Laboratory's Qualification Plan #17491-5.

7 - Byron & Braidwood FSAR, Table 3.11-2 for Zone A13C.

8 - Ingersoll-Rand and Durametallic maintenance and Instruction Manuals.

9 - K. J. Green's memo to T. Thorsell, dated 7-21-82.

10 - Ingersoll-Rand Co.'s Certificate of Conformance for the design of the pumps.

11 - ASME See XI-Div. 1, Article IWP-1000.

12 - NRC's memorandum from Z. R. Rosztoczy to W. V. Johnston, dated 6-23-82.

13 - IEEE 627-1980, "Standard for Design Qualification of Safety Systems equipment used in Nuclear Power Generating Stations.

14 - P&ID Drawings: M-46 and M-61 Sheet 4 of 6.

Calc. No: CQD- 006151
Rev: 00 Date: 2-25-83
Proj. No: 4391/92/4683/01-00
Page C7 Of C15

Procedure:

The procedure to be followed will be in accordance with the guidelines of IEEE 627-1980 standard (ref. 13) & ref 12. There is no previous environmental qualification available and as such we will qualify these Pumps by Analysis and any information or data available. References will be provided for any information used. The Report applies only to the environmental qualification of the pumps. The dynamic qualification is covered by our report EMD # 025038.

Analysis/Justification:

The pumps Safety related function is to pump the containment water (with a mixture of boric acid and NaOH) to the Spray Nozzles in the Containment. For details refer to S&L Spec. F/L-2758 B.
The pumps will be utilized only in the event of a loss of coolant accident and will be automatically started. A conservative estimate of operation time is 200 hours during the plant life. (ref. 9)
A comparison of the Procurement and Design Specifications and the environment conditions of the zone A13c of these pumps is shown in the Environmental Qualification Parameters Comparison table in this Tab.
Per IEEE-627-1980, only significant aging mechanisms have to be analyzed and considered for aging program. The Standard lists four criteria to be met for significant aging mechanism.
The pumps' analysis show that their aging mechanisms donot meet the above mentioned criteria and hence are not significant for the purpose of an aging program.
For these pumps, leakage due to the wearing of Seals and O-Rings can be the potential failure due to

aging. This can be detected by the visual inspection of the Pumps during required maintenance and inspection and since the equipment is assessable for normal inservice maintenance, the third criteria is not satisfied and the mechanism is insignificant for aging purpose. Also, Vendor's Supplied Certificate of Conformance (ref. 10) verifies the design of these pumps per S&L Specification. With no significant aging mechanism, the pumps are deemed qualified for 40 years design life provided the maintenance and inspection is carried out in accordance with ASME Sec. XI - Div. I, Article IWP-1000 (ref. 11) and the Manufacturer's recommended manuals (ref. 2) besides the maintenance and inspection laid out in Byron/Braidwood FSAR.

The aging mechanism of these pumps has been determined insignificant and as such no aging program has to be developed.

In addition, Analysis of the pumps and their components show that there is no component which could be susceptible to any aging condition and cause a common mode failure.

Following is the analysis of the pumps and justification for qualification:

The Material list in reference 1 Drawings, P.L. 8x23WBF500X6 shows that the only non metallic component is O-Ring of Ethylene Propylene Terpolymer.

The mechanical seal used is Durametallic's Type HPTO. This seal is verified in the manufacturer's Proposal Technical Data, Amd. 1, dated 6-3-77 found in Spec. F/L2752B. Reference 2, drawing # 2D-157002 lists the materials of this seal. The only non metallics identified are #5 Carbon and Ethylene Propylene Terpolymer.

Telephone Conversation with Henry Schelter of Durametallic (ref. 4)

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For		Calc. No.	
		Rev.	Date
X Safety–Related	Non–Safety–Related	Page	of

Client	Prepared by	Date
Project	Reviewed by	Date
Proj. No. Equip. No.	Approved by	Date

CARBON GRAPHITE

Higher temperature resistant, i.e. can operate at temp. > 1300°F (ref 5, P. 391 & 325)

High Radiation threshold, i.e: 1.5×10^9 Rads (ref. 5, P: 395)

The high ratings of Carbon graphite as compared to the plant's environment justify its qualification for thermal and Radiation aging.

Humidity : - Effectively used for water jacketed Stuffing boxes (ref 5, P: 385)
- Good sealant for hot water at 700 Psi (ref. 5, P: 386)

Corrosion : No corrosion at 100% of NaOH & Boric Acid. (ref. 5, P: 390)
Does not Soften at any temp. (ref. 5, P: 391)

Pressure : Has been successfully used for sealing hot water at pressure of 700 Psi (ref. 5, P: 386)

Note that an adequate margin per IEEE 327-1974 (greater than 10%) has been shown.

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For		Calc. No.
		Rev. / Date
X Safety-Related	Non-Safety-Related	Page / of

Client	Prepared by / Date
Project	Reviewed by / Date
Proj. No. / Equip. No.	Approved by

Calc. No: COD-00615 Date 2-25-83
Rev: 00
Proj. No: 4391.92.46831.84-00
Page C11 of C15

ETHYLENE PROPYLENE TERPOLYMER (EPT)

Temperature : Range : -65° to 300°F (ref. 5, P: 416)

EP rubber good for atleast 1000 hrs. at max temp. of 250°F. Can stand upto 400°F varying with environment. (ref. 5 P: 427)

E.P. used in O-Rings for Seals rated for : 120°C (ref 6, P: 23)

Radiation : - Threshold : 5×10^7 Rads (ref. 6, P: 23)

Corrosion : Excellent for NaOH & Boric acid at a range of -70 to 250/400 °F (Ref 5, P: 432 & 446)

Humidity : Recommended for water & Steam (to 400°F), Dilute Acids & Alkalies. (for details, See ref. 5, P: 416)

The material's ratings are much higher than the plant's environment and hence will be exempted from Aging Qualification.
This also provides an adequate margin (> 10%) per IEEE 323-1974.

Form GQ.3.08.1 Rev. 2

verifies that #5 Carbon used is Carbon graphite.

Together, in the pump and the seal assembly, the only nonmetallics identified are Carbon graphite and EPT. EPT is Ethylene Propylene rubber with a third additional monomer, Diene. (ref 5, Page: 427)

To justify the aging qualification of the pumps by analysis, we have to look at these two materials and see if they can withstand operating and ambient environment of zone A13C.

Plant's environment : (zone- A13C) (Ref. 7)

Ambient Temperature : max. 115°F for 40 years
Water " : max. 290°F for total operation of 200 hours.

Radiation : 1×10^7 rads (T.I.D.)
Additional radiation due to the recirculation of Radiated water } (Spec F/L 2758B, P: 2-2)
: 0.275 rads/hour for 24 hours of recirculation
+ 2.93 rads (T.I.D) → insignificant as compared to 10^7 rads.

Pressure : -0.5 in H_2O

Humidity : 0 — 90 % R.H.

NOTE: The Radiation requirement for these pumps as shown in E/G FSAR, Amd. 39, Sept. 1982, Sec. 3.3 does not agree with the S&L spec. F/L-2758B. This has been brought to NSLD's (S&L) notice (CQD# 006155). However, this does not affect the status of our qualification.

From the above analysis of the non metallics used in the pump and seal, it is determined that the pumps do not need any Thermal or Radiation aging and are qualified with an adequate margin per IEEE 323-1974.

Pressure

The pumps are designed for 350 Psig pressure. (ref. 1)
The design is verified per Manufacturer's Certificate of Conformance.
The plant's environmental pressure of -0.5 to 0.0 in w.g. is insignificant as compared to the design Pressure.

Humidity

The pumps' components are designed for water at 290°F which means all the parts are designed for a higher humidity condition than the ambient of 0—90% R.H.
This design has been verified and the parts have been checked for their Integrity in the operating condition by method of Analysis.
Thus, the pumps components will not be effected by the ambient Relative Humidity of 0—90%.
This has also been shown in the materials Analysis in the previous pages.

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For		Calc. No.
		Rev. / Date
X Safety-Related	Non-Safety-Related	Page / of

Client	Prepared by / Date
Project	Reviewed by / Date
Proj. No. / Equip. No.	Approved by / Date

Calc. No: CQD-00615 Date 2-25-83
Rev: 00
Proj. No: A391/92/4633/37-00
Page C13 Of C15

Cycling

A conservative estimate of operation time has been determined as 200 hours/plant life. (ref. 9)
The number of cycles in the operation time of 200 hours will be insignificant to consider for cyclic aging.
Also, the nonmetallic components of the pumps are static and will not be subjected to operational stress.
Operation time of 200 hours was determined in K. J. Green's memo to T. Thorsell, dated 7-21-1982 and includes the periodic test times which are very short intervals. (Ref. Tab G.9)

Lubricant

A telephone conversation with Mr. Stan Samuelson of Ingersoll-Rand (ref. 3) verifies the fact that the pumps are product lubricated. The product is water and hence there is no lubricant for qualification.

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calc. For		Calc. No.	
		Rev.	Date
X Safety-Related	Non-Safety-Related	Page	of

Client	Prepared by	Date
Project	Reviewed by	Date
Proj. No. Equip. No.	Approved by	Date

Calc. No: CQD 006151
Rev: 00 Date: 2-25-83
Proj. No: 4391/92/4683/8500
Page C14 of C15

CONCLUSION

Based on the preceeding Analysis / Justification, the c.s. pumps are deemed qualified for Byron / Braidwood Nuclear Power Station's environment of zone A 13 C. A qualified life of 40 years can be justified if proper maintenance and Inspection is carried out in accordance with vendor's recommended manuals (ref. 9) and ASME, Sec. XI - Div. 1, Article IWP-1000 (ref. 12) to meet the basic requirements of 10 CFR 50 (Q.A Criteria for N.P. Generating stations).
Tab E also gives the maintenance & Surveillance imposed for the qualification of Pumps for 40 years.

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs For	Environmental Qualification of Ingersoll-Rand's Centrifugal Pumps, 8x23WDF
	X Safety-Related ‖ Non-Safety-Related
Calc. No.	CQD-006151
Rev. 00	Date 2-25-83
Page	C15 of C15

Client	Commonwealth Edison Company
Project	Byron/Braidwood, Units 1 & 2
Proj. No.	4391,2/4683,4-00 Equip. No. 1,2 CS01 PA,PB

Prepared by	
Reviewed by	
Approved by	

Calc. No: CQD-006151 Date
Rev: 00 Date: 2-25-83
Proj. No: 4391/92/4682/84-00
Page C15 Of C15

ENVIRONMENTAL QUALIFICATION PARAMETERS COMPARISON

Equipment Name: Containment Water Spray Pumps Manufacturer: Ingersoll-Rand Co.

Location: Aux. Building, Elev. 346' for PA & 343' for PB Model (Catalog) No.: 8x23WDF, Centrifugal

Function: To pump reactor grade water to the spray nozzles.
(see S&L spec. F/L-2758B and Proposal Technical Data in Spec.)

PARAMETERS	PROCUREMENT SPECIFICATION	DESIGN SPECIFICATION	CONTROLLED ENVIRONMENT CONDITIONS
Temperature	290°F	290°F	115°F*
Pressure	–	350 Psig	-0.5-0 in H_2O
Humidity	–	–	0-90%
Radiation	–	–	1×10^7 Rads
Fluid	Reactor grade water	Reactor grade water	Reactor grade water
Voltage	–	–	–
Current	–	–	–
Frequency	–	–	–
Seismic Class	Category I	Category I	Verified in EMD-02
Power	–	–	–
Qualified Life	40 years	40 years	–
OTHERS			
	*During operation, the water in the pump is at 93° - 290°F		

3.0 DESIGN LOADING CONDITIONS

Seismic - The DBE accelerations used in the static analysis for rigid, active equipment are as follows:

Horizontal .25g (in each of two orthogonal directions)

Vertical .85g

Multiplying these accelerations by the weight of the pump equipment produces the equivalent static forces for the analysis.

Nozzle - The faulted loads are listed in Appendix E. These loads are considered in the analysis of the casing, foot and anchor bolting.

Torque - The torque created by the rated motor horsepower calculates to be 21,245 in.-lb.

Steady-State - Design conditions for the pump are:

Pressure: 350 psi

Temperature: 290°F

Transient - The thermal and pressure transients are as follows:

Temperature Differential	Cycles	Mode
290°F	1	Accident
Pressure Differential	**Cycles**	**Mode**
275 psi	481	Testing & Accident

The analysis considers the combined loading which creates the maximum stresses and deflections.

4.0 SUMMARY OF RESULTS

4.1 Natural Frequency

First Five (5) calculates frequencies

1. 58.4 HZ
2. 58.5
3. 108.7
4. 108.8
5. 110.1

4.2 Structural Integrity (Faulted Condition)

Component		Calculated, psi	Allowable, psi	
Casing Foot Attachment		1,745	23,250	
Casing Disch. Noz. Attachment		4,708	23,250	
Casing Suct. Noz. Attachment		3,625	23,250	
Main Flange Bolting		16,767	37,500	
Foot		12,229	29,880	(1)
Foot Weld		12,320	29,880	
Anchor Bolting	Tension	10,576	40,000	
	Shear	4,137	15,390	
Support Head		174	18,900	
Motor Attachment Bolting		3,043	37,500	

4.3 Operability

Description	Calculated	Allowable
Rotor/Stator Deflection (Motor Air Gap)	.0003	.051 in.
Impeller/Ring Deflection	.001	.0115
Shaft/Cover Deflection at Mechanical Seal	.0004	.010

Attachment B7
Essential Service Water Butterfly Valve (1SX027A)
(PVORT-BOP)

Responses to the open audit items are as follows:

a) A revised PVORT form is included.

b) The subject valve was procured under Specification F/L-2884. This specification contained detailed information on four valve sizes (12, 24, 36 and 48") but not on 16" valves such as 1SX027A. This valve was procured via Purchase Order 803068 (attached) which references Data Sheet D5004, Rev. 1 (attached) and Specification F/L-2884. This data sheet provides all size specific information required and with Specification F/L-2884, fully defines the valve requirements. This method of equipment procurement is a common procedure and is fully documented and traceable. As a result no revision to the specification is required.

c) The subject valves are marked with an arrow to indicate the preferred installation direction. This installation direction is independent of flow direction; the valve will close against flow in either direction. The arrow indicates the preferred direction for sealing against flow. A field check has been made to verify that in the installed position the valve will seal against flow from the containment when used to isolate the containment.

d) The seismic qualification report for this valve has been received, reviewed and approved (Jamesbury Corporation Report JCS 82-02, Rev. 2). The valve was qualified by analysis. The Limitorque operator has been qualified by test. (Limitorque generic qualification report).

These valves are included in the Byron preservice and inservice test program. The valve will be fully stroked every three months and a position indication test will be performed at refueling outages. Refer to page 43 of the Byron Preservice/Inservice Testing Program Plan for Valves submitted to the NRC in the November 4, [illegible] letter from T.R. Tramm to H.R. Denton.

e) The operating torque of 1180 ft-lbs., as reported in the vendor report VHA-76-71, was used to review the valve design and was compared with the available operator torque to verify that the valve would function as required. The operator torque was obtained from Limitorque and found to be 1250 ft./lb. (memo of telecon attached)

f) The valve operator has been environmentally qualified in the generic Limitorque qualification program. Environmental qualification of the valve itself is not required. The only non-metallic parts in the valve are the valve seat (EPT-Ethylene Propylene Terpolyner) and the valve packing (John Crane 187-I). This valve is included in the inservice testing program and containment isolation valve leak rate testing program. Any degradation of the valve which could affect its ability to isolate the containment will be detected by testing and surveillance.

PUMP AND VALVE
OPERABILITY ASSURANCE REVIEW

I. PLANT INFORMATION

1. Name: Byron/Braidwood Unit No. 1&2 2. Docket No.: 50-454, 50-455 50-456, 50-457

3. Utility: Commonwealth Edison

4. NSSS: Westinghouse Electric [X] PWR [ ] BWR

5. A/E: Sargent & Lundy

II. GENERAL COMPONENT* INFORMATION

1. Supplier: [ ] NSSS [X] BOP

2. Location: a. Building/Room Auxiliary

   b. Elevation 395'-0 (13-Y)

   c. System Essential Service Water

3. Component number on in-house drawings: 1SX027A

4. If component is a [ ] Pump complete II.5.

   If component is a [X] Valve complete II.6.

5. General Pump Data

a. Pump		b. Prime-mover	
Name		Name	
Mfg.		Mfg.	
Model		Model	
S/N		S/N	
Type		Type	

* The component, whether pump or valve, is considered to be an assembly composed of the body, internals, prime-mover (or actuator) and functional accessories.

a. Pump (continued)

Size _____

Weight _____

Mounting Method _____

Required B.H.P. _____

Parameter	Design	Operating
Press	_____	_____
Temp	_____	_____
Flow	_____	_____
Head	_____	_____

Required NPSH at maximum flow _____

Available NPSH _____

Operating Speed _____

Critical Speed _____

List functional accessories:* _____

_____

_____

List control signal inputs: _____

_____

_____

b. Prime-mover (continued)

Size _____

Weight _____

Mounting Method _____

H.P. _____

Power requirements: (include normal, maximum and minimum).

Electrical _____

_____

_____

Other _____

_____

If MOTOR list:

Duty cycle _____

Stall current _____

Class of insulation _____

_____

_____

* Functional accessories are those sub-components not supplied by the manufacturer that are required to make the pump assembly operational, (e.g., coupling, lubricating oil system, etc.)

6. General Valve Data

a. Valve		b. Actuator (if not an integral unit)	
Name	1SX027A	Name	1SX027A
Mfg.	Jamesbury	Mfg.	Limitorque
Model	16-8026 Ex. "A"	Model	SMB - 00/7.5 H1BC
S/N	NC-48856 - 03C	S/N	264768
Type	Wafersphere	Type	H1BC
Size	16"	Size	SMB-00
Weight	190	Weight	335 lbs.
Mounting Method	Bolted	Mounting Method	Bolted
Required Torque	1180 ft./lbf	Torque	1320 ft-lbf.

Parameter	Design	Operating
Press	240	50
Temp	190	189
Flow	6,000	6,000
Max ΔP across valve	100 psi	
Closing time @ max ΔP	15 sec	
Opening time @ max ΔP	15 sec	
Power requirements for functional accessories, (if any)	120AC	

Power requirements: (include normal, maximum and minimum).

Electrical 33 Hp
460 V - 3 phase
60 Hz
Class B Insulation

Other: [] Pneumatic [] Hydraulic

List control signal inputs: 4106V breaker feeding 1SX01PA; 480V breaker feeding 1VP01CA and 1VP01CC

R

List functional accessories:* OT2 Control Switch @ 1PM06J

III. FUNCTION

1. Briefly describe components normal and safety functions: Normally open for normal and post accident essential service water system (sx) in the event of a breech of the essential service water system in containment.

2. The components normal state is: [x] Operating [ ] Standby

3. Safety function:

a. [ ] Emergency reactor shutdown

b. [ ] Containment heat removal

c. [x] Containment isolation*
*for breech of sx system only

d. [ ] Reactor heat removal

e. [ ] Reactor core cooling

f. [ ] Prevent significant release of radio-active material to environment

g. [ ] Does the component function to mitigate the consequences of one or more of the following events? [x] Yes* [ ] No
If "Yes", identify. *Confirmatory open signal

[x] LOCA [ ] HELB [x] MSLB

[x] Other Breech of the sx system inside containment

4. Safety requirements:

[ ] Intermittent Operation [ ] During postulated event

[x] Continuous Operation [x] Following postulated event

If component operation is required following an event, give approximate length of time component must remain operational.
single operation required immediately after accident (e.g., hours, days, etc.)

* Functional accessories are those sub-components not supplied by the manufacturer that are required to make the valve assembly operational, (e.g., limit switches).

5. For VALVES:

does the component [ ] Fail open [ ] Fail closed [x] Fail as is

Is this the fail safe position? [x] Yes*
*except for breech of sx system

Is the valve used for throttling purposes? [ ] Yes [x] No

Is the valve part of the reactor coolant pressure boundary?
[ ] Yes [x] No

Does the valve have a specific limit for leakage? [ ] Yes [x] No

If "Yes" give limit: _____

IV. QUALIFICATION

1. Reference by specific number those applicable sections of the design codes and standards applicable to the component: _____

ASME III 1974 ed. thru S'75

2. Reference those qualification standards, used as a guide to qualify the component: IEEE 323 - 1974 (actuator only)

IEEE 344 - 1975

3. Identify those parts of the above qualification standards deleted or modified in the qualification program.

Deleted:	Modified:

4. Have acceptance criterias been established and documented in the test plan(s) for the component? [x] Yes [ ] No

5. What is the expected failure mode that would keep the pump or valve assembly from performing its safety function? fail open after breech of sx system

6. Are the margins* identified in the qualification documentation? [x] Yes [ ] No

d. Margin is the difference between design basis parameters and the test parameters used for equipment qualification.

If component is a PUMP, complete IV.7.

If component is a VALVE, complete IV.8.

7. Pump operability has been demonstrated by: [] Analysis
[] Test [] Combination

Identify PUMP tests performed:

a. [] Shell hydrostatic (ASME Section III)

b. [] Bearing temperature evaluations

c. [] Seismic loading

d. [] Vibration levels

e. [] Exploratory vibration (Fundamental freq.____)

f. [] Seal leakage @ hydro press

g. [] Aging: [] Thermal [] Mechanical

h. [] Flow performance
Are curves provided [] Yes [] No

i. [] Pipe reaction end loads (nozzle loads)

j. [] Others _____

k. [] Extreme environment:

[] Humidity

[] Chemical

[] Radiation

8. Valve operability has been demonstrated by: [] Analysis
[] Test [] Combination

Identify VALVE tests performed:

a. [X] Shell hydrostatic (ASME Section III)

b. [] Cold cyclic List times:
Open _____
Closed _____

c. [X] Seismic loading

d. [] Hot cyclic List times:
Open _____
Closed _____

e. [X] Exploratory vibration*

f. [X] Main seat leakage

(Fundamental freq.____)

*Resonant frequency analytically determined.

g. [x] Aging*: [x] Thermal [x] Mechanical
*Actuator only

h. [] Back seat leakage

i. [] Pipe reaction end loading

j. [] Disc hydrostatic

k. [x] Extreme environment
Actuator Only
[] Humidity
[] Chemical
[x] Radiation

l. [] Flow interruption capability

m. [] Flow characteristics
Are curves provided?
[] Yes [] No

n. [x] Others pneumatic test

9. As a result of any of the tests (or analysis), were any deviations from design requirements identified? [] Yes [x] No
If "Yes", briefly describe any changes made in tests (or analysis) or to the component to correct the deviation.

10. Was the test component precisely identical (as to model, size, etc.) to the in-plant component? [x] Yes [] No If "No", is installed component [] oversized or [] undersized?

11. If type test was used to qualify the component, does the type test meet the requirements of IEEE 323-1974, Section 5.?
[x] Yes [] No *for motor operator only

12. Is component orientation sensitive? [] Yes [] No [x] Unknown*
If "Yes", does installed orientation coincide with test orientation? [] Yes [] No

13. Is the component mounted in the same manner in-plant as it was during testing (i.e., welded, same number and size bolts, etc.)
[x] Yes [] No [] Unknown

*However, installed orientation coincides with test orientation.

14. Were the qualification tests performed in sequence and on only one component? [X] Yes [ ] No A tuator only.

If "Yes" identify sequence, (e.g., radiation, seismic, cyclic, thermal, etc.): thermal aging, mechanical aging, radiation, seismic

15. If "aging"* was performed, identify the significant aging mechanisms:

16. Identify loads imposed (assumed) on the component for the qualification tests (analysis) performed:

a. [ ] Plants (shutdown loads)
b. [ ] Extreme environment
c. [X] Seismic load
d. [ ] Others

17. Have component design specifications been reviewed in-house to assure they envelope all expected operating, transient, and accident conditions? [X] Yes [ ] No

18. Does the component utilize any unique or special materials? (Examples are special gaskets or packing, limitations on nonferrous materials, or special coatings or surfaces.)
[ ] Yes [X] No

If "Yes", identify:

19. Does component require any special maintenance procedures or practices, (including shorter periods between maintenance).
[ ] Yes [ ] No

If "Yes", identify: The standard plant maintenance programs will address all required maintenance considerations for this component.

20. Is the qualified life for the component less than 40 years?
[ ] Yes [X] No If "Yes", what is the qualified life?

* As outlined in Section 4.4.1 of IEEE-627 1980.

EST. COPY

Commonwealth Edison Company

ITEM CLASS	VENDOR NO.	C.C.	ITEM	FUNCT. OR ORDER	SUB	EST. COST		PURCHASE ORDER NO.	RELEASE NO.
568	A6585A					$		803067	01
REQUISITION	REQUESTED BY							4-30-76	
NU-15,0[illegible]	Reed-Troy								
TAKE VIA								DATE	
Byron [illegible]on								6-21-76	
Units 1 & 2									

NAME AND ADDRESS

[illegible]sbury Corporation
[illegible] Lincoln Street
[illegible]orcester, MA 01605

SHIP TO

COMMONWEALTH EDISON CO.

c/o Station Construction Department
Byron Station, Units 1 & 2
West Side of County Highway 2,
3 miles South of IL Route 72
Byron, IL
Attention Mr. A. W. Kleinrath

INVOICE DATA

	DATE PASSED	AMOUNT
A		
B		
C		
D		
E		

SHOW ITEM FROM CONTROLLING PURCHASE ORDER

F.O.B. Worcester, MA
P/A To Byron Station

SHIP VIA

Unit 1 3-1-77 - 6-1-77
Unit 2 3-1-78 - 6-1-78

1	2 QTY.	DESCRIPTION	STORES ITEM	QUANTITIES BILLED A	B	C	D	E
12	8	16" Motor-operated Butterfly Valves - Tags 1SX016A, 1SX016B, 1SX027A, 1SX027B, 2SX016A, 2SX016B, 2SX027A, 2SX027B per Data Sheet 5004						
13	4	30" Motor-operated Butterfly Valves - Tags 1SX004, 1SX005, 2SX004, 2SX005 per Data Sheet D5005						
14	4	36" Motor-operated Butterfly Valves - Tags 1SX033, 1SX034, 2SX033, 2SX034 per Data Sheet D5006						
15	4	36" Motor-operated Butterfly Valves - Tags 1SX001A, 1SX001B, 2SX001A, 2SX001B per Data Sheet D5007						

SIGNED

1	SPEC NO. F/L 2884	6	DESCRIPTION & TAG NO.	(16 VALVES TOTAL
2	PIPE CLASS: E SEISMIC CLASS: A		1SX016A 2SX016A	
3	P & ID: M- 042-05		1SX016B 2SX016B	
4	PIPE DESIGN TABLE: 105 BB		1SX027A 2SX027A	
5			1SX027B 2SX027B	

SERVICE

7 FLUID: ☐ RAW WATER ☐ OIL ☐ STEAM ☐ DEMIN. WATER ☐ AIR ☒ OTHER SEE NOTE WATER

		MAXIMUM UNDER NORMAL CONDITIONS	DESIGN
8	INLET PRESSURE (PSIG)	100	125
9	TEMPERATURE SX016 VALVES; SX027 VALVES (°F)	100; 189	100; 190
10	MAXIMUM Δ P VALVE MUST OPEN AGAINST (PSIG): 50		
11	MAXIMUM Δ P VALVE MUST CLOSE AGAINST (PSIG): 100		
12	MAXIMUM DESIGN RADIOACTIVITY LEVEL: 1.0 X 10⁷ RADS		
13	FLUID VELOCITY @ VALVE INLET 11 (FT/SEC)		
14	Δ P WHEN VALVE FULL OPEN 3 MAX. (PSIG) @ 6000 ☐ LB/HR ☒ GPM ☐ SCFM		

BODY

15 BODY SIZE (INCHES): 16

16 BODY TYPE: ☐ GATE ☐ GLOBE ☐ DIAPHRAGM ☒ BUTTERFLY ☐ OTHER

17 BODY MATERIAL: ☒ CARBON STEEL: ASME SA 515 Gr. 70 ☐ ____ % CR-MOLY ☐ CAST IRON: ASTM ____ ☐ BRONZE: ASTM ____ ☐ 304 SS: ASTM ____ ☐ 316 SS: ASTM ____ ☐ OTHER ____

		INLET	OUTLET
18	TYPE END CONNECTION	☐ BUTT WELD ☐ FLNGD. ☐ SOC. WELD ☐ SCRWD. ☒ FLANGELESS (WAFER)	☐ BUTT WELD ☐ FLNGD. ☐ SOC. WELD ☐ SCRWD. ☒ FLANGELESS (WAFER)
19	CONNECTING PIPE SIZE/SCHEDULE	16 1 3/0" NOM.	16 1 3/0" NOM.
20	WELD END STANDARD (BUTT WELD ONLY)	☐ MF-270.8. ____ ☐ OTHER ____	☐ MF-270.8. ____ ☐ OTHER ____

OPERATOR

21 FLOW ACTION: ☒ OPEN ☐ CLOSE ☐ BI-DIRECTIONAL ☐ NEUTRAL

22 STEM LEAKOFF REQUIRED: ☐ YES ☒ NO

23 MOTOR RATING: ☒ AC ☐ DC

24 MOTOR VOLTAGE: ☒ PER PROJECT SPEC. OR ☐ ____ VOLTS

25 CLASS 1E: ☐ NO ☒ YES

26 VALVE CLOSING TIME: ☐ AS REQUIRED FOR SPECIFIED STEM SPEED ☒ OTHER, SEC. 15 OR LESS

27 VALVE OPENING TIME: ☐ AS REQUIRED FOR SPECIFIED STEM SPEED ☒ OTHER, SEC. 15 OR LESS

28 FREQUENCY OF OPERATION: 12 CYCLES/YEAR

ACCESS

29 POSITION TRANSMITTER: ☒ NO ☐ YES

30 ZONE: ☐ CONTAINMENT ☒ AUXILIARY ☐ TURBINE ☐ OTHER

31 SAFETY FUNCTION CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE ☐ NOT APPLICABLE

1. DISC MATERIAL : 316 SS SA 351 CF8M
2. SEAT MATERIAL : EPT
3. ADJ. PIPE FLANGES : 150# ANSI

* REV. 1 ADDED LINES 30 & 31
REVISED LINES 12 & 14

Dept. Mgr. Approved By

FORM NES-5.6.1 (4/75)

MOTOR-OPERATED VALVE DATA SHEET

PROJECT BYRON/BRAIDWOOD

CLIENT COMMONWEALTH EDISON | JOB NO. 4391/4683

DESIGN BY	J.C Rorick	DATE	4-25-77
CHECKED BY	J.C. Fagan	DATE	4-25-77
REVISED BY	J.C Rorick	DATE	4-25-77

GARGENT & LUNDY ENGINEERS

STANDARD

DATA SHEET NO. D 5004 REV. 1

SARGENT & LUNDY

MEMORANDUM OF
TELEPHONE CONVERSATION

Date: June 29, 1983

Time: 11:15 a.m.

Person Called: Dave Montgomery (Name) of Limitorque Corporation (Company)

Person Calling: H. G. L. McCullough (Name) of Sargent & Lundy (Company)

Project: Byron/Braidwood Project No. 4391-00

Subject Discussed:

Motor operator for valves 1SX027A, B, for Butterfly Valves

Specification F/L 2884.

Summary of Discussion, Decisions and Commitments:

Per Drawing #9030 - 2 Sheets

Question: Does Motor Operator SMB00/7.5-HIBC develop 1180 ft-lbs or more of torque?

Answer: This model has a motor torque normal rating of 7.5 ft-lbs. HI BC refers to worm gear reducer, with a maximum rating of 1300 ft-lbs. For a 15 second valve closure time, the motor operator gear ratio is 24:1. When operated on 100% voltage required, the developed nominal torque is 1250 ft-lbs.

The operator is adequate for the valve operational requirements.

cc:

H. G. McCullough
Signature

CC. K. J. Green

File:

Attachment B6

Responses to PVORT Draft
SER Generic Items

PORVT Draft SER
Generic Item 1

The status of completion of qualification documentation is as shown on the attached updated SQRT summary sheets. The status of completion of equipment installation can be inferred from these summary sheets. Complete (C) means equipment is in place and mounted. However, incomplete construction details on individual pieces of equipment are not tracked by the SQRT summary sheets to ensure completion.

There are provisions presently incorporated in the construction process and preoperational test program to identify and track incomplete construction details (such as temporary pipe supports, unconnected drain lines, etc.) In the construction process, contractors to Commonwealth Edison use procedures for installing equipment that have been reviewed and approved by Commonwealth Edison. These procedures include QC/QA signoffs to ensure installation is complete and in conformance with design drawings. The contractors' QC department inspects equipment to verify it is completely and properly installed. This review and inspection function is periodically audited by the contractors' QA department and the Commonwealth Edison QA department, also.

In the preoperational test program, all systems are walked down and inspected by the construction department and the system test engineer before performing the preoperational test on the system. If any incomplete installation details are identified during these walkdowns, a turnover deficiency is written to document the problem at the time of turnover for test, or thereafter. All turnover deficiencies and test deficiencies for each system are evaluated at the time the preoperational test results are reviewed and a schedule is established for resolving all deficiencies.

In addition, all Category 1 piping systems are given an as-built walkdown for piping analysis reconciliation. Any incomplete installation details with respect to pipe supports or hangers would be noted at that time.

Based on the documentation and inspection programs described above, all Category 1 equipment will be completely installed by fuel load.

KAA/sb/3120b

PVORT Draft SER
Generic Item 2

Qualification documentation for pump and valve operability primarily consists of QC Documents (Test Reports and Procedures) and Engineering Documents (Environmental Qualification Reports, Seismic and Stress Reports, Performance Curves, Vendor Calculations). The documentation required for safety-related pumps and valves includes various material test reports such as radiographs, liquid penetrant tests and magnetic particle tests. Documentation which assures pump and valve operability may include material test reports, welding reports, hydrostatic and seat leakage test reports, rotor balancing test reports, performance test reports, seismic and IE electrical qualification reports. Specific requirements for pumps and valves vary depending on type and required function.

QC documentation has consistently been reviewed, approved and transferred to the Byron Site QA Office, however, an actual listing of required documents was not made until recently. Currently, Master Documentation Lists are being compiled for each S&L procurement specification on which all required QC documents and Engineering Technical Data Documents are listed for each piece of equipment (by S&L Tag Number). As of 06-01-83, all lists for safety-related specifications have been transferred to Byron Station. The lists show which items are on file at the Site QA Office and items which are still required for submittal by vendors for review. S&L Monthly Engineering Status Reports on Environmental Qualification, Seismic and Stress are used to correlate the status of items on these Master Lists. Engineering Reports (Seismic, Stress and EQ) are in the process of being transferred to both stations. All of the QC Documentation for the BOP pump and valve audit items has been transferred to the site. Engineering documents are on file at S&L. Verification that all items on file at the site correspond with all items listed on the Master Documentation List is being performed by the site QA Department.

To demonstrate the acceptability and completeness of the operability qualification for the Byron plant, the Westinghouse files were reviewed. Enclosed is a summary report of this review which identifies the qualification documentation associated with each active pump and valve. It was agreed with the Staff at the 05-13-83 meeting that such a review and summary report would be adequate to demonstrate completion of the operability qualification for Byron.

Attachment A1
Electrical Penetration Assemblies
(BOP/1)

Responses to the open audit items are as follows:

Open Item 1 - The report describing the environmental aging and qualification testing (Conax IPS-369, Rev. C) has been reviewed and approved and is available for SQRT review. This report was audited by the NRC during the Environmental Qualification Audit on June 21, and 22, 1983.

Open Item 2 - The nitrogen supply to the Byron Unit 1 penetrations was originally designed to meet the requirement of the Amphenol containment penetrations. Subsequently, Conax penetrations were installed in place of the Amphenol penetrations. The Conax penetrations are qualified to operate with air rather than nitrogen between the seals. The nitrogen has been retained on Byron Unit 1 as an additional design feature beyond qualification requirements. The nitrogen lines are provided with a Category I isolation valve to allow for isolation in the event that one of the seals does leak. The nitrogen system is not Category I because its failure will not adversely affect the penetration integrity.